GENERAL CHAPTERS
AND
TAXONOMICAL REVISIONS

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AND
TAXONOMICAL REVISIONS

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REPUBLIK INDONESIA
REPUBLIC OF INDONESIA
KEMENTERIAN PERTANIAN / MINISTRY OF AGRICULTURE

FLORA MALESIANA

BEING
AN ILLUSTRATED SYSTEMATIC ACCOUNT OF THE MALAYSIAN FLORA / INCLUDING KEYS FOR DETERMINATION / DIAGNOSTIC DESCRIPTIONS / REFERENCES TO THE LITERATURE / SYNONYMY · AND DISTRIBUTION / AND NOTES ON THE ECOLOGY OF ITS WILD AND COMMONLY CULTIVATED PLANTS

PUBLISHED
UNDER THE AUSPICES OF THE KEBUN RAYA INDONESIA / BOGOR / JAVA / BOTANIC GARDENS OF INDONESIA / BOGOR (BUITENZORG) AND OF THE RIJKSHERBARIUM / LEYDEN / NETHERLANDS

PREPARED
ON AN INTERNATIONAL CO-OPERATIVE BASIS UNDER THE SUPERVISION OF SEVERAL DIRECTORS OF BOTANIC GARDENS / KEEPERS OF HERBARIA AND VARIOUS PROMINENT BOTANISTS

FOR THE PROMOTION OF
BOTANICAL SCIENCE AND THE CULTURAL ADVANCEMENT OF THE PEOPLES OF SOUTH-EASTERN ASIA TO THE SOUTHWEST PACIFIC REGION

SERIES I
SPERMATOPHYTA

VOLUME 5

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PUBLISHED BY
NOORDHOFF-KOLFF N.V. / DJAKARTA
1955-1958

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Dedicated to the memory
of A. A. PULLE

DEDICATION

The completion of the fifth volume of this Flora brings the pleasant task of dedicating it to the memory of my former teacher in systematic botany, the late professor doctor August Adriaan Pulle, of Utrecht University.

As I have explained on a former occasion, descriptive botany and plant geography had since Miquel's time lost a great deal of attention and recognition. It is largely due to Pulle that scientia amabilis in Holland owes its remarkable réveil.

Stimulated in his turn by his teacher, our common, venerated professor of general botany, F. A. F. C. Went, who never failed to interest his pupils in tropical botany, Pulle focussed his attention first on the flora of Surinam and later on that of New Guinea. Through personal exploration in both countries he acquired an excellent field knowledge. Owing to his ability as an organizer and editor, and to long sustained hard work, his efforts gradually led to increased publication facilities. He soon gave up his own research work in favour of organizing the herbarium and library at Utrecht, and of his teaching, and succeeded gradually in attracting capable students for various sections of plant taxonomy and geography. His tolerant, sympathetic personality, his convivial students' excursions in Holland and abroad, and his versatile and wide knowledge created a most agreeable working sphere in his laboratory. He varied the subject of his capita selecta for advanced graduates regularly: the course on plant sociology led D. M. de Vries to initiate practical plant sociology in Holland, that on phytopalaeontology led R. G. Koopmans to a thesis on the Netherlands carboniferous flora and stimulated F. Florschütz to initiate a centre for practical palynology of the Netherlands Pleistocene. Pulle's main achievement materialized in raising a school of systematists, including the large majority of present Netherlands taxonomists who have jointly made research on the floras of Holland, the West, and the East Indies. The centre of research on the West Indies remained at Utrecht and found its expression in the Flora of Suriname; the centre for the East Indies was shared by the Bogor and Leyden herbaria. But he kept a vigilant eye on both all the time and in his most excellent address at the opening of the enlarged Utrecht Herbarium and Museum in 1938 he dwelt at length on 'De inventarisatie van het erfdeel der vaderen' (The inventory of our heritage).

Before I went to Bogor I was invited by Went and Pulle to a private talk on the subject of the future outline, coordination, and development of the work on the Malaysian flora for which they suggested in a general way that I should consider a very gradual planning of a final, regional Flora, with the emphasis on gradual as I had first to acquire a large pre-knowledge for this task. Neither of my wise tutors believed in ad hoc planning of long-range scientific objectives. In this way Pulle and Went can be considered as the mental progenitors of the initiative towards the present work. They were ultimately responsible for the magnificent body of biological research work performed by the best of their students in the former colonies. It is their everlasting monument, and our pride.

It is due to their education and wisdom that botany in the Netherlands has developed harmoniously, in both the descriptive and experimental fields. Their pupils who are now in leading positions have been impregnated with this ideal and will maintain it. This satisfactory situation of mutual appreciation has been decisive, I feel, for the joyful news just received that my country will be the first official body to grant funds to cope with the financial emergency with which our Foundation was confronted recently. I trust that this emergency will be temporary and that the Governments in the immense Malaysian area will appreciate the basic value of this Flora for the development of pure and applied botany for their peoples and will take a liberal share in the project.

C. G. G. J. van Steenis

ABBREVIATIONS AND SIGNS

acc. = according
Ak. Bis. = Aklan Bisáya (Philip. language)
Alf. Cel. = Alfurese Celebes (language)
alt. = altitude
Anat. = Anatomy
Ap. = Apáyao (Philip. language)
app. = appendix, appendices
appr. = approximate
Apr. = April
Arch. = Archipelago
atl. = atlas
auct. div. = *auctores diversi*; various authors
auct(t). mal. = *auctores malayenses*; authors dealing with Malaysian flora
auct(t). plur. = *auctores plures*; several authors
Aug. = August
Bag. = Bagóbo (Philip. language)
basionym = original name of the type specimen; its epithet remains permanently attached to the taxon which is typified by it provided it is of the same rank
Bg = Buginese (language)
Bik. = Bíkol (Philip. language)
Bil. = Bilá-an (Philip. language)
Bill. = Billiton
Bis. = Bisáya (Philip. language)
Bon. = Bontók (Philip. language)
Born. = Borneo
Bt = Bukit; mountain
Bug. = Buginese (language)
Buk. = Bukídnon (Philip. language)
c. = *circiter*; about
C. Bis. = Cebu Bisáya (Philip. language)
cf. = *confer*; compare
Chab. = Chabecáno (Philip. language)
citations = see references
cm = centimetre
c.n. = see *comb. nov.*
comb. nov. = *combinatio nova*; new combination
c.s. = *cum suis*; with collaborators
cum fig. = including the figure
cur. = *curante*; edited by
D (after a vernacular name) = Dutch
Daj. = Dyak (language)
Dec. = December
D.E.I. = Dutch East Indies
descr. added behind a reference = means that this contains a valid description. Compare for example p. 107*a* lines 7 & 8 from bottom where the combination *Salix zollingeriana,* originally referred to as a *nomen nudum*, was 5 years later provided with a description; nomenclaturally the date of publication is that of its valid description
diam. = diameter
Distr. (as an item) = Distribution
Distr. (with a geographical name) = District
ditto = the same, see *do*
Div. = Division
div. = *diversus* (masc.) = various
do = *ditto* (Ital.); the same
Dum. = Dumágat (Philip. language)
dupl. = duplicate
E = east (after degrees: eastern longitude)
E (after a vernacular name) = English
Ecol. = Ecology
ed. = edited; edition; editor
e.g. = *exempli gratia*; for example
elab. = *elaboravit*; revised
em. = *emendavit*; emended
em(erg). ed. = *emergency edition*
Engl. = English
etc., &c. = *et cetera*; and (the) other things
ex auctt. = *ex auctores*; according to authors
excl. = *exclusus* (masc.); excluding, exclusive of
f. (before a plant name) = *forma*; form
f. (after a personal name) = *filius*; the son
f. (in citations) = figure
fam. = family
Feb. = February
fide = according to
fig. = figure
fl. = *flore, floret* (*floruit*); (with) flower, flowering
For. Serv. = Forest Service
fr. = *fructu, fructescit*; (with) fruit, fruiting
Fr. (after a vernacular name) = French
G. = Gunung (Malay); mountain
Gad. = Gaddáng (Philip. language)
gen. = *genus*; genus
genus delendum = genus to be rejected, see p. 344*b* *Lemairea*
Germ. = German
geront. = Old World
haud = not, not at all
holotype = the specimen on which the original description was actually based or so designated by the original author
homonym = a name which duplicates the name of an earlier described taxon (of the same rank) but which is based on a different type species or type specimen; all later homonyms are nomenclaturally illegitimate, unless conserved
ib(id). = *ibidem*; the same, in the same place
Ibn. = Ibanág (Philip. language)
ic. = *icon, icones*; plate, plates
ic. inedit. = *icon ineditum, icones inedita*; inedited plate(s)
id. = *idem;* the same
i.e. = *id est*; that is
If. = Ifugáo (Philip. language)
Ig. = Igorot (Philip. language)
Ilg. = Ilongót (Philip. language)
Ilk. = Ilóko (Philip. language)
in adnot. = *in adnotatione*; in note, in annotation
incl. = including, inclusive(ly); *inclusus* (masc.)
indet. = indetermined
Indr. = Indragiri (in Central Sumatra)
inedit. = *ineditus* (masc.); inedited
in herb. = *in herbario*; in the herbarium
in litt. = *in litteris*; communicated by letter
in sched. = *in schedula*; on a herbarium sheet
in sicc. = *in sicco*; in a dried state
in syn. = *in synonymis*; in synonymy
Is. = Isinái (Philip. language)
Isl. = Islands
Ism. = Isámal (Philip. language)
isotype = a duplicate of the holotype; in arboreous plants isotypes have often been collected from

a single tree, shrub, or liana from which the holotype was also derived
Iv. = Ivatán (Philip. language)
J(av). = Javanese (language)
Jan. = January
Jr = Junior
Klg. = Kalínga (Philip. language)
Kul. = Kuláman (Philip. language)
Kuy. = Kuyónon (Philip. language)
Lamp. = Lampong Districts (in S. Sumatra)
Lan. = Lánao (Philip. language)
lang. = language
l.c. = *loco citato*; compare reference
lectotype = the specimen selected a posteriori from the authentic elements on which the taxon was based when no holotype was designated or when it is lost
livr. = livraison, part
ll.cc. = *l.c.* (plur.)
m = metre
M = Malay (language)
Mag. = Magindanáo (Philip. language)
Mak. = Makassar, Macassar (in SW. Celebes)
Mal. = Malay(an)
Mal. Pen. = Malay Peninsula
Mand. = Mandáya (Philip. language)
Mang. = Mangyán (Philip. language)
Mar. = March
Mbo = Manóbo (Philip. language)
Md = Madurese (language)
Minangk. = Minangkabau (a Sumatran language)
min. part = *pro minore parte*; for the smaller part
mm = millimetre
Mng. = Mangguángan (Philip. language)
ms(c) = manuscript
Mt(s) = Mount(ains)
N = north (after degrees: northern latitude); or New (*e.g.* in N. Guinea)
NE. = northeast
nec = not
neerl. = Netherlands, Netherlands edition
Neg. = Negrito (Philip. language)
N.E.I. = Netherlands East Indies
neotype = the specimen designated to serve as nomenclatural type when no authentic specimens have existed or when they have been lost; a neotype retains its status as the new type as long as no authentic elements are recovered and as long as it can be shown to be satisfactory in accordance with the original description or figure of the taxon
N.G. = New Guinea
N.I. = Netherlands Indies
no = number
nom. = *nomen*; name (only) = *nomen nudum*
nom. al. = *nomen aliorum*; name used by other authors
nom. al.(ern). = *nomen alternativum*; alternative name
nom. cons(erv). = *nomen conservandum, nomina conservanda*; generic name(s) conserved by the International Rules of Botanical Nomenclature
nom. fam. cons. = *nomen familiarum conservandum;* conserved family name
nom. gen. cons. prop. = *nomen genericum conservandum propositum*; generic name proposed for conservation
nom. illegit. = *nomen illegitimum*; illegitimate name
nom. legit. = *nomen legitimum*; legitimate name
nom. nov. = *nomen novum*; new name
nom. nud. = *nomen nudum*; name published without description and without reference to previous publications
nom. rej. = *nomen rejiciendum*; name rejected by the International Rules of Botanical Nomenclature
nom. seminudum = a name which is provided with some unessential notes or details which cannot be considered to represent a sufficient description which is, according to the International Rules of Botanical Nomenclature, compulsory for valid publication of the name of a taxon. See for example p. 401*a* line 2
nom. subnudum = *nomen seminudum*
nom. superfl. = a name superfluous when it was published; in most cases it is a name based on the same type as an other earlier specific name. See for example p. 342*b* lines 32 & 33 from top
non followed by author's name and year, not placed in parentheses, and put at the end of a citation = means that this author has published the same name mentioned in the citation *independently*. These two (names) combinations are therefore homonyms. Compare p. 327 lines 15 & 16 from top; there are two independent genera of the name *Lophiocarpus*. Compare p. 310*b* lines 21 & 22 from bottom; there are two independent species described under the name *Dichapetalum holopetalum*, by MERRILL and by RUHLAND respectively
(*non* followed by abbreviation of author's name) before a reference (citation) headed by an other author's name = means that the second author has misinterpreted the taxon of the first author. Compare for example p. 339*a* under *Scaevola sericea* lines 9 & 10 where the citation means that BURMAN *f.* misapplied the name *Lobelia plumieri*, in other words wrongly identified the plant he had in hand with a species described by LINNAEUS
non al. = *non aliorum*; not of other authors
non vidi = not seen by the author
nov. = *nova* (femin.); new (species, variety, *etc.*)
Nov. = November
n.s. = new series
n. sp. = *nova species*; new species
n. (*sp.*) *prov.* = *nomen* (*specificum*) *provisorium*; provisional new (specific) name
n.v. = *non vidi*; not seen
NW. = northwest
Oct. = October
op. cit. = *opere citato*; in the work cited
p. = *pagina*; page
P. = Pulau, Pulu (in Malay); Island
Pal(emb). = Palembang
Pamp. = Pampángan (Philip. language)
Pang. = Pangasinán (Philip. language)

paratype = a specimen cited with the original description other than the holotype
part. alt. = for the other part
P. Bis. = Panay Bisáya (Philip. language)
P.I. = Philippine Islands
pl. = plate
plurim. = most
pr. max. p. = *pro maxima parte*; for the greater part
pro = as far as is concerned
prob. = *probabiliter*; probably
prop. = proposed
Prov. = Province
p(r).p. = *pro parte*; partly
pt = part
quae est = which is
quoad basionym, syn., specimina, *etc.* = as far as the basionym, synonym(s), specimen(s), *etc.* are concerned
references = see for abbreviations the list pp. cxlv-clxv
Res. = Residency
resp. = respective(ly)
S = south
S = Sundanese (language)
Sbl. = Sambáli (Philip. language)
SE. = southeast
sec. = *secus*; according to
sect. = *sectio*; section
sens. ampl. (*ampliss.*) = *sensu amplo* (*amplissimo*); in a wider sense, in the widest sense
sens. lat. = *sensu lato*; in a wide sense
sens. str. (*strictiss.*) = *sensu stricto* (*strictissimo*); in the narrow sense, in the narrowest sense
Sept. = September
seq., *seqq.* = *sequens, sequentia*; the following
ser. = series
s.l. = see *sens. lat.*
S.-L.Bis. = Samar-Leyte Bisáya (Philip. language)
Sml. = Sámal (Philip. language)
s.n. = *sine numero*; (specimen) without the collector's number
Sp. = Spanish (language)
sp(*ec*). = *species*; species
specim. = specimen(s)
sphalm. = *sphalmate*; by error, erroneous
spp. = *species*; species (plural)
Sr = Senior
s.s. = see *sens. str.*
ssp. = *subspecies*; subspecies
s.str. = see *sens. str.*
stat. nov. = *status nova*; proposed in a new rank
Sub. = Subánum (Philip. language)
subgen. = *subgenus*; subgenus
subsect. = *subsectio*; subsection
subsp. = *subspecies*; subspecies
Sul. = Súlu (Philip. language)
Sum. E.C. = Sumatra East Coast
Sum. W.C. = Sumatra West Coast
Suppl. = *supplementum*; Supplement
SW. = southwest
syn. = *synonymum*; synonym
synonyms = the names of taxa which have been referred to an earlier described taxon of the same rank and with which they have been united on taxonomical grounds or which are bound together nomenclaturally
syntypes = the specimens used by the original author when no holotype was designed or more specimens were simultaneously designated as type
t. = *tabula*; plate
Tag. = Tagálog (Philip. language)
Tagb. = Tagbanúa (Philip. language)
Tagk. = Tagaká-ólo (Philip. language)
Tapan. = Tapanuli (in NW. Sumatra)
taxon = each entity throughout the hierarchic ranks of the plant kingdom which can be described and discriminated from other taxa of the same rank
Tg = Tandjung (Malay); cape
Ting. = Tinggián (Philip. language)
Tir. = Tiruraí (Philip. language)
transl. = translated
type = each taxon above the rank of a species is typified by a type belonging to a lower rank, for instance a family by a genus, a genus in its turn by a species; a species or infraspecific taxon is typified by a specimen. The name of a taxon is nomenclaturally permanently attached to its type; from this it can not be inferred that the type always represents botanically the most typical or average structure found in the circumscription of the taxon
type specimen = the specimen or other element to which the name of a species or infraspecific taxon is (nomenclaturally) permanently attached; botanically a type specimen is a random specimen on which the name was based by description. Therefore, it does not need to represent the average or most typical representative of a population. See holotype, isotype, lectotype, syntype, paratype, and neotype
typ. excl. = *typo excluso*; type excluded
typ. incl. = *typo incluso*; type included
typus = see type and type specimen
var. = *varietas*; variety
var. nov. = *varietas nova*; new variety
Vern. = Vernacular
vide = see
viz = *videlicet*; namely
vol. = volume
W = west
Yak. = Yakán (Philip. language)
± = about
& = and
♂ = male (flower, *etc.*)
♀ = female (flower, *etc.*)
☿ = bisexual (flower)
(♂)(♀) = dioecious with unisexual flowers
(♂♀) = monoecious with unisexual flowers
(♂☿) = polygamous
(♀☿) = polygamous
∞ = very many
> = diminishing (in size, number, *etc.*)
< = accrescent (size, number, *etc.*)
× $^{2}/_{5}$ = $^{2}/_{5}$ of natural size
× montana = means that the epithet montana is that of a hybrid

ANNOTATED SELECTED BIBLIOGRAPHY

page
1. *General botanical handbooks* v
2. *General and local botanical bibliographies* . v
3. *Interpretation of early botanical works* . vi
4. *Keys for identifying Malaysian plants* . . vii
5. *Floras and botanical enumerations of neighbouring countries* viii

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6. *Flora of Malaysia proper* xiii
   a. *General works* xiii
   b. *Local works* xv
   c. *Proper taxonomic bibliography, alphabetically arranged according to families* xxv

In the absence of a complete bibliography of the botanical literature of Malaysia, comparable to those on Eastern Asia and the Pacific by Merrill & Walker, and as the 'Flora Malesiana' will not to be completed within the near future, the need was felt to have at hand a concise, selected bibliography of existing revisions and other phytographical publications temporarily providing taxonomists with a reference to what is roughly available for the identification of Malaysian collections. When the 'Flora Malesiana' is completed, after some decades, this bibliography should no longer be required, as the references contained in it will all have been accounted for in the Flora itself in one way or another.

In the meantime, however, a list arranged by families seems to serve a very practical purpose, as it gives access to the main body of accumulated knowledge precursory to the final revisions in the Flora.

This need is apparently felt in other regions, as during the course of this work, which was started about 1943, similar projects were undertaken for East Asia and the Pacific by Merrill & Walker and for India by Santapau.

I agree with Dr Walker that the use of such bibliographies is essentially facilitated by annotations indicating the contents. I have specially paid attention to the presence or absence of keys for identification. In some cases keys lead only to groups of species; I have called these 'partial keys'.

Merrill & Walker's bibliographies aimed at completeness. My object has been more limited and from the beginning I wanted to make it selective for two reasons. On the one hand an exhaustive bibliography would mean years of bibliographical research on which I cannot afford to spend part of the little time left for my scientific work. On the other hand my aim was more limited in that I felt that the need alluded to was focussed rather on a bibliographic guide, enabling rapid orientation in some family or genus, than on a complete bibliographic account. The desired concise data would be swamped in an ocean of detailed references in a really exhaustive work.

The large detailed MS bibliography, which I have gradually compiled during the past twenty five years, is arranged by families and is not suitable for publication; but it will always be at the disposal of revisors working at the Flora Malesiana.

The selection has proved very difficult and was often arbitrary in order to obtain a satisfactory uniform bibliographical level, as the scope and quality of the various papers and their importance for our aim varies enormously. It cannot be denied that, through this selection, a subjective element inevitably enters in.

Many papers are, unfortunately, not provided with keys; still, they have a certain value in efforts towards naming collections. Many papers are not exhaustive, treating representatives of a family or genus from a local region or even part of an island. Other papers were prepared without aiming at a thorough revision. A taxonomist will, however, be glad to have some literature at hand for naming current collections. It is for that aim that the present tool has been forged.

It was, of course, not necessary to give extracts from the great complete Floras and taxonomical handbooks, as these are commonly the recognized tools of the systematist.

The bibliography tends to go from the large and wide to the small and narrow, as can be observed from the table of contents.

In chapter 6c families have been arranged alphabetically. It should be borne in mind that the choice of the delimitation of these families is arbitrary. Newly proposed changes have been followed with some conservatism. It has not been found of very great advantage to take up all the segregates which have been proposed in recent times.

Lately there has been a distinct fad towards splitting families, genera, species, in many instances resulting into raising taxa to the next higher rank, a tendency against which the Makers of Botany of the last century were always warning us. On the other hand, if it appears that a family contains entirely discordant elements which, in accordance with additional detailed research into pollen structure, embryology, phytochemistry, anatomy, *etc.*, fit in *different* places in the system of affinities, such a splitting seems entirely justified. If, however, there is only a difference of opinion about the rank of certain groups, which after segregation merely remain in a different rank (level), but with about the same mutual relationship, there seems to be very little scientific advance gained by this splitting. It seems to me that the recent splitting of *Magnoliaceae* into several families and raising the complex to the order *Magnoliales* belongs to this category, as well as similar cases in *Olacaceae*, *Sapotaceae*, *Icacinaceae*, *Monimiaceae*, *Cornaceae*, *Annocaceae*, *etc.* The case of the anomalous genera *Sphenoclea* and *Pentaphragma* now removed from the *Campanulaceae* seems to me to be of another category, since these genera are removed from the order to which the family *Campanulaceae* belongs. I am perfectly aware that some families contain definitely anomalous genera and that in such cases the situation is really clarified by the removal of such genera. If the *Siphonodontaceae* still remain in position next to the *Celastraceae* there is little scientific gain in raising it to family rank, as the rank of a subfamily would be sufficient to stress its distinction within the *Celastraceae*. If in *Oleaceae*, AIRY SHAW has found good arguments in favour of removing *Nyctanthes* from this family to the *Verbenaceae*, I assume this to be of significant value.

Purely for technical reasons *Bambusaceae* have, in this bibliography, not been merged with *Gramineae* proper but are separately treated on a family level immediately after the *Gramineae*.

Amaryllidaceae, *Liliaceae*, *etc.* have only for convenience been accepted in their old delimitation which is, as HUTCHINSON has demonstrated, certainly artificial in its simplicity and taxonomically untenable.

For the same aim *Conifers* are treated as an entity, though by general consent they consist of many families. In the *Moraceae* the genus *Ficus* has been treated separately on account of its colossal size. *Saurauia* has also been treated separately within the *Actinidiaceae*.

For the convenience of those using this bibliography cross-references have been made for family names and for generic names in so far as they have been referred to more than one family.

The choice of the references is not wholly uniform. In general the larger works and Floras have not been classified under families, but in several cases the user will find that I have for instance cited one of BACKER's works on the Java flora. This means that either this treatment is significant for the group in Malaysia or perhaps even comprehensive; from a large experience in using literature for rapid orientation I have intentionally inserted such entries, which at first sight seem superfluous, since they belong to general books dealt with in chapters 5 and 6a.

I was in doubt whether to insert entries for those families which have already been treated in this Flora and would seem, for this reason, now superfluous; it is merely for completeness and uniformity that I have treated such families in the same way as the others.

Families of which only cultivated or introduced species are known to occur in Malaysia, as *e.g. Betulaceae*, *Bromeliaceae*, *Caricaceae*, *Tropaeolaceae*, *etc.* are treated in less detail as compared with families possessing mainly native representatives.

Although the 'Flora Malesiana' is principally concerned with native and wild plants, it appeared useful to insert references to revisions of ornamental plants or those cultivated for other reasons.

Concerning the Philippines and New Guinea I have been rather lavish with references and I hope this will be a help for those who have to identify specimens from these islands.

Those who consult chapter 6c should bear in mind that it embraces only books and papers which I assume to be of interest to Malaysian botany! When genera are of worldwide distribution, like many in the *Scrophulariaceae*, I found it necessary to insert also major works on the New World representatives. In the *Araceae*, *Lauraceae*, *Loranthaceae*, *etc*., however, I have omitted several important papers revising only African or New World representatives.

In families like the *Podostemonaceae* in which the number of Malaysian representatives is negligeable with respect to the total size of the family, only some of the main works have been mentioned just as far as necessary to understand the taxonomy of the Malaysian members.

Papers in which only a few genera have been revised are not mentioned under the family but have been entered under the respective genera. Comprehensive family monographs as DE CANDOLLE's Monographia Phanerogamarum and the Pflanzenreich have not been cited under the various genera. In some large families treated in the latter work, which consist of a number of parts, names of Malaysian genera have been mentioned as an annotation.

No reference has been made in chapter 6c to the first edition of the 'Pflanzenfamilien', since that work is complete and is provided with indices, but reference has been made to the families treated in the incomplete 2nd edition. No annotations seemed necessary for the 'Pflanzenfamilien' and the 'Pflanzenreich' entries as the scope of these works is well known.

There are very many articles, reports, and even books, in which plant names are mentioned in the text but do not occur as official lists (with or without references). Although they sometimes contain valuable information, they do not belong to proper phytography and have, for this reason, been omitted.

Papers mainly dealing with anatomy, morphology or geographical distribution are only mentioned if they may be of help for orientation or appear to be of important taxonomic value.

For the convenience of those who can read Dutch, and to whom journals or books written in Dutch are available, references to such works have been cited.

I am perfectly aware that, from the purely bibliographical standpoint of citation, this bibliography leaves much to be desired; sometimes citation of figures has been omitted and there is no absolute uniformity in abbreviations. This is partly due to the fact that the work was done over a considerable period with many interruptions. It should also be considered that no bibliographical aims were pursued, but the purely practical goal of temporarily providing our readers with a tolerable basis for current work. It is not accurate enough to depend on for copying citations without consulting the originals. But I hope that during the typing, retyping, and printing, only few errors will have crept into the tens of thousands of figures it contains.

It should be borne in mind that in titles I have intentionally not kept the original orthography of certain words as regards capitals, the use of which differs in the Latin, German, French, English, *etc*. languages. I have preferred to capitalize (hence, emphasize) all those words which appear in a title as important words. I have therefore written '*Hortus Indicus Malabaricus*' and not '*Hortus indicus malabaricus*' which is the correct way in Latin. The names of towns in which works in Latin were issued I have not kept under their Latin equivalents; thus a work issued at 'Leipzig' is not mentioned as having been printed at 'Lipsiae'.

Under each family, country (island) or genus references have been enumerated alphabetically under author's names, except in a very few cases.

Synonyms of several genera have been added in brackets after the accepted generic name. As the references under each genus have been enumerated alphabetically under authors' names, it does not follow that the reduction has been made by the author of the first reference to a generic name.

It is intended to compile, in subsequent volumes, supplementary lists in order to furnish subscribers with up to date references and corrections, and enable them to take full advantage of progress in our field.

In compiling this bibliography I enjoyed the co-operation of Mrs M. J. VAN STEENIS-KRUSEMAN and acknowledge the facilities given by the librarian of the Rijksherbarium who assisted in procuring a great number of books for checking. Dr H. SLEUMER, during a visit to the British

Museum (Nat. Hist.) and the Royal Botanic Gardens, Kew, was kind enough to verify a number of items not available in Holland in which he was assisted by the Librarian of the Museum and by Mr H. S. MARSHALL. There remained a small number of books which could not be located within my immediate reach and the pertaining references could therefore not be annotated; they are marked '*Non vidi*'.

1. GENERAL BOTANICAL HANDBOOKS

Bentham, G. & J. D. Hooker, *Genera Plantarum, etc.* 3 vols (1862–1883).–Generic descriptions; in Latin.

Candolle, A. & C. de, *Monographia Phanerogamarum prodromi nunc continuatio, nunc revisio,* 1–9 (1878–1896).–The families monographed herein are inserted in chapter 6c.

Candolle, A. P., A. & C. de, *c.s., Prodromus systematis naturalis regni vegetabilis sive enumeratio contracta ordinum generum specierumque plantarum, etc.* 17 vols (1824–1873), index 1–4 (1842–1874).–Complete descriptive account of genera and *spp.* in Latin; no keys.

Dalla Torre, C. G. de & H. Harms, *Genera Siphonogamarum, etc.* (1900–1907).–Index of generic and infrageneric names.

Engler, A. (*ed.*), *c.s., Das Pflanzenreich, etc.* Heft 1–107 (1900–1953).–Families of which monographs have appeared in this work have been referred to in chapter 6c. References to these have been made with the separate parts (Hefte) to avoid the intricate way of numbering of these parts. Keys and descriptions in Latin, other matter in German.

—, & K. Prantl (*ed.*), *Die natürlichen Pflanzenfamilien* (1st ed.), 4 Teile (1887–1908), 4 Nachträge (1897–1915).–This widely used work has *not* been extracted in chapter 6c. Families treated in the 2nd edition of the work which is still far from complete have been referred to in chapter 6c. In German.

Index Kewensis, etc. 2 vols (1893–1895), 11 Suppl. (1901–1953).–References to descriptions of new genera and species.

Index Londinensis, etc. 6 vols (1929–1931), Suppl. 1–2 (1941).–Index to figures of plants.

Lemée, A., *Dictionnaire descriptif et synonymique des genres de plantes phanérogames.* Brest. 1–7, 8a–b (1929–1943).–Descriptions of all genera alphabetically arranged; vol. 8 contains keys to the genera of each family.

2. GENERAL AND LOCAL BOTANICAL BIBLIOGRAPHIES

with special reference to the tropics of the Old World except Africa

Anonymous, *Tooa Kyoo ei ken-Sigenkagaku-bunkenmokuroku.* Bibliographic index for the study of the natural resources of the Great Asia co-prosperity sphere. Department of Education, Dai Nippon. Except for the references wholly in Japanese.

1. *New Guinea* (1942) 259 + 81 pp. Botany p. 20–61.
2. *French Indo-China & Thailand* (1942) 253 + 81 pp. Botany p. 19–48.
3. *Philippines* (1942) 391 + 61 pp. Botany p. 35–155.
4. *Malay Peninsula* (*'Malay'*) (1943) 241 + 11 pp. Botany p. 38–108.
5. *Micronesia* (1944) (by Huzio Utinomi). *Bibliographia Micronesica scientiae naturalis et cultus.* Kokoryukan. Tokyo (1945) i–iii, 1–3, 1–208; Botany 1–21. *Non vidi.*–A 2nd edition in English was edited by the Univ. of Hawaii Press (1952), the botany section of which was translated by K. Sakimura and edited by H. St. John; repr. p. 3–16.
6. *East Indies* (1944) 689 + 19 pp. *Non vidi.*

—, *An annotated bibliography of the Southwest Pacific and adjacent areas.* Issued by the Allied Forces. 1944. 3 vols.–*Non vidi.*

1. *The Netherlands and British East Indies and Philippine Islands.*
2. *Malaya. Thailand, Indo-China.*
3. *The China Coast and the Japanese Empire.*

Blake, S. F. & A. C. Atwood, *Geographical guide to Floras of the World. Part 1* (U.S. Dep. Agric. Wash. Misc. Publ. 101, 1942, 1–336).–Useful annotated list of Floras and plant-geographical works in the wide sense, geographically arranged. Asia has not yet been treated.

Blatter, E., *A bibliography of the Botany of British India and Ceylon* (Journ. Bombay Nat. Hist. Soc. 20, 1911, lxxix–clxxvi).

Boerlage, J. G., *Literatuur Botanie* (in F. S. A. de Clercq, Ethnogr. Beschrijving v. d. Westen Noordkust van Ned. Nieuw-Guinea. Leiden, 1893, 272–273).–Bibl. New Guin. 1884 onwards.

Field, H., *Bibliography on Southwestern Asia.* Univ. Miami Press (1953) xvi + 106 pp.–Anthropogeography, botany and zoology; total 3000 titles. Covering Near East as far as and including Afghanistan.

Jackson, B. D., *Guide to the literature of botany; being a classified selection of botanical works, including nearly 6000 titles not given in Pritzel's 'Thesaurus'.* London (1881) i–xl, 1–626.

Junghuhn, F., *Opgaaf betreffende de literatuur over de Flora van Java* (in Junghuhn, Java, ed. 2, Dutch ed., 1, 1853, 179–198).–Annotated bibliography of Java; in Dutch.

Kuntze, O., *Notizen zu Pritzel's Thesaurus Literaturae Botanicae* (Rev. Gen. Pl. 1891, cxxii–cxlvi; *ibid.* pars III, 1898, 153–162).–These corrections contain unfortunately many errors.

Lam, H. J., *Materials towards a study of the Flora of the island of New Guinea* (Blumea 1, 1934, 115–159).–Contains lists of families revised in Bot. Jahrb. and Nova Guinea and a list of books and papers.

Merrill, E. D., *Index to Philippine literature 1–6* (Philip. J. Sc. 2, 1907, Bot. 241–250, 345–349, 437–439; *l.c.* 3, 1908, 87–94; *l.c.* 4, 1909, 677–685; *l.c.* 5, 1910, 259–266).–Lists of annotated references.

—, *A contribution to the bibliography of the botany of Borneo* (Sarawak Mus. J. 2, 1915, 99–136), supplemented in Merrill, E. D., *A bibliographic enumeration of Bornean plants* (J. Str. R. As. Soc. Special *no*, 1921, 2–6).–Extensive Bornean bibliography.

—, *An enumeration of Philippine flowering plants* vol. 4 (1926) 155–239.–Extensive bibliography on Philippine botany.

—, *Polynesian botanical bibliography, 1773–1935* (Bull. Bern. P. Bish. Mus. *no* 144, 1937, 1–194).

—, *A botanical bibliography of the islands of the Pacific* with *A subject index* by E. H. Walker (Contr. U.S. Nat. Herb. 30, pt 1, 1947, 1–404).—Amplification of that of 1937. Annotated!

— & E. H. Walker, *A bibliography of Eastern Asiatic Botany* (Arn. Arb. Harv. Univ. 1938, i–xlii, 1–719).–Comprehensive account.

Petch, T., *Bibliography of books and papers relating to Agriculture and Botany to the end of the year 1915.* Peradeniya Manuals *no* 3 (1925) 1–256.–Bibliogr. of Ceylon arranged under headings; over 5000 titles. References 3737–4368 deal with taxonomy of Phanerogams and ferns; most references arranged under families.

Pritzel, G. A., *Thesaurus Literaturae Botanicae, etc.* (ed. Jessen *pp.*). Leipzig (1872–1877) 1–577. –Covers all botanical literature with admirable accuracy, specially regarding books and pamphlets.

Rehder, A., *The Bradley Bibliography.* Arnold Arboretum, Jamaica Plain, Mass. (1911–1918) 5 vols.–Comprehensive bibliography of mainly woody plants described before 1900.

—, *Bibliography of cultivated Trees and Shrubs, etc.* Arnold Arboretum, Jamaica Plain, Mass. (1949) i–xl, 1–825.–With many references to infraspecific taxa. *Non vidi.*

Santapau, H., *Contributions to the bibliography of Indian Botany* (Journ. Bombay Nat. Hist. Soc. 50, 1952, 520–548; *ibid.* 51, 1952, 205–259). –Intended as a complement to Blatter's work (see above). Besides the list of titles, the greater part of the work consists of extracted references arranged in families.

Steenis, C. G. G. J. van, *Annotated list of literature for the use of botanists and explorers in Malaysia* (Fl. Mal. I, 1, 1950, xxxiii–xli).

Steenis-Kruseman, M. J. van, *Malaysian plant collectors and collections, etc.* (Fl. Mal. I, 1, 1950, i–clii, 1–639).–Bibliographic references to the collections arranged under the collectors.

— & W. T. Stearn, *Dates of Publication* (Fl. Mal. I, 4, 1954, clxiii–ccxix).–Extremely useful account of exact dates of publication of certain botanical works; supplementary to Pritzel's, Jackson's and other's bibliographies.

Tucker, E. M., *Catalogue of the Library of the Arnold Arboretum of Harvard University.* Cambridge, Mass. 3 vols (1914–1933).–Valuable catalogue.

Walker, E. H., *Contribution toward a Bibliography of Thai Botany* (Nat. Hist. Bull. Siam Soc. 15, 1952, 27–88).–Annotated bibliogr. of Siamese taxonomic botany.

Wit, H. C. D. de, *Short history of the phytography of Malaysian vascular plants* (Fl. Mal. I, 4, 1949, lxx–clxi).–Each chapter has been provided with numerous references relating to the history of Malaysian phytography.

Woodward, B. B., *Catalogue of the books, manuscripts, maps, and drawings in the British Museum (Natural History).* 8 vols, London (1903–1940).–A very useful reference work for botany and zoology.

3. INTERPRETATION OF EARLY BOTANICAL WORKS

of importance for Malaysian Botany

Blanco, M., *Flora de Filipinas* (1837), ed. 2 (1845), ed. 3 (1877–1883).

cf. Merrill, E. D., *A review of the identifications of the species described in Blanco's Flora de Filipinas* (Govt Lab. Publ. (Philip.) 27, 1905, 1–132).

—, *Species Blancoanae.* Manila (1918) 1–423, map.–Evaluation of species described by Blanco and Llanos.

Burman, N. L., *Flora Indica.* Amsterdam (1768).

cf. Merrill, E. D., Philip. J. Sc. 19 (1921) 329–388.–This review of the new species of plants proposed by Burman has been made without actually examining Burman's herbarium at Geneva which has, unfortunately, been merged into the general Herbier Delessert.

Houttuyn, M., *New genera and species* published in various works.

cf. Merrill, E. D., J. Arn. Arb. 19 (1938) 291–375; *ibid.* 20 (1939) 264–268.–Critical consideration of new genera and species proposed by Houttuyn.

Jack, W., *Descriptions of Malayan Plants* (Mal. Misc. 1 (1), 1820, 1–27; 1 (5), 1821, 1–41; 2 (7), 1822, i–iii, 1–96).

cf. Merrill, E. D., J. Arn. Arb. 33 (1952) 199–250, t. 11.–Evaluation of Jack's new genera and species.

Linnaeus, C., *Species Plantarum, etc.* ed. 1 (1753–1754) 2 vols.

cf. Jackson, B. D., *Index to the Linnean Herbarium, with indication of the types of species marked by Carl von Linné* (Proc. Linn. Soc. Lond. 124, 1912, Suppl. 1–152).

—, *Notes on a catalogue of the Linnean Herbarium* (*ibid.* sess. 134, 1922, Suppl. 1–38, 1 fig.). –Supplementary to the latter entry.

Savage, Sp., *A Catalogue of the Linnean Herbarium.* Ed. by the Linn. Soc. London (1945) i–xv, 1–225.–A valuable account of the contents of the Linnean Herbarium in the possession of the Linnean Society of London indicating the details of the annotations on the sheets.

Loureiro, J. de, *Flora Cochinchinensis, etc.* (1790) i–xx, 1–744. New verbatim ed. by C. L. Willdenow (1793) i–xxiv, 1–882.
cf. Merrill, E. D., Trans. Amer. Philos. Soc. Philad. new ser. 24, 2 (1935) 1–445.–A critical commentary; as far as necessary and possible the types in the British Museum have been examined.

Pennant, T., *Flora Indica* (in Outlines of the Globe 4, 1800, 237–317, 1–8).
cf. Merrill, E. D., J. Arn. Arb. 29 (1948) 186–192.—Evaluation of the new accidental combinations proposed in Pennant's compilation.

Rafinesque, C. S., *Various works.*
cf. Merrill, *Index Rafinesquianus.* Arnold Arboretum, Jamaica Plain, Mass. (1949) i–ix, 1–296.–Complete account and evaluation of the new genera, species, and combinations proposed by Rafinesque.

Rheede tot Draakestein, H. A. van,[1] *Hortus Indicus Malabaricus etc.* 12 vols (1678–1703).
cf.[2] Burman, J., *Flora Malabarica, sive index in omnes tomos horti malabarici, quem juxta normam a botanicis hujus aevi receptam conscripsit, et ordine alphabetico digessit* (1769) 1–10.
Dennstedt, A. W., *Schlüssel zum Hortus Indicus Malabaricus* (1818) 1–40.
Buchanan-Hamilton, F., *Commentary on the Hortus Malabaricus* (1822–1835) 1–410; repr. from Trans. Linn. Soc. 13 (1822) 474–560; 14 (1824) 171–312; 15 (1826) 78–152; 17 (1835) 147–252.
[Dillwyn, L. W.] *A review of the references to the Hortus Malabaricus of Henry van Rheede van Draakenstein* (1839) i–viii, 1–69.

Rumphius, G. E., *Herbarium Amboinense* (1741–1750) 6 vols; (1755), with index universalis, vol. 7 (Auctuarium).–See next entry.
cf.[2] Burman, J., *Index universalis in sex tomos et auctuarium Herbarii Amboinensis cl. Georgii Everhardi Rumphii* (Herb. Amb. Auct. 1755, 1–20).
—, *Index alter in omnes tomos Herbarii Amboinensis cl. G. Everhardi Rumphii, quem de novo recensuit, auxit et emendavit Joannes Burmannus* (1769) 1–22.–This was issued in connection with Burman's index to Rheede's Hortus Malabaricus and is sometimes bound in the last volume of that work.
Linnaeus, C., *Herbarium Amboinense, quod consens. experient. Facult. Medicae in Regia Academia Upsalensi, sub praesidio Linnaei . . . publico examini submittit, Alumnus Regius Olavus Stickman* (1754) i–iv, 1–28.–Republished with slight alterations under the title: *Herbarium Amboinense, sub praesidio D. D. Car. Linnaei, proposuit Olavus Stickman* (Amoen. Acad. 4, 1759, 112–143).
Buchanan-Hamilton, F., *Commentary on the Herbarium Amboinense. Liber Primus* (Mem. Wern. Soc. 5, 1826. 307–383).
—, *A commentary on the second book of the Herbarium Amboinense* (*ibid.* 6, 1832, 268–333).
Henschel, A. G. E. T., *Clavis Herbarii Amboinensis:* in his *Vita G. E. Rumphii* (1833) 139–202.
Hasskarl, J. K., *Neuer Schlüssel zu Rumph's Herbarium Amboinense* (Abh. Naturf. Gesellsch. Halle 9, 1866, 145–389; reprint 1866, 1–247).
Merrill, E. D., *An interpretation of Rumphius's Herbarium Amboinense.* Manila (1917) 1–595, 2 maps.–The latest evaluation of the Rumphian work, which does not rest on actual herbarium specimens, but on the descriptions and plates on which many genera and species have been based.

Thunberg, C. P. (ed. L. Winberg & F. O. Widmark), *Florula Javanica* (1825).
cf. Backer, C. A., R. C. Bakhuizen van den Brink Jr & C. G. G. J. van Steenis, Blumea 6 (1950) 358–362.–Result of an examination of the types preserved at Uppsala as far as new species are concerned.

4. KEYS FOR IDENTIFYING MALAYSIAN PLANTS

Backer, C. A., *Schoolflora voor Java.* Weltevreden (1911) vii-cii.–Contains an original key to Javanese plants which has often proved to be useful for regions outside Java, though based on characters strictly belonging to the Javanese species. In Dutch.

—, *Onkruidflora der Javasche Suikerrietgronden.* Handboek ten dienste van de Suikerriet-cultuur en de rietsuikerfabricage op Java. Vol. 7. Soerabaja (1934) lxxiii–lxxxvii.–Key to *c.* 750 weeds of sugar-cane fields in Java. In Dutch.

Endert, F. H., *Geslachtstabellen voor Nederlandsch-Indische boomsoorten naar vegetatieve kenmerken.* Thesis, Wageningen (1928).–Appeared also as 'Mededelingen van het Bosbouwproefstation te Buitenzorg' 20 (1928) 242 pp. (Commun. For. Res. Institute Buitenzorg).–Valuable key to the genera containing trees in Indonesia based on vegetative characters with the aid of a hand-lens. In Dutch.

Gagnepain, F., *Clef analytique et synoptique des familles de plantes vasculaires décrites dans la Flore Générale de l'Indo-Chine.* Supplément à la Flore Générale de l'Indo-Chine.–Private issue, Paris (1922) 34 pp. Published in a slightly revised edition in the said Flora, tome préliminaire, Paris (1943) 50–89.

Hutchinson, J., *Families of flowering plants.* 1. Dicotyledones. London (1926) 9–80; *ibid.* 2. Monocotyledones. London (1934) 9–25.–Exceedingly useful, general keys covering all genera.

Merrill, E. D., *A Flora of Manila.* Manila (1912) 33–45.–A small key of a local Flora, still origin-

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(1) The name is spelt in different ways, in the 1st vol. as H. van Rheede van Draakenstein, in the last vol. as H. van Rhede tot Drakestein.

(2) Chronologically.

al and not without merits for identifying specimens outside the area it covers.

ST. JOHN, H. & F. R. FOSBERG, *Identification of Hawaiian plants.* Part 1, Dicotyledons. University of Hawaii, Occas. Pap. Bern. P. Bish. Mus. *no* 36 (1938) 4–25; part 2, Gymnosperms & Monocotyledons, *op. cit. no* 41 (1942) 5–13.– Intended only for Hawaii; the second part gives keys as far as the genera.

THONNER, F., *Anleitung zum Bestimmen der Familien der Blütenpflanzen.* 2nd edition, Berlin (1917) 280 pp.–Originally based on a general key to African plants but extended to all flowering plants.

5. FLORAS AND BOTANICAL ENUMERATIONS OF NEIGHBOURING COUNTRIES

India and Pakistan (Nepal, Bhotan)[1]

ANONYMOUS, *Bibliographies of East Indies.* See Chapter 2.

BEDDOME, R. H., *Icones plantarum Indiae Orientalis, etc.* 1 vol., Madras (1868–1874).–300 pl. with descr.

—, *The Flora Sylvativa for Southern India, etc.* Madras (1869–1874).–Plates of principal timber trees of the Madras Presidency with descr.; 2 vols with 325 pl.; vol. 3 with text of a Flora with keys to genera; species descr. & listed.

BENTHALL, A. P., *The trees of Calcutta and its neighbourhood.* Calcutta (1946) i–cii, 1–513, fig. 1–274.–Keys to *spp.* mentioned.

BISCOE, W. F., *A list of trees and shrubs of Indore State.* Bombay (1910) 1–108.–*Non vidi.*

BLATTER, E., *A Bibliography of the Botany of British India & Ceylon.* See Chapter 2.

—, *Beautiful flowers of Kashmir.* London. 2 vols: 1 (1927) i–xv, 1–198, t. 1–33; 2 (1929) i–xv, 1–204, t. 34–62.–Descr.; short key to *spp.*; plates mostly coloured.

— & F. HALLBERG, *The Flora of the Indian desert* (Jodhpur and Jaisalmer) (Journ.Bombay Nat. Hist. Soc. 26, 1918–1919, 218–246, 525–551, 811–818, t. 1–31; 968–987; *ibid.* 27, 1920–1921, 40–47, 270–279, 506–512, t. 32–37).–Plant list with some new *spp.*

— & C. McCANN, *Revision of the Flora of the Bombay Presidency* (*ibid.* 31–38, 1926–1935, in all 27 parts; unfinished).–Keys.

—, —, & T. S. SABNIS, *The Flora of the Indus Delta* (Journ. Ind. Bot. Soc. 6, 1927, 31–47, 57–78, 115–132; *ibid.* 7, 1928, 22–43, 70–96, 168–175; *ibid.* 8, 1929, 19–77; 50 pl., 140 fig.).– Lists of *spp.* and localities; no keys; composition of the flora; ecological notes.

— & W. S. MILLARD, *Some beautiful Indian Trees.* London (1937) i–x, 1–110, t. 1–91, fig. 1–60 (repr. from articles in Journ. Bomb. Nat. Hist. Soc.).

BOISSIER, E., *Flora Orientalis, sive Enumeratio plantarum in Oriente, a Graecia et Aegypto ad Indiae fines hucusque observatarum.* Geneva/ Bazel (1867–1884) 5 vols + Suppl. vol. (ed. BUSER) 1888.–Enum. of flora of the Near East.

BOR, N. L., *Manual of Indian Forest Botany.* Oxford Univ. Pr. (1953) xv + 441, t. 1–31.– Families generally; key to families & genera, occasionally to *spp.*

BRANDIS, D., *Indian Trees.* London (1906) 767 pp., 201 fig.; 3rd ed. (1911).–Flora for foresters; with keys.

CALDER, C. C., V. NARAYANASWAMI & M. S. RAMASWAMI, *List of species and genera of Indian Phanerogams not included in Sir J. D. Hooker's Flora of British India arranged in alphabetical order* (Rec. Bot. Surv. Ind. 11, 1926, i–ii, 1–157).–List of plant names with reference arranged alphabetically under specific names.

COLLETT, H., *Flora Simlensis.* Calcutta & Simla (1902); 2nd ed. (1921).–Illustrated Flora with keys.

COOKE, TH., *The Flora of the Presidency of Bombay.* 3 vols, London (1901–1909).–Not illustrated; keys.

DUTHIE, J. F., *Flora of the Upper Gangetic Plain, etc.* Calcutta (1903–1922) 3 vols.–Non-illustrated flora with keys.

FISCHER, C. E. C., *A survey of the flora of the Anaimalai Hills in the Coimbatore District, Madras Presidency* (Rec. Bot. Surv. Ind. 9, 1921, xxi + 218 pp., 5 pl.).–List.

—, *New or little-known plants from Southern India I-XIII* (Kew Bull. 1932–1940).–*Ditto*; records and new *spp.*

FYSON, P. F., *The Flora of the Nilgiri and Pulney Hill-tops* (*above 6500 ft*). Madras (1915–1920). 1 (1915) i–xxvi, 1–475 (keys and descr.); 2 (1915) Atlas with illustr. on 286 pp.; 3 (1920) i–xviii, 1–136, illustr. on pp. 287–581 (Supplement to the original edition and including the country round Coonoor and down to 5000 ft).

—, *The Flora of the South Indian Hill Stations.* Madras (1932) i–xxix, 1–697, Atlas t. 1–611.– Flora with keys & descr.

GAMBLE, J. S. & C. E. C. FISCHER, *Flora of the Presidency of Madras.* 11 parts, London (1915–1936).–Critical non-illustrated Flora with keys.

GUPTA, B. L., *Forest Flora of the Chakrata, Dehra Dun and Saharanpur Forest Divisions, United Provinces.* Ed. 3. Calcutta (1928) i–xviii, 1–558. –Keys.

HAINES, H. H., *The Botany of Bihar and Orissa, etc.* 2 vols, London (1921–1925) i–x, 1–1350. Supplement by H. MOONEY, Ranchi (1950) i–iii, 1–294.–Important Flora with keys and descr.

HOOKER, J. D. & T. THOMSON, *Flora Indica* vol.

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(1) Assam, Andamans & Nicobars have for convenience been entered separately at the end.

1 (1855) i–xv, 1–280, 1–285.–Valuable introductory essay; Ranunculaceae to Fumariaceae; as in Fl. Br. Ind. keys to genera, not to *spp.*

—, *c.s.*, *Flora of British India.* 7 vols (1872–1897).

Mayuranathan, P. V., *The flowering plants of Madras City and its immediate neighbourhood* (Bull. Madras Govt Mus. n.s. (Nat. Hist. Sect.) 2, 1929, 1–345, t. 1–38).–Very short descr.; keys.

Supplement by E. Barnes (*ibid.* 4, *no 2*, 1938, i–ii, 1–46, t. 1–7).

McCann, C., *Trees of India. A popular handbook.* Bombay (1947) t. 1–78, 17 fig.–*Non vidi.*

Osmaston, A. E., *A Forest Flora of Kumaon.* Allahabad (1927) i–xxxiv, 1–605.–Keys.

Parker, R. N., *A Forest Flora of the Punjab with Hazara and Delhi.* Lahore (1918) i–xxxv, 1–577.–Keys. A 2nd ed. in 1924.

Prain, D., *Bengal Plants.* Calcutta (1903) 2 vols, 1–1319.–Flora with keys; Lower Provinces and Chittagong.

—, *Flora of the Sundribuns* (Rec. Bot. Surv. Ind. 2, 1903, 231–370).–Key to genera; *spp.* listed.

Rao, M. R., *Flowering Plants of Travancore.* Trivandrum (1914).–*Non vidi.*

Rheede tot Draakestein, H. A. van, *Hortus Malabaricus.* See Chapter 3.

Roxburgh, W., *Plants of the Coast of Coromandel, etc.* 3 vols (1795–1820).–Containing 300 tab.

—, *Hortus Bengalensis, etc.* (1814) i–v, i–xii, 1–76. –Catalogue. For a list of validly published names (based on pre-Linnean descriptions) *cf.* Robinson, C. B., in Philip. J. Sc. 7 (1912) Bot. 411–419.

—, *Flora Indica* (ed. Carey) 1 (1820) 1–7, 1–493; 2 (1824) 1–5, i–v, 1–588.

—, *ditto* ed. 2 (1832) 3 vols, resp. 741, 691, and 875 pp. Repr. by Clarke *literatim* (1874).

Santapau, H., *Bibliography of Indian Botany.* See Chapter 2.

Stewart, J. L. & D. Brandis, *The Forest Flora of North-West and Central India.* London (1874) 2 vols, text i–xxxi, 1–608; Atlas ('Illustrations') t. 1–70.

Talbot, W. A., *The Trees, Shrubs, and Woody Climbers of the Bombay Presidency.* Ed. 2, Bombay (1902) i–xi, 1–385.–Keys.

—, *Forest Flora of the Bombay Presidency and Sind.* Poona (1909, 1911) 2 vols: 1 (1909) i–vi, 1–508, i–xxvi, fig. 1–288; 2 (1911) i–xxxvii, 1–574, fig. 289–541.–Descr. illustr., keys.

Wight, R., *Icones Plantarum Indiae Orientalis.* 6 vols (1838–1853) t. 1–2101.

— & G. A. Walker-Arnott, *Prodromus Florae Peninsulae Indiae Orientalis* 1 (1834) i–xxxvii, 1–480.–Partial keys; most of the *Choripetalae*; also *Rubiaceae.*

Assam:

Burkill, I. H., *The Botany of the Abor Expedition* (Rec. Bot. Surv. India 10, 1924–25, 1–420, t. 1–10).–List; ecology and vegetation.

Fischer, C. E. C., *Plants new to Assam I–XIII* (Kew Bull. 1929–1940).–Lists of records and new *spp.*

Kanjilal & Das, *c.s.*, *Flora of Assam.* 5 vols (in 6), Calcutta (1935–1940).–Flora with keys; unfinished.

Andaman Islands:

Gamble, J. S., *A preliminary List of the Plants of the Andaman Islands.* Port Blair (1903) 54 pp.–List.

Kurz, S., *Report on the Vegetation of the Andaman Islands, etc.* Calcutta (1870) 75 pp.–List of *spp.* observed.

Parkinson, C. E., *A Forest Flora of the Andaman Islands.* Simla (1923) i–v, i–v, i–xiii, 1–325, t. 1–6.–Annotated descr. Flora with keys.

Nicobar Islands:

Kurz, S., *A Sketch of the Vegetation of the Nicobar Islands* (J. As. Soc. Bengal 45, ii, 1876, 105–164, t. 12–13).–*Spp.* listed; some new; sketch of vegetation.

Prain, D., *On a botanical visit to Little Andaman and the Nicobars* (Proc. As. Soc. Beng. 1891, 156–175, 1892).–Lists of *spp.* observed.

Ceylon

Abeyesundere, L. A. J. & R. A. de Rosayro, *Draft of first check-list for Ceylon.* Oxford (1939). Mimeogr. 1–115.–Tree catalogue.

Alston, A. H. G., *The Kandy Flora.* Colombo (1938) i–xvii, 1–109, fig. 1–404.–For the use of schools; keys.

Petch, T., *Bibliography of Botany.* See Chapter 2.

Trimen, H. & J. D. Hooker, *A Handbook to the Flora of Ceylon.* 5 vols + 1 vol. plates, London (1893–1900).–An important suppl. vol. 6 (1931) by A. H. G. Alston.

Willis, J. C. & M., *A revised Catalogue of the Flowering Plants and Ferns of Ceylon* (Perad. Manuals of Bot., Entom., Agric. & Hort. *no* 2, 1911, 1–188).–Name list.

Burma

Fischer, C. E. C., *Contributions to the Flora of Burma I–XVIII* (Kew Bull. 1926–1941).–Records and descr. new *spp.*

Kurz, S., *Report on the Forests and Vegetation of Pegu.* Calcutta (1875) 1–97, i–cxxxviii, 1–95, i–xiv, 1–34, maps, t. 1–2.—Extract journey; vegetation; vernacular names and data of forest trees; flora with keys.

—, *Contributions towards a knowledge of the Burmese Flora I–IV* (J. As. Soc. Bengal 43–46, 1874–1877).–Keys!

—, *Forest Flora of British Burma.* 2 vols. Calcutta (1877).–Keys.

Merrill, E. D., *The Upper Burma Plants collected by Capt. F. Kingdon Ward on the Vernay-Cutting Expedition, 1938–1939* (Brittonia 4, 1941, 20–188).–List; descr. new *spp.*

Siam

Anonymous, *Bibliographies of Thailand.* See Chapter 2.

Craib, W. G., A. F. G. Kerr, J. B. Imlay, *c.s.*, *Contributions to the Flora of Siam I–LIV* (Kew

Bull. 1911–1941).–Lists of records and new *spp.*

Craib, W. G., A. F. G. Kerr, H. R. Fletcher, *c.s.*, *Flora Siamensis Enumeratio.* Vols 1–3^2, Bangkok (1925–1954).–Critical synonymy; list; no keys.

Hosseus, C. C., *Die botanischen Ergebnisse meiner Expedition nach Siam* (Beih. Bot. Centralbl. 28, ii, 1911, 357–457).–List.

Ridley, H. N., *The Flora of Lower Siam* (J. Str. Br. As. Soc. *no* 59, 1911, 15–234).–List.

—, *On a collection of plants from Peninsular Siam* (J. Fed. Mal. Stat. Mus. 10, 1920, 65–126).–List.

Walker, E. H., *Bibliography of Botany.* See Chapter 2.

Indo-China

Anonymous, *Bibliographies of Indo-China.* See Chapter 2.

Lecomte, H., F. Gagnepain, *c.s.*, *Flore générale de l'Indo-Chine.* 7 vols, 1 vol. Suppl. and tome préliminaire. Paris (1907–1951).–Flora with keys and figures.

Loureiro, J. de, *Flora Cochinchinensis, etc.* (1790) i–xx, 1–744. For an evaluation *cf.* Merrill, Trans. Amer. Philos. Soc. Philad. new ser. 24, 2 (1935) 1–445.

Pierre, L., *Flore Forestière de la Cochinchine.* Paris (1879–1907) 26 parts (5 vols) t. 1–400.–Plates accompanied by text; quite some Malaysian plants are mentioned or are critically considered.

Hainan

Masamune, G., *Flora Kainantensis.* Taiwan (1943) xv + 443 pp.–Enum.; except names and references in Japanese.

Merrill, E. D., *An Enumeration of Hainan plants* (Lingn. Sc. J. 5, 1927, 1–186).–List; no keys. Many supplements in later vols of same journal and in Sunyatsenia.

— & Walker, *Bibliography of Eastern Asia.* See Chapter 2.

Formosa (Taiwan)

Hayata, B., *Flora Montana Formosae* (J. Coll. Sc. Imp. Univ. Tokyo 25 (art. 19), 1908, 1–260, t. 1–41).–Enum. plants above 900 m.

—, *Materials for a Flora of Formosa* (*ibid.* 30, art. 1, 1911, 1–471).–Descr.

—, *Icones Plantarum Formosanarum.* (1911–1921) vol. 1–10; Suppl. 5 parts (1925–1932) by Y. Yamamoto.–Revisions & descr.; sometimes keys; beautiful illustrations.

Kanehira, R., *Formosan Trees indigenous to the island.* Dep. Forestry, Govt Res. Inst. Taihoku. Revised ed. (1936) i–x, 1–754, fig. 1–664, t. 1–50.–Descr.; synon.; no keys.

Kudo, Y. & G. Masamune, *Genera Plantarum Formosanarum I* (Ann. Rep. Taihoku Bot. Gard. 2, 1932, 1–141).–*Saururaceae-Rosaceae.* Keys to and descr. of genera.

Matsumura, J. & B. Hayata, *Enumeratio Plantarum in Insula Formosa, etc.* (J. Coll. Sc. Tokyo 22, 1906, 1–704, t. 1–18).–Enum.; t. 18 is a map.

Merrill & Walker, *Bibliography of Eastern Asia.* See Chapter 2.

Sasaki, S., *A Catalogue of the Government Herbarium.* Taihoku (1930) vii + 592 pp.

Micronesia

Glassmann, S. F., *The Flora of Ponape* (Bern. P. Bish. Mus. Bull. 209, 1952, 1–152, fig. 1–21).–List; no keys.

Hosokawa, T., *Materials of the botanical research towards the Flora of Micronesia I–XXI* (Trans. Nat. Hist. Soc. Formosa 24–31, 1934–1941, only XIV–XVI in J. Jap. Bot. 13, 1937, 53–203, 274–284, 608–617).–A well-illustrated series of papers with records and new *spp.*; for some genera keys.

Kanehira, R., *New or noteworthy trees from Micronesia 1–20* (Tokyo Bot. Mag. 46–52, 1932–1938).–Series of illustrated papers with records and descr. new *spp.*

—, *Flora Micronesica.* South Seas Bureau (1933) viii, 468, 37 pp., fig. 1–211, t. 1–21.–Well-illustrated Flora with keys but the text except the Latin names in Japanese.

—, *Plantae novae Micronesicae* (Trans. Nat. Hist. Soc. Formosa 25, 1935, 136–139).–Records and some new *spp* in a few families.

—, *An Enumeration of Micronesian plants* (J. Dept Agric. Kyushu Imp. Univ. 4, 1935, 237–464).

Merrill, E. D., *An Enumeration of the plants of Guam* (Philip. J. Sc. 9, 1914, Bot. 14–155; *ibid.* 15, 1919, 539–544).–Enum.; descr. new *spp.*

—, *Bibliography of the Pacific.* See Chapter 2.

Utinomi, H., *Bibliography of Micronesia.* See Chapter 2.

Volkens, G., L. Diels, *c.s.*, *Beiträge zur Flora von Mikronesien* (*und Polynesien*) I (Bot. Jahrb. 52, 1915, 1–18); *ditto* II (*ibid.* 56, 1921, 429–577); *ditto* III (*ibid.* 59, 1924, 1–29); *ditto* IV (*ibid.* 63, 1930, 272–323); *ditto* V (*ibid.* 69, 1938, 395–400).–Revisions; sometimes with keys; incomplete.

Walker, E. H. & R. Todin, *Additional phanerogams in the Flora of Guam, with notes on unverified records* (Contr. U. S. Nat. Herb. 30, 1949, 449–468, t. 8–9).–List of records; no novelties.

Melanesia

Bentham, G., *Enumeration of the plants collected by R. B. Hinds Esq. and Mr Barclay, etc.* (in Hook. J. Bot. 2, 1843, 211–240).–List of plants coll. in Fiji, Tanna, New Ireland, and New Guinea, and a few from Ambon (Moluccas).

Burkill, I. H., *c.s.*, *On a collection of Plants from New Britain* (*Neu Pommern*) (Proc. Cambr. Phil. Soc. 9, 1896, 91–98).–List; some new *spp.*; bibliogr. New Britain Botany.

Burtt, B. L., *Melanesian Plants* (Kew Bull. 1935, 298–306; *ibid.* 1936, 459–466).–Descr. some new *spp.* from the Solomons, a single one from Fiji.

Diels, L., *c.s.*, *Plantae Peekelianae Papuanae* (Notizbl. Berl.-Dahlem 10, 1930, 273–282).–Descr. some new *spp.* and records.

Engler, A., *c.s.*, *Uebersicht über die botanischen Ergebnisse der Gazelle-Expedition* (Bot. Jahrb. 7, 1886, 444–480).–*Cyperaceae, Gramineae, Orchidaceae* were published in *op. cit.* 5 (1884) 89–94; 6 (1885) 233–248; 7 (1885) 435–443.–List of records; also new *spp.*

Fosberg, F. R., *Melanesian vascular plants* (Lloydia 3, 1940, 109–124, 1 pl., 5 fig.).–List of 60 *spp.* from the Templeton Crocker Exp. in the Solomon & Santa Cruz Isl.; some new.

Hemsley, W. B., *c.s.*, *Flora of the Solomon Islands* (Kew Bull. 1894, 211–215).–List of new *spp.*

—, *ditto* (*ibid.* 1895, 132–139).–Coll. Comins; list; new *spp.*

—, Ann. Bot. 5 (1891) 501–508, t. 27.–Misc. descr. new *spp.*; *Cominsia n.g.*

—, *ibid.* 6 (1892) 203–210, t. 11–14.–Descr. 2 new gen. of *Sapotaceae.*

—, J. Linn. Soc. Lond. Bot. 30 (1894) 163–165, 211–217, t. 9–11.–Misc. descr. new *spp.*; *Sararanga n.g.*

Lauterbach, C., *Beiträge zur Flora von Neu-Mecklenburg* (Bot. Jahrb. 45, 1911, 354–365).–Records from New Ireland coll. Peekel; some new *spp.*

—, *Beiträge zur Flora Papuasiens.*–See under New Guinea. Occasionally Melanesian collections are mentioned.

Merrill, *Bibliography of the Pacific*. See Chapter 2.

— & Perry, *Plantae Archboldianae.*–See under New Guinea. In this series, as well as in other papers on the New Guinean flora by A. C. Smith, C. T. White, *etc.* Melanesian *spp.* have been recorded or described.

Rechinger, K., *c.s.*, *Botanische Ergebnisse der wissenschaftlichen Forschungsreise nach den Samoainseln, dem Neuguinea-Archipel und den Salomonsinseln* (Denkschr. Kais. Ak. Wiss. Wien 84, 1910, 408–455 (*Pteridophytes* and *Cyperaceae*); *ibid.* 89, 1914, 468–621).–List of records and new *spp.* coll. Rechinger.

—, *Plantae Papuanae* (in Fedde, Rep. 11, 1912, 179–187).–Descr. misc. new *spp.*; some from New Guinea.

Record, M., *A collection of woody plants from Melanesia* (Trop. Woods 81, 1945, 9–45).–List of records of 400 *spp.* coll. Waterhouse 1932–1936 from Bougainville, New Britain, *etc.*; no new *spp.* or new comb.

Schumann, K., *Die Flora des Deutschen Ostasiatischen Schutzgebietes* (Bot. Jahrb. 9, 1887, 189–223).–List of plants coll. Hollrung, Naumann, *etc.* from New Guinea, New Britain, Solomons, *etc.* with occasional new *spp.*

—, *c.s.*, *Die Flora von Neu-Pommern* (Notizbl. Berl.-Dahlem 2, 1898, 59–158, map).–List records and new *spp.*

White, C. T., *Ligneous plants from the Solomon Islands (and New Guinea)* (J. Arn. Arb. 31, 1950, 81–116).–List records and new *spp.*

New Hebrides

Guillaumin, A., *Contributions to the Flora of the New Hebrides. Plants collected by S. F. Kajewski in 1928 and 1929* (J. Arn. Arb. 12, 1931, 221–264, fig. 1–3; *ibid.* 13, 1932, 1–29, fig. 1, 81–126, fig. 1–2, t. 43).–Records and new *spp.*

—, *Compendium de la Flore Phanérogamique des Nouvelles Hébrides* (Ann. Mus. Col. Marseille 55/56, 1948, 1–56).–List of plants known.

Merrill, *Bibliography of the Pacific*. See Chapter 2.

New Caledonia

Däniker, A. U., *c.s.*, *Katalog der Pteridophyta und Embryophyta Siphonogama* (Beibl. Vierteljahrschr. Naturf. Ges. Zürich 77–78, 1932–43, 1–507).

Guillaumin, A., *Matériaux pour la Flore de la Nouvelle-Calédonie.*–A series of 85 revisions and lists, mostly published in Bull. Soc. Bot. Fr. and Not. Syst. 1914–1945. Indispensable for consulting the next work.

—, *Flore analytique et synoptique de la Nouvelle-Calédonie. Phanérogames.* Paris (1948) 1–369.–Merely keys; no descr. of genera & *spp.*; no author names; no references.

Merrill, *Bibliography of the Pacific*. See Chapter 2.

Rendle, A. B., E. G. Baker & S. Moore, *A Systematic Account of the Plants collected in New Caledonia and the Isle of Pines by Prof. R. H. Compton, M. A. in 1914* (J. Linn. Soc. Lond. Bot. 45, 1921, 245–417, t. 13–24).–List; many new *spp.* not considered by Guillaumin.

Schlechter, R., *Beiträge zur Kenntnis der Flora von Neu-Kaledonien* (Bot. Jahrb. 39, 1907, 1–274, fig. 1–23).–Account of his collections; records and descr.; no keys.

Australia

General:

Bentham, G., assisted by F. von Mueller, *Flora Australiensis.* 7 vols. London (1863–1878).–Standard work; keys.

Domin, K., *Beiträge zur Flora und Pflanzengeographie Australiens* (Bibl. Bot. 20 and 22, 1915–1929, 1317 pp.).–Refers primarily to Queensland.

Francis, W. D., *Australian Rain-forest Trees.* 2nd ed. For. & Timber Bur. Commonwealth Australia (1951) i–xv, 1–469, 24 fig., 260 tab., 1 map.–Descr.; key to genera; artificial key to *spp.*

Mueller, F. von, *Second systematic census of Australian plants.* Melbourne (1889) 244 pp.–Enumeration of *spp.* and their distr. in Australia.

North Australia:

Ewart, A. J. & O. B. Davies, *The Flora of the Northern Territory, etc.* Melbourne (1917) viii + 387 pp., t. 1–27.–Keys.

Queensland:

Bailey, F. M., *The Queensland Flora.* 6 parts, index. Brisbane (1899–1902) xxxii + 2015 pp., index (1905) 1–66.–Keys.

—, *Comprehensive Catalogue of Queensland Plants, etc.* Brisbane (1913) 879 pp., 976 fig., 16 tab.

DOMIN, K., See above under Australia. DOMIN's work deals mostly with Queensland plants.

WHITE, C. T., *Ligneous plants collected for the Arnold Arboretum in North Queensland by S. F. Kajewski in 1929* (Contr. Arn. Arb. 4, 1933, 113 pp., t. 1–9).–Enum. & descr.

— & W. D. FRANCIS, *Contributions to the Queensland Flora 1–8* (Proc. R. Soc. Queensland 1921–1944).–*Ditto.*

West Australia:

DIELS, L. & E. PRITZEL, *Fragmenta phytographiae Australiae occidentalis* (Bot. Jahrb. 35, 1904–05, 55–662, fig. 1–70).–Enum.; no keys.

GARDNER, C. A., *Enumeratio plantarum Australiae occidentalis.* Perth (1931) iv + 150 pp.—Name list.

—, *Flora of West Australia.* vol. 1, part 1 (*Gramineae*) (1953); other volumes in course of preparation.

New South Wales:

DIXON, W. A., *The plants of New South Wales, etc.* Sydney (1906) xxiv + 322 pp.–Analytical keys. *Non vidi.*

MAIDEN, J. H. & E. BETCHE, *A census of New South Wales plants.* Sydney (1916) xx + 216 pp.–*Non vidi.*

MOORE, CH. & E. BETCHE, *Handbook of the Flora of New South Wales.* Sydney (1893) xxxix + 582 pp.–*Non vidi.*

Victoria:

EWART, A. J., *Flora of Victoria.* Melbourne (1930) 1257 pp., 349 fig.

South Australia:

BLACK, J. M., *Flora of South Australia.* 4 parts (1922–1929).–Parts 1–3 have already been revised in a 2nd edition; pt 4 is in the press.

Tasmania

RODWAY, L., *The Tasmanian Flora.* Hobart (1903) xix + 320 pp., tab.–*Non vidi.*

New Zealand

CHEESEMAN, T. F., *Manual of the New Zealand Flora.* 2nd ed. Wellington (1925) xliv, 1163 pp. –Keys.

HOOKER, J. D., *Handbook of the New Zealand Flora, etc.* London (1864–67).–Standard Flora with keys.

Fiji

GIBBS, L. S., *c.s., A contribution to the montane Flora of Fiji (including Cryptogams), with ecological notes* (J. Linn. Soc. Lond. Bot. 39, 1909, 130–212, t. 11–16, fig. 1–2).–Listed records with new *spp.*

GILLESPIE, J. W., *New plants from Fiji I–III* (Bern. P. Bish. Mus. Bull. 74, 1930, 1–41, 43–99 (t. 1–57); *ibid.* 83, 1931, 1–32, 33–72 (t. 1–40); *ibid.* 91, 1932, 1–38, 39–81 (t. 1–43)).–Mainly miscellaneous new *spp.*

GRAY, A., *Botany, Phanerogamia* (in U.S. Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N., 1854, 1–777, atlas, 1857, t. 1–100).–Listed records and descr.

MERRILL, *Bibliography of the Pacific.* See Chapter 2.

SEEMANN, B., *Flora Vitiensis: etc.* London (1865–1868) 1–324, t. (col.) 1–90.–Descr.

SMITH, A. C., *Fijian Plant Studies* (Bern. P. Bish. Mus. Bull. 141, 1936, 1–166, fig. 1–83).—Account of 1933–1934 expedition; records and new *spp.* of pteridophytes and phanerogams.

— *c.s., Ditto* II (Sargentia 1, 1942, i–iv, 1–148, fig. 1–5).–Results of 1940–1941 expeditions by DEGENER; keys.

—, *Studies of Pacific Island plants I–XVI* (Bull. Torrey Bot. Club 68, 1941, 397–406; J. Arn. Arb. 24, 1943, 347–361; Bull. Torrey Bot. Club 70, 1943, 533–549; J. Arn. Arb. 26, 1945, 97–110, 319–322; *ibid.* 31, 1950, 137–171, 288–319; *ibid.* 32, 1951, 27–58, 226–255; Contr. U.S. Nat. Herb. 30, 1952, 469–522; J. Arn. Arb. 33, 1952, 97–149, 367–402; *ibid.* 34, 1953, 37–51; Contr. U. S. Nat. Herb. 30, 1953, 523–575; J. Arn. Arb. 34, 1953, 97–124).–Mostly dealing with Fijian plants, partly as revisions with keys of separate families.

Samoa

CHRISTOPHERSEN, E., *c.s., Flowering Plants of Samoa* (Bern. P. Bish. Mus. Bull. 128, 1935, 1–221, fig. 1–32).–Records and descr. new *spp.*

ENGLER, A., *c.s., Uebersicht über die botanischen Ergebnisse der Gazelle-Expedition* (Bot. Jahrb. 7, 1886, 444–480).–*Cyperaceae, Gramineae, Orchidaceae* were published in *op. cit.* 5 (1884) 89–94; 6 (1885) 233–248; 7 (1885) 435–443.–List of records; also new *spp.*

GRAY, A., *Botany, Phanerogamia* (in U.S. Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N., 1854, 1–777, atlas, 1857, t. 1–100).–Listed records and descr.

MERRILL, *Bibliography of the Pacific.* See Chapter 2.

RECHINGER, K., *c.s., Botanische Ergebnisse der wissenschaftlichen Forschungsreise nach den Samoainseln, dem Neuguinea-Archipel und den Salomonsinseln* (Denkschr. Kais. Ak. Wiss. Wien 84, 1910, 408–455 (Pteridophytes and Cyperaceae); *ibid.* 89, 1914, 468–621).–List of records and new *spp.* coll. RECHINGER.

REINECKE, F., *Die Flora der Samoa Inseln. II. Siphonogamen* (Bot. Jahrb. 25, 1898, 578–708, t. 8–13, fig. 1).–Enum.

Southeastern Polynesia

BROWN, F. B. H., *c.s., Flora of Southeastern Polynesia I–III* (Bern. P. Bish. Mus. Bull.; Monocotyledons: 84, 1931, 1–194, t. 1–35, fig. 1–18; Pteridophytes: 89, 1931, 1–123, t. 1–21, fig. 1–19; Dicotyledons: 130, 1935, 1–386, fig. 1–70, t. 1–9).–Flora with keys of the Marquesas, Society Isl., Tuamotu Arch., Austral Isl., Rapa & Pitcairn.

DRAKE DEL CASTILLO, E., *Flore de la Polynésie Française*. Paris (1893) i–xxiv, 1–352, map (of Tahiti).–Flora with keys of the Marquesas, Society Isl., Pomotou, Gambier, and Wallis Isl.

—, *Illustrationes Florae Insularum Maris Pacifici*. Paris (1886) 1–458, t. 1–50.–Enum. *spp.* from Fiji, Samoa, Tahiti, Tonga, and SE. Polynesia.

ENGLER, A., *c.s.*, *Uebersicht über die botanischen Ergebnisse der Gazelle-Expedition* (Bot. Jahrb. 7, 1886, 444–480).–*Cyperaceae*, *Gramineae*, *Orchidaceae* were published in *op. cit.* 5 (1884) 89–94; 6 (1885) 233–248; 7 (1885) 435–443.–List of records; also new *spp.*

GRAY, A., *Botany, Phanerogamia* (in U.S. Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N., 1854, 1–777, atlas, 1857, t. 1–100).–Listed records and descr.

MERRILL, *Bibliography of the Pacific*. See Chapter 2.

6. FLORA OF MALAYSIA PROPER

a. GENERAL WORKS

BACKER, C. A., *Contributiones ad cognitionem Florae Indiae Batavae* (Bull. Jard. Bot. Btzg III, 2, 1920, 315–330).–Descr. miscellaneous new *spp.*

BECCARI, O., *c.s.*, *Malesia*. 3 vols. Firenze (1877–1890).–Beautifully illustrated series of semi-monogr. revisions of various groups mostly on the basis of BECCARI's own collections. Other than descr. text in Ital.

BLUME, C. L., *Bijdragen tot de Flora van Nederlandsch Indië*, parts 1–17 (1825–1827).–Descr. of many new genera and over 1000 new *spp.* from various collections; in Latin.

—, *Enumeratio Plantarum Javae et insularum adjacentium minus cognitarum vel novarum, etc.* Fasc. 1 (1827) i–vi, 1–98; fasc. 2 (1827) i–x, 99–274; Verbatim repr. 1830.–Enum.; descr. (in Latin). Besides plants from Java this work contains also some descr. from other Mal. islands, *e.g.* from Celebes coll. REINWARDT; some *spp.* based on Rumphian references.

—, *Rumphia, etc.* 4 vols (1836–1849).–Illustrated with col. plates of selected plant groups and genera; in Latin.

—, *Museum botanicum Lugduno-Batavum, etc.* 2 vols (1849–1856) 396 + 256 pp.–Account of Leyden collections; mainly descr. text; not confined to Malaysian plants; many new *spp.*, some new genera; in Latin; a few plates with analyses.

BOERLAGE, J. G., *Handleiding tot de kennis der Flora van Nederlandsch Indië*. 3 vols (1890–1900). –Incomplete; descriptions of genera, appr. following BENTHAM & HOOKER's Genera Plantarum; sometimes keys to the genera; in Dutch.

—, *Catalogus plantarum phanerogamarum quae in horto botanico Bogoriensi coluntur herbaceis exceptis*. 2 parts (1899–1901).–Enum. *spp.* cultivated in Hort. Bog.; some new.

—, TH. VALETON, J. J. SMITH, *etc.*, *Icones Bogorienses*. 4 vols, Leiden (1897–1914).–Planned like HOOKER's Ic. Plant.; with many valuable contributions, several new genera and many new *spp.*

BURKILL, I. H., Some changes in plant names (Kew Bull. 1935, 316–319).–List of transfers from his Dictionary of Econ. Prod. of the Malay Peninsula.

BURMAN, N. L., *Flora Indica, etc.* Leyden/Amsterdam (1768) i–iv, 1–242, t. 1–67, indices 1–15.–Enum.; no keys; a bibliographic evaluation is given by MERRILL, Philip. J. Sc. 19 (1921) 328–388.

CHOISY, J. D., *Plantae Javanicae nec non ex insulis finitimis et etiam e Japonia*. Genève (1858) i–iv, 5–30.–Records and descr. of ZOLLINGER's second collection and a continuation of his 'Syst. Verz.'; contains accounts of *Hypericaceae*, *Guttiferae*, *Theaceae*, *Saurauia*, and *Convolvulaceae*; in Latin.

ENGLER, A., *c.s.*, *Uebersicht über die botanischen Ergebnisse der Gazelle-Expedition* (Bot. Jahrb. 7, 1886, 444–480).–*Cyperaceae*, *Gramineae*, *Orchidaceae* were published in *op. cit.* 5 (1884) 89–94; 6 (1885) 233–248; 7 (1885) 435–443.–List of records; also new *spp.*; from Timor, Solomon Isl., New Britain, New Guinea, Tonga Isl. and Samoa.

HALLIER *f.*, H., *Neue und bemerkenswerte Pflanzen aus dem Malaiisch-Papuanischen Inselmeer* I (Ann. Jard. Bot. Btzg 13, 1896, 276–327); *ditto* II (Bull. Herb. Boiss. 6, 1898, 213–220, 283–288, 348–360, 604–622); *ditto* III (*ibid.* II, 1, 1901, 667–676); *ditto* IV (Med. Rijksherb. Leiden 26, 1915, 1–8).–Miscellaneous contrib.; records; descr. new *spp.*

—, *Neue Indonesische Dikotyledonen* (in FEDDE, Rep. 2, 1906, 59–64).–New *spp.* and miscellaneous records.

HASSKARL, J. K., *Adnotationes de plantis quibusdam Javanicis nonnullisque Japonicis, haud rite cognitis e Catalogo Horti Bogoriensis excerptae. Accedunt nonnullae novae species* (in HOEVEN & DE VRIESE, Tijd. Nat. Geschied. & Phys. 10, 1843, 115–150).–List of new records and descr. new *spp.* occurring in the Catalogue of 1844, see next entry.

—, *Catalogus plantarum in Horto Botanico Bogoriensi cultarum alter*. Batavia (1844) 1–391.–Contains descr. of new gen. & *spp.*; also new comb. and new names.

—, *Adnotationes de plantis horti Bogoriensis* (in HOEVEN & DE VRIESE, Tijd. Nat. Geschied. & Phys. 12, 1845, 77–139).–Continuation of the article of 1843.

—, *Retzia, sive observationes botanicae, quas in primis in Horto Botanico Bogoriensi, etc. Pugillus I* (Nat. Tijd. Ned. Ind. 10, 1855, 1–252, 1856).–Descr. mostly of Javanese plants, partly from the Botanic Gardens at Bogor; in Latin.

—, *ditto. Pugillus II* (Acta Soc. Sc. Indo-Neerl. 1, 1856, 1–54).–*Ditto.*

—, *Hortus Bogoriensis descriptus, sive Retzia editio nova, valde aucta et emendata.* Amsterdam & Bonn (1858) xx + 376 pp.–A revised edition of the former work.

—, *ditto, pars II* (Bonplandia 7, 1859, 170–183, 254–274; *ibid.* 8, 1860, 90–100, 118–146).–Miscellaneous descr., mostly of plants from the Botanic Gardens, Bogor; hardly any new *spp.*

Heyne, K., *De Nuttige Planten van Nederlandsch-Indië* ('The useful plants of the Netherlands East Indies'). 2nd ed. Weltevreden (1927), 3 vols, ccxi + 1662 pp. Repr. *literatim* (1950) under the title: '*De Nuttige Planten van Indonesië*'.–Critical enum. of useful plants; in Dutch.

Hochreutiner, B. P. G., *Catalogus Bogoriensis novus I–II* (Bull. Inst. Bot. Btzg *no* 19, 1904, 1–48; *ibid. no* 22, 1905, 1–132; index 1908, 1–22).–Catalogue of the Botanic Gardens, Bogor; contains descr. of new taxa.

—, *Plantae Bogorienses exsiccatae novae vel minus cognitae quae in Horto Botanico coluntur.* Bogor (1904) 1–75, index i–ix.–Contains descr. of miscellaneous new *spp.*

—, *Descriptiones plantarum Bogoriensium exsiccatarum novarum* (Ann. Jard. Bot. Btzg, Suppl. 3, 1910, 815–870).–Miscellaneous descr. of plants cultivated in the Botanic Gardens, Bogor.

Korthals, P. W., *Kruidkunde* ('Botany') in Temminck, Verh. Nat. Geschied. 1 vol. (1840–1844) 1–259, t. 1–70.–Treatments of various groups of his collections.

Miquel, F. A. W., *Flora Indiae Batavae* 1^1 (1855–1858) xxiv + 1116 pp.; 1^2 (1858–1859) xii + 704 pp.; 2 (1856–1859) ix + 1103 pp.; 3 (1855–1859) x + 773 pp.–Enum.; no keys.

—, *Choix des plantes rares ou nouvelles, etc.* The Hague (1864) 1–30, t. 1–26, folio.

—, *c.s.*, *Annales Musei botanici Lugduno-Batavi.* 4 vols, Leyden (1863–1869).–Contains many revisions additional to Fl. Ind. Bat.

—, *Illustrations de la Flore de l'Archipel Indien.* 3 parts. Leyden (1870–1871) x + 114 pp., t. 1–37.–Semi-monogr. revisions of various families in Malaysia; continuation of the latter work.

Ochse, J. J. & R. C. Bakhuizen van den Brink, *Indische Groenten* ('Vegetables of the Dutch East Indies'). Batavia-C. (1931) xxxv + 1003 pp., 463 fig.–In Dutch; there is also an English edition (1931).–Descriptions.

Roxburgh, W., *Flora Indica.* 2 vols. Serampore (1820–1824); ed. Carey, 3 vols. London (1832). –The latter edition reprinted literatim (1872). –Many types of Malaysian plants are among those described by Roxburgh, specially from the Malay Peninsula.

Scheffer, R. H. C. C., *Observationes phytographicae I–III* (Nat. Tijd. Ned. Ind. 31, 1870, 1–23, 338–390; *ibid.* 32, 1873, 387–426).–Records and descriptions of new genera & *spp.*, mostly based on the collections of Teysmann.

Smith, J. J., *Plantae novae vel criticae ex herbario et horto bogoriensi I–III* (Bull. Jard. Bot. Btzg III, 1, 1918, 399–411; *ibid.* 4, 1922, 230–240; *ibid.* 6, 1924, 73–107).–Misc. descr. of Mal. plants with plates.

Steenis, C. G. G. J. van, *On the origin of the Malaysian mountain flora I* (Bull. Jard. Bot. Btzg III, 13, 1934, 174–260).–Semi-critical enum. of *spp.* belonging to microtherm genera.

—, *Annotated list of literature.* See Chapter 2.

—, *Miscellaneous botanical notes I–VI* (Bull. Bot. Gard. Btzg III, 17, 1948, 383–411; Blumea 6, 1948, 242–263; Bull. Bot. Gard. Btzg III, 18, 1950, 457–461; Reinwardtia 1, 1952, 467–481; Act. Bot. Neerl. 2, 1953, 298–307; Blumea 7, 1954, 595–598).–Misc. notes, records & descr. new genera & *spp.*

Steenis-Kruseman, M. J. van, *Malaysian Plant Collectors.* See Chapter 2.

— & W. T. Stearn, *Dates of Publication.* See Chapter 2.

Teysmann, J. E. & S. Binnendijk, *Nieuwe plantensoorten in 's Lands Plantentuin te Buitenzorg* (Nat. Tijd. Ned. Ind. 2, 1851, 303–310; *ibid.* 3, 1852, 326–332; *ibid.* 4, 1853, 393–398).–Descr. miscellaneous new Malaysian *spp.*

—, *Plantae novae in Horto Bogoriensi cultae* (Nat. Tijd. Ned. Ind. 24, 1862, 305–332; *ibid.* 25, 1863, 399–428; *ibid.* 27, 1864, 15–58).–Important series of descr. of miscellaneous new *spp.* from Malaysia.

Turczaninow, N., *Animadversiones, etc. I–III* (Bull. Soc. Nat. Moscou 27^2, 1854, 271bis–372; *ibid.* 31^1, 1858, 185–250, 379–476; *ibid.* 36^1, 1863, 545–615).–Miscellaneous Latin diagnoses of new genera and *spp.* from the author's herb. in Charkow; several based on Zollinger numbers.

Vriese, W. H. de, *Plantae Indiae Batavae Orientalis, etc.* Leyden (1856–1857) 1–160, t. 1–8.–Revisions of some groups; misc. records and descr. of plants coll. Reinwardt in Java, Celebes, Ambon, Ternate, *etc.*

Warburg, O., *c.s.*, *Monsunia. Beiträge zur Kenntnis der Vegetation des Süd- und Ostasiatischen Monsungebietes.* Leipzig (1900) i–vii, 1–201, t. 1–11.–Descr. various groups of *Bryophytes*, *Fungi*, *Pteridophytes*, and *Gymnosperms.*

Wit, H. C. D. de, *History of Phytography.* See Chapter 2.

Zollinger, H., *Observationes phytographicae, etc.* (Nat. & Geneesk. Arch. Ned. Ind. 1, 1844, 372–405, 599–616; *ibid.* 2, 1845, 1–19, 200–273, 563–587).–Lists; records & descr. of new genera & *spp.*

—, *Systematisches Verzeichnis der im Indischen Archipel in den Jahren 1842–1848 gesammelten sowie der aus Japan empfangenen Pflanzen.* Zürich (1854–1855). pt 1 (1854) i–xii, 1–80, tab.; pt 2 (1854) 81–160; pt 3 (1855) 1–67.–Enum. of *spp.* from his collections made during his second stay in Java and his trips to Bali, Lombok, S. Celebes, Saleyer, Flores, Bima, and Sumbawa. Includes also species from Japan received by him. For a continuation see Choisy and the next entry.

—, *Observationes botanicae novae* (Nat. Tijd. Ned. Ind. 14, 1857, 145–176, repr. 1–32).–Misc. records and descr. of novelties mostly from Java, partly based on his own collections, partly on those of the Botanic Gardens, Bogor, partly from the heritage of Kuhl and van Hasselt; continuation and correction of the latter book. In Dutch; descr. in Latin.

b. LOCAL WORKS[1]

Sumatra

Bartlett, H. H., *Sumatran plants collected in Asahan and Karoland with notes on their vernacular names* (Pap. Mich. Acad. Sc. Arts & Lett. 6, 1926, 1–66).

Boerlage, J. G., *Flora; Systematische lijst, etc.* (in Veth, Midden-Sumatra 4, pt 2, 1884, 16–50). –List; some new *spp.* from Central Sumatra. In Dutch.

Hildebrand, F. H., Report For. Res. Institute, Bogor, *no* 8 (1949) 14 pp., mimeogr.–List of tree *spp.* from Djambi Division, South Sumatra.

—, *ditto, no* 9 (1949) 50 pp.–*Ditto*, from Sumatra's East Coast Division.

—, *ditto no* 56 (1952) 64 pp.–Revised edition of the latter.

—, *ditto, no* 11 (1949) 67 pp.–*Ditto*, from Riouw, Bengkalis & Indragiri.

—, *ditto no* 36 (1953) 26 pp.–*Ditto*, from Bengkalis (Riouw).

—, *ditto no* 61 (1953) 67 pp.–*Ditto*, from Riouw & Indragiri.

—, *ditto, no* 12 (1949) 29 pp.–*Ditto*, from Banka & Billiton Islands.

—, *ditto, no* 57 (1952) 46 pp.–Revised edition of the latter.

—, *ditto, no* 19 (1949) 78 pp.–*Ditto*, from Palembang, South Sumatra.

—, *ditto, no* 20 (1949) 19 pp.–*Ditto*, from Lampung Districts, South Sumatra.

—, *ditto, no* 65 (1954) 27 pp.–Revised edition of the latter.

—, *ditto, no* 22 (1949) 47 pp.–*Ditto*, from Bencoolen Division.

—, *ditto, no* 26 (1950) 60 pp.–*Ditto*, from Sumatra's West Coast Division.

—, *ditto, no* 64 (1953) 67 pp.–Revised edition of the latter.

—, *ditto, no* 29 (1950) 43 pp.–*Ditto*, from Tapanuli Division, Northwest Sumatra.

—, *ditto, no* 67 (1954) 50 pp.–Revised edition of the latter.

—, *ditto, no* 32 (1950) 70 pp.–*Ditto*, from Atjeh Division and neighbouring Simalur Island, N. Sumatra.

Jack, W., *Descriptions of Malayan plants* (in Mal. Miscell. 1 (1), 1820, 1–27; 1 (5), 1821, 1–41; 2 (7), 1822, i–iii, 1–96). Repr. by Hooker (in his J. Bot. 1, 1834, 358–380; Comp. Bot. Mag. 1, 1835, 147–157, 219–224, 253–272). Again reprinted at Calcutta (with addition of data in Calc. J. Nat. Hist. 4, 1843, 1–62, 159–213, 305–374, t. 14–16; repr. 1–230).–Descr. of new genera and *spp.*—For an evaluation *cf.* Merrill, J. Arn. Arb. 33 (1952) 199–250.

Koorders-Schumacher, A., *Systematisches Verzeichnis der zum Herbar Koorders, etc.* II. Abt. Sumatra. Buitenzorg (1910–1914) 1–62.–Account of his coll. in the islands P. Weh & P. Bras (extreme N. extremity of Sumatra) and in Central Sumatra; some new *spp.*

Kurz, S., *Korte schets der vegetatie van het eiland Bangka* (Nat. Tijd. Ned. Ind. 27, 1864, 142–258).–List of his collection from Banka Island; few new *spp.*; in Dutch.

Merrill, E. D., *Notes on the Flora of Sumatra* (Philip. J. Sc. 14, 1919, 239–250).–Misc. new records and *spp.* from the Bartlett & LaRue coll.

—, *c.s.*, *An enumeration of plants collected in Sumatra by W. N. & C. M. Bangham* (Contr. Arn. Arb. 8, 1934, 1–178, t. 1–13).–Records and new *spp.* listed.

—, *New Sumatran plants I–IV* (Mich. Acad. Sc. Arts & Lett. 19, 1933, 149–203, t. 16–35, 1934; *ibid.* 20, 1934, 95–112, 1935; *ibid.* 23, 1937, 177–202, 1938; *ibid.* 24, 1938, 63–92, 1939).–Lists of records and new *spp.* based on collections of Bartlett, Hamel, Rahmat si Toroes and Yates from the northern part of Central Sumatra.

—, *Botanical Results of the George Vanderbilt Sumatran Expedition 1939* (Not. Nat. Acad. Sc. Philad. *no* 47, 1940, 9 pp.).–New *spp.* from N. Sumatra.

Miquel, F. A. W., *c.s.*, *Plantae Junghuhnianae, etc.* 6 parts (1851–1856) 1–570.–Lists, records, & descr.

—, *Sumatra* (Fl. Ind. Bat. Suppl. 1, 1860–1861; repr. 1862).–Complete enum. of the Sumatran flora with descr. of new genera and *spp.*

Rendle, A. B., *c.s.*, *Dr H. O. Forbes's Malayan plants* (J. Bot. 62–64, 1924–1926, Suppl. 1–149). –Account of Forbes's coll. from S. Sumatra; list with descr. of new gen. & *spp.*

Ridley, H. N., *c.s.*, *Results of an Expedition to Korinchi Peak, Sumatra. Botany* (Fed. Mal. St. Mus. 8, pt 4, 1917, 1–145).–List Boden Kloss coll. W. Central Sumatra.

—, *A Botanical Excursion to North Sumatra* (J. Mal. Br. R. As. Soc. 1, 1923, 46–113).–List of his collection N. of Toba Lake; various new *spp.*

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(1) The smaller islands are inserted with adjacent large islands or island groups, *e.g.* those W of Sumatra with Sumatra; Riouw, Banka, Billiton, *etc.* with Sumatra; Anambas & Natuna Islands with Borneo; Krakatau & Madura with Java, *etc.* In general the map in vol. 1, facing p. cxii has been followed.

—, *Plants from Bencoolen, Sumatra* (Kew Bull. 1925, 76–94).–List coll. C. J. Brooks; records and new *spp.*

—, *The Flora of the Mentawi Islands* (Kew Bull. 1926, 57–94).–List of Boden Kloss coll.

Steenis, C. G. G. J. van, *Die Pteridophyten und Phanerogamen der Deutschen Limnologischen Sunda Expedition* (Arch. f. Hydrobiol. Suppl. vol. 11, 1932, 231–387).–Account of coll. by Ruttner, mostly waterplants from S. to Central Sumatra; some new records and new *spp.*

—, *Report of a Botanical Trip to the Ranau Region, S. Sumatra* (Bull. Jard. Bot. Btzg III, 13, 1933, 1–56, fig. 1–11).–Records of his own coll.; mostly plant-geographical.

Vriese, W. H. de & F. Junghuhn, *Bijdragen tot de kennis der Flora van Sumatra* (Ned. Kruidk. Arch. 1, 1846, 1–19).–Misc. records and new *spp.*

Malay Peninsula

Anonymous, *Bibliographies of the Malay Peninsula.* See Chapter 2.

Burkill, I. H., *Some changes in plant names* (Kew Bull. 1935, 316–319).–List of new comb. made in the following work.

—, *A Dictionary of the Economic Products of the Malay Peninsula.* London (1935) 2 vols, i–xi, 1–2402.–Alphabetic standard account; the new comb. are accounted for in Kew Bull. (1935).

— & M. R. Henderson, *The flowering plants of Taiping in the Malay Peninsula* (Gard. Bull. Str. Settl. 3, 1925, 303–458).–List.

— & R. E. Holttum, *A Botanical Reconnaissance upon the Main Range of the Peninsula at Fraser Hill* (*ibid.* 3, 1923, 19–110).–*Ditto.*

Corner, E. J. H., *Notes on the systematy and distribution of Malayan Phanerogams I–IV* (Gard. Bull. Str. Settl. 10, 1939, 1–81; *ibid.* 239–329; *ibid.* 11, 1941, 177–235).–Critical consideration of various genera.

—, *Wayside Trees of Malaya.* Singapore (1940) 2 vols; text i–vii, 1–770, fig. 1–259; Atlas t. 1–228; 2nd ed. (1952) (very slightly revised).–Descr. and keys!

Curtis, C., *A catalogue of the flowering plants and ferns found growing wild in the Island of Penang* (J. Str. Br. Roy. As .Soc. *no* 25, 1894, 67–169).–Pages 163–169 are occupied by an appendix by Ridley on the Botanists of Penang. *Non vidi.*

Foxworthy, F. W., *Commercial timber trees of the Malay Peninsula* (Mal. For. Records 3, 1927, 1–195, map, many plates).–Key to principal trees by bark & wood characters; to each *sp.* a descr. and one or more plates (photographs).

Gray, A., *Botany, Phanerogamia* (in U.S. Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N., 1854, 1–777, atlas, 1857, t. 1–100).–Listed records and descr.

Griffith, W., *Notulae ad Plantas Asiaticas* (Posthumous Papers), arranged by J. M.'–Clelland, 1 (1847) 1–256; 2 (1849) 257–628, i–viii; 3 (1851) 1–436, i–xii; 4 (1854) i–xli, 1–764.–Contains numerous records, notes and descr. of new genera and *spp.* from the Malay Peninsula. To this pertains the Atlas of next item.

—, *Icones Plantarum Asiaticarum* 1 (1847) i–iii, t. 1–62; 2 (1849) i–viii, t. 1–138; 3 (1851) i–v, t. 139–359; 4 (1854) i–xii, t. 360–561.

—, *Some account of the Botanical Collection, brought from the eastward, in 1841* (J. As. Soc. Bengal 23, 1855, 623–650, t. 1–4). Also account of Mal. Pen. coll. p. 631.–*Non vidi.*

Henderson, M. R., *On a collection of plants from Gunong Benom, Pahang* (J. Fed. Mal. Stat. Mus. 13, 1927, 217–227).–Listed records and new *spp.*

—, *A list of plants from Cameron's Highlands, Pahang* (J. Mal. Br. R. As. Soc. 5, 1927, 237–277).–*Ditto.*

—, *Additions to the Flora of the Malay Peninsula* (Gard. Bull. Str. Settl. 4, 1927, 48–56; *ibid.* (1929) 411–414; *ibid.* 5, 1930, 72–80, 92–98;*ibid.* 7, 1933, 87–128).–Records and descr. of new *spp.*

—, *The Flowering Plants of Kuala Lumpur* (Gard. Bull. Str. Settl. 4, 1928, 211–373).–List of *spp.* with notes on their distribution.

—, *New species from the Malay Peninsula* (*ibid.* 5, 1930, 72–80, 5 fig.).–Descr. some new *spp.*

—, *Notes on the Flora of P. Tioman and neighbouring islands* (*ibid.* 5, 1930, 80–93).–List.

—, *List of additions to the flora of the Malay Peninsula* (*ibid.* 5, 1930, 93–98).–List of additions published since 1925 (last vol. of Ridley's Flora).

—, *The Flora of the Limestone Hills of the Malay Peninsula* (J. Mal. Br. R. As. Soc. 17, 1939, 13–87).–List; distr.

—, *Malayan wild flowers.* 1. Dicotyledons (Malayan Nature Journ. 4, 1949, 1–181; *ibid.* 6, 1950, 182–399; *ibid.* 1952, 400–472, fig. 1–424); 2. Monocotyledons. Kuala Lumpur (1954) 1–357, fig. 1–201.–Descr. & keys of selected herbaceous plants from the Malay Peninsula.

Holttum, R. E., *New species of vascular plants from the Malay Peninsula* (Gard. Bull. Sing. 11, 1947, 267–298).–Descr. of some Pteridophytes & Monocotyledonous *spp.*

Hooker, J. D., *Illustrations of the Floras of the Malayan Archipelago and of tropical Africa* (Trans. Linn. Soc. Lond. 23, 1860, 155–172, t. 20–28).–Descr. various new genera and *spp.*

—, *Catalogue of the plants distributed at the Roy. Gard. Kew . . . from the Herbaria of Griffith, Falconer and Helfer.* London (1865) iii–iv + 58 pp.–List of plant names.

Jack, W., *Descriptions of Malayan plants* (in Mal. Miscell. 1 (1), 1820, 1–27; 1 (5), 1821, 1–41; 2 (7), 1822, i–iii, 1–96). Repr. by Hooker (in his J. Bot. 1, 1834, 358–380; Comp. Bot. Mag. 1, 1835, 147–157, 219–224, 253–272). Again reprinted at Calcutta (with addition of data in Calc. J. Nat. Hist. 4, 1843, 1–62, 159–231,

305–374, t. 14–16; repr. 1–230).–Descr. of new genera and *spp.*–For an evaluation *cf.* MERRILL, J. Arn. Arb. 33 (1952) 199–250.

KING, G. & J. S. GAMBLE, *Materials for a Flora of the Malay Peninsula* (J. As. Soc. Beng. 1889–1936, repr. 5 vols).–Standard Flora with keys and excellent descr. not wholly complete for all families.–For Monocotyledonous plants *cf.* RIDLEY (1907).

MERRILL, E. D., *Additions and corrections of Ridley's Flora of the Malay Peninsula* (Gard. Bull. Str. Settl. 8, 1935, 131–134).–Additional records, mostly alien weeds; some nomenclatorial notes.

NARAYANASWAMI, V., *Provenance of early Malayan plant collections* (J. & Proc. As. Soc. Beng. n.s. 27, 1931, 327–477, 1933).–Exact localities of the sheets collected by KUNSTLER, WRAY, and SCORTECHINI.

PLANCHON, J. E., *Catalogue of Malayan plants collected by Thom. Lobb, sets of which have been announced for sale, etc.* (in HOOK. Lond. J. Bot. 6, 1847, 469–473).–Merely a list of preliminary names on p. 472–473.

RIDLEY, H. N., in KELSALL, *Notes on a trip to Bukit Etam, Selangor* (J. Str. Br. Roy. As. Soc. *no* 23, 1891, 67–75).–List of plant names; no novelties.

—, *On the Flora of the Eastern Coast of the Malay Peninsula* (Trans. Linn. Soc. Lond. II, 3, 1893, 267–408, t. 61–66).–Account of his collections from E. Pahang, Kelantan, Trengganu, and P. Tioman. Records and descr. of new *spp.*

—, *A botanical excursion to Gunong Jerai* (Kedah Peak) (J. Str. Br. Roy. As. Soc. *no* 34, 1900, 23–30).–*Non vidi.*

—, *The Flora of Singapore* (J. Str. Br. R. As. Soc. *no* 33, 1900, 27–196; *ibid. no* 35, 1901, 84–90). –List.

—, *The Flora of Mt Ophir* (*ibid. no* 35, 1901, 1–28). –*Ditto.*

—, *New or rare Malayan plants I–XII* (*ibid. nos* 41, 44, 49, 50, 54, 61, 68, 73, 75, 79, 82, 86, 1904–1922).–Important series of new records, new genera and *spp.*

—, *Materials for a Flora of the Malay Peninsula. Monocotyledons.* 3 vols, Singapore (1907).–Revision of the Monocotyledons; descr.; keys.

—, *On a collection of plants made by C. H. Robinson and L. Wray from G. Tahan, Pahang* (J. Linn. Soc. Lond. Bot. 38, 1908, 301–336).–Records and new *spp.*
An extract of this appeared under the same title in J. Fed. Mal. St. Mus. 2^3, 1907, 107–142. This contains also the descr. of new *spp.* with reference to their pages in the latter paper (which may have been accomplished from proof sheets); at least the reprints are dated 1907.

—, *The Flora of the Telom and Batang Padang Valleys* (J. Fed. Mal. St. Mus. 4, 1903, 1–98).–Records and descr. of new *spp.*

—, *A Scientific Expedition to Temengoh, Upper Perak* (J. Str. Br. R. As. Soc. *no* 57, 1910, 5–122).–*Ditto.*

—, *A Botanical Excursion to Pulau Adang* (*ibid.* 61, 1912, 45–65).–*Ditto.*

—, *An Expedition to Mount Menuang Gasing, Selangor, etc.* (J. Linn. Soc. Lond. Bot. 41, 1913, 285–304).–*Ditto.*

—, *On a collection of plants from G. Mengkuang Lebah, Selangor* (J. Fed. Mal. St. Mus. 5, 1914, 28–50).–*Ditto.*

—, *An Expedition to Mt Menuang Gasing, Selangor* (*ibid.* 6, 1915, 1–21).–*Ditto.*

—, *Plants from G. Kerbau, Perak* (*ibid.* 6, 1915, 43–62).–*Ditto.*

—, *The Botany of G. Tahan* (*ibid.* 6, 1915, 127–202). –*Ditto.*

—, *The natural history of Kedah Peak.* Botany (*ibid.* 7, 1916, 37–58).–*Non vidi.*

—, *New and rare plants from the Malay Peninsula* (*ibid.* 10, 1920, 128–156).–*Ditto.*

—, *New Malayan plants* (J. Bot. 58, 1920, 147–149).–*Ditto.*

—, *The Flora of Klang Gates, Selangor* (J. Fed. Mal. St. Mus. 10, 1922, 247–251).–Records and descr. new *spp.*

—, *The Flora of the Malay Peninsula.* 5 vols, London (1922–1925).–Complete Flora with keys; illustrated.

—, *New Malayan plants* (J. Bot. 62, 1924, 294–301).–New records & *spp.*

—, *Additions to the Flora of Malaya* (Kew Bull. 1926, 469–479).–New *spp.* from the Malay Peninsula and Borneo.

Java

BACKER, C. A., *Flora van Batavia.* Batavia (1907) 25 + xvi + 405 pp.–The first vol. of a planned work; contains only a small part of the Choripetalae: *Ranunculaceae-Moringaceae.* Keys to genera and *spp.*; no new *spp.*; in Dutch.

—, *Voorlooper eener Schoolflora voor Java.* Batavia (1908) lxxx + 112 + 8 pp.–Concise Flora with keys to genera and *spp.*; contains part of the Choripetalae: *Ranunculaceae-Leguminosae*; in Dutch.

—, *Plantes exotiques naturalisées dans Java* (Ann. Jard. Bot. Btzg Suppl. 3, 1909, 393–420).–List of introduced plants either cultivated or aliens; in French.

—, *Schoolflora voor Java.* Weltevreden (1911) clxv + 676 pp.–Concise Flora with keys to genera and *spp.*; contains part of the Choripetalae: *Ranunculaceae-Myrtaceae;* in Dutch.

—, *On some results of the botanical investigation of Java* (*1911–1913*) (Bull. Jard. Bot. Btzg II, *no* 12, 1913, 1–40).–List of records.

—, *Handboek voor de Flora van Java.* 3 parts. Batavia (1924–1928) 66 + 291 + 141 pp.–Unfinished ample Flora, containing only revisions of some families of the Gymnosperms and Fern-allies but mostly treating monocotyledonous families (*Liliiflorae, Gramineae, etc.*); keys; in Dutch.

—, *Onkruidflora der Javasche suikerrietgronden* (Weed Flora of Javan sugar-cane fields). Soerabaja (1928–1934) 2 vols, text lxxxvii +

907 pp.; Atlas t. 1–480 (unfinished).–Ample descr.; keys; in Dutch.

—, *A revision of Kuntze's types of new Javan species* (Brittonia 3, 1938, 75–90).–Evaluation of new *spp.* described by O. KUNTZE from Java.

—, *c.s.*, *Notes on the Flora of Java I* (Bull. Jard. Bot. Btzg III, 16, 1939, 107–110); *ditto II* (Blumea 5, 1945, 490–524); *ditto III* (*ibid.* 6, 1948, 302–309); *ditto IV* (*ibid.* 310–336); *ditto V* (*ibid.* 1950, 358–362); *ditto VI* (*ibid.* 363–406). –Precursory papers to the book of next entry containing new records, synon., new comb., genera and *spp.*

—, *c.s.*, *Beknopte Flora van Java* (*nooduitgave*). Parts 1–13, Leyden (1940–1953).–Mimeographed emergency edition of a complete concise Flora of Java; complete except for the *Gramineae*, *Zingiberaceae*, *Araceae*, *Marantaceae*; *Rubiaceae* in print; in Dutch. An English translation is in preparation.

— & D. F. VAN SLOOTEN, *Geïllustreerd Handboek der Javaansche Theeonkruiden* (Illustrated Handbook of the Weed Flora of Javan tea plantations). Batavia (1924) 47 + 247 pp.–Descr.; keys; in Dutch.

BENNETT, J. J. & R. BROWN, *Plantae Javanicae Rariores descriptae iconibus illustratae, etc.* (1838–1852) viii, xvi, 1–259, t. 1–50.–Elaboration of HORSFIELD's coll. in Java 1802–1818; in Latin; comments in English.

BLUME, C. L., *Enumeratio Plantarum Javae et insularum adjacentium, etc.* Leyden 2 fasc. (1827–1828) i–vi, i–x, 1–274; 2nd literatim ed. (1830).–List.

—, *Flora Javae.* 3 vols (1828–1851); ser. 2 vol. 1 (1858) *Orchidaceae*; *c.* 1863, Suppl. only consisting of plates (*pl. ined.*).–Monogr. treatments; in Latin.

BOLDINGH, I., *Zakflora voor de Landbouwstreken op Java.* Batavia (1916) i–xvii, 1–204.–Flora of weeds of agricultural fields in Java, the whole book consisting of one large key. It contains some new comb. which have been considered by MERRILL (Brittonia 5, 1948, 25–32).

CHOISY, J. D., *cf.* Chapter 6a.

DOCTERS VAN LEEUWEN, W. M., *Krakatau 1883–1893* (Ann. Jard. Bot. Btzg 46/47, 1936, xii + 506, t. 1–37).–Listed records; in English.

HASSKARL, J. K., *Plantarum genera et species novae aut reformatae Javenses* (Flora 25², 1842, Beibl. *no* 1, 1–114).–Misc. records and descr.; in Latin.

—, *Adnotationes de plantis quibusdam Javanicis nonnullisque Jqponicis, haud rite cognitis e Catalogo Horti Bogoriensis excerptae. Accedunt nonnullae novae species* (in HOEVEN & DE VRIESE, Tijd. Nat. Geschied. & Phys. 10, 1843, 115–150).–List of new records and descr. new *spp.* occurring in the Catalogue of 1844 (see Chapter 6a).

—, *Adnotationes de plantis horti Bogoriensis* (*ibid.* 12, 1845, 77–139).–Continuation of the latter item.

—, *Plantarum Javanicarum aut novarum aut minus cognitarum adumbrationes* (Flora 27², 1844, 583–595, 599–609, 615–626; *ibid.* 28, 1845, 225–237, 241–251, 292–302, *sphalm.* 260–269).–*Ditto*; in Latin.

—, *Plantae Javanicae Rariores adjectis nonnullis exoticis, in Javae horti cultis.* Berlin (1848) i–viii, 1–555 pp.–*Ditto*; including a number of non-Malaysian species cultivated in the Botanic Gardens at Bogor; in Latin.

HILDEBRAND, F. H., Report For. Res. Institute, Bogor, *no* 35 (1950) 171 pp.–List of tree *spp.* of the islands of Java and Madura. Revised edition, *ibid. no* 50 (1951) 183 pp.

HOCHREUTINER, B. P. G., *Plantae Hochreutineranae* (Ann. Cons. & Jard. Bot. Genève 15/16, 1912, 145–247; Candollea 2, 1925, 317–513; *ibid.* 5, 1934, 175–341; *ibid.* 6, 1934–1936, 399–488; *ibid.* 8, 1940, 47–60; *ibid.* 9, 1943, 481–493).–Account of his collections; besides Javanese plants also those from other parts of the world.

JUNGHUHN, F., *Bibliography on the Flora of Java.* See Chapter 2.

KOORDERS, S. H., *Exkursionsflora von Java.* 3 vols, Jena (1911–1912) + 1 vol. atlas (1913–1937).–Atlas not yet completed; keys; in German.

—, *Atlas der Baumarten von Java.* 4 vols, Leyden (1913–1918) t. 1–800.–An illustrated account of most *spp.* treated in the 'Bijdragen' by KOORDERS & VALETON, see below.

—, *Flora von Tjibodas.* Batavia-Buitenzorg. 3 vols (1918–1923) 123 + 246 + 139 + 87 + 31 pp.–Complete local Flora of Mt Gedeh, W. Java; keys; in German.

— & TH. VALETON, *Bijdragen tot de kennis der Boomsoorten van Java.* Batavia (1894–1914) 13 vols.–Issued in the series 'Mededeelingen van 's-Lands Plantentuin te Buitenzorg'; descr. ligneous Jav. *spp.* in Latin and Dutch; some family revisions are provided with keys in Dutch.

KUNTZE, O., *Revisio Generum Plantarum.* vol. 1–2 (1891) 1011 pp.; vol. 3¹ (1893) ccccxxii pp.; vol. 3² (1898) vi + 201 + 576 pp.–Contains descr. of new *spp.* from his Java tour.

MORITZI, A., *Systematisches Verzeichnis der von H. Zollinger in den Jahren 1842–1844 auf Java gesammelten etc.* Solothurn (1845–1846) xii + 144 pp.–List ZOLLINGER coll. with occasional new *spp.*

NOROÑA, F., *Relatio plantarum Javanensium iterfactione usque in Bandong recognitarum* (Verh. Bat. Genootsch. K. & W. 5, 1827, 64–86).–List of Latin and vernacular plant names. A great number of new genera and new species, all *nomina nuda.* An evaluation on the basis of the vernacular names is given by J. K. HASSKARL (in HOEVEN & DE VRIESE, Tijd. Nat. Geschied. & Phys. 11, 1844, 209–228).

PLANCHON, J. E., *Catalogue of the first series of plants of Java collected by Thom. Lobb, etc.* (in HOOK. Lond. J. Bot. 5, 1846, 246–250; 6 (1847) 469–471.–Merely a list of names of preliminary identifications.

RENDLE, A. B., *c.s.*, *Dr H. O. Forbes's Malayan Plants* (J. Bot. Suppl. 1924–1926, 149 pp.).–

List Forbes's coll. with occasional new genera and species.

Steenis, C. G. G. J. van, *Die Pteridophyten und Phanerogamen der Deutschen Limnologischen Sunda Expedition* (Arch. f. Hydrobiol. Suppl. vol. 11, 1932, 231–387).–Account of coll. Ruttner, mostly water- and marsh-plants; list.

—, *Account of Javan plants collected by C. F. Hornstedt* (Act. Hort. Berg. 15: 2, 1949, 39–43, fig. 1).–List of coll. Hornstedt; no novelties or new comb.

—, C. A. Backer & R. C. Bakhuizen van den Brink Jr, *Identification of the new species and combinations proposed by C. P. Thunberg in the Florula Javanica by L. Winberg & F. O. Widmark (1825)* (Blumea 6, 1950, 358–362).–Nomencl. evaluation; 3 new comb.

—, G. den Hoed, S. Bloembergen & P. J. Eyma, *Flora voor de Scholen in Indonesië.* Batavia (1949) 407 pp. 46 fig.; 2nd ed. (1951).–Flora containing only well-known, large-flowered lowland plants, native as well as cultivated, intended only for secondary schools; keys; in Dutch.

—, M. J. van Steenis-Kruseman & C. A. Backer, *Louis Auguste Deschamps* (Bull. Brit. Mus. (Nat. Hist.), hist. ser. 1, 1954, 51–68, t. 13).–List of 270 *spp.* from Java.

Teysmann, J. E. & S. Binnendijk, *Plantae novae Horti Bogoriensis in insula Java* (Ned. Kruidk. Arch. 3, 1855, 391–413).–Descr. miscellaneous new *spp.* from Malaysia.

Thunberg, C. (ed. L. Winberg & F. O. Widmark) *Florula Javanica.* Upsala (1825) 23 pp. (*cf.* also Blumea 6, 1950, 358–362).–List Thunberg coll.; list with two dozen new *spp.*

Vriese, W. H. de, *Plantarum javanicarum minus cognitarum vel novarum, etc.* (Tijd. Nat. Geschied. & Phys. 11, 1844, 336–347).–Descr. of some Jav. plants introduced in the Amsterdam Botanic Garden; a few new *spp.*

Zollinger, H., *cf.* under Moritzi and Chapter 6a.

Christmas Island

Baker, E. G., in Andrews, *A monograph of Christmas Island.* London (1900) 171–200, t. 17–18.–Plant list.

Hemsley, W. B., *Report on the botanical collections from Christmas Island, Indian Ocean, etc.* (J. Linn. Soc. Lond. Bot. 25, 1890, 351–362).–List; a few new *spp.*

Ridley, H. N., *An Expedition to Christmas Island* (J. Str. R. As. Soc. *no* 45, 1906, 170–271; addit. note *l.c.* 48, 1907, 107–108).–Contains a plant list with descr. new *spp.*

Borneo[1]

Diels, L. & K. G. Hackenberg, *Beiträge zur Vegetationskunde und Floristik von Süd-Borneo* (Bot. Jahrb. 60, 1926, 291–316).–Vegetation; records and new *spp.* coll. Hackenberg.

Fischer, C. E. C., *Contributions towards a Flora of British North Borneo I–IV* (Kew Bull. 1932–1934).–Lists of records & new *spp.*

Gibbs, L. S., *c.s.*, *A contribution to the flora and plant formations of Mt Kinabalu, etc.* (J. Linn. Soc. Bot. 42, 1914, 1–240, t. 1–8).–Records and new *spp.* coll. Gibbs.

Hallier *f.*, H., *Beiträge zur Flora von Borneo* (Beih. Bot. Centralbl. 34, ii, 1916, 19–53).–Records and descr.

Heine, H., *Diagnoses novae plantarum in Borneo septentrionali a J. et M. S. Clemens lectarum* (Mitt. Bot. Staatssamml. München 1^2, 1950, 57–61).–Descr. some new *spp.* from Mt Kinabalu.

—, *ditto II* (*ibid.* 1^6, 1953, 208–230).–*Ditto.*

—, *Pflanzen der Sammlung J. & M. S. Clemens von Mt Kinabalu in Britisch Nord-Borneo* (in Fedde, Rep. 54, 1951, 223–248).

—, *Pflanzen der Sammlung J. & M. S. Clemens vom Mount Kinabalu in Britisch Nord-Borneo.* Thesis, München (1953), mimeographed 1–118. Identifications of an incomplete set of the Clemens Kinabalu coll. 1931–1933; many erroneous identifications.

Henderson, M. R., *The 'Padang' flora of Jemaja, in the Anamba Islands, N. E. I.* (Gard. Bull. Str. Settl. 5, 1931, 234–240).–Plant list of a sandy heath.

Hildebrand, F. H., *List of tree names* issued by For. Res. Institute, Bogor, *no* 7 (1941).–Mimeographed list of tree *spp.* from Sampit Subdivision, South Borneo.

—, *ditto, no* 9 (1941).–*Ditto* from Bulungan & Berau, East Indonesian Borneo.

—, *ditto, no* 55 (1952).–Revised edition of the latter.

—, *ditto, no* 10 (1941).–*Ditto* from West Indonesian Borneo.

—, *ditto, no* 54 (1952) 80 pp.–Revised edition of the latter.

—, Report For. Res. Institute, Bogor, *no* 2 (1949) 76 pp.–*Ditto* from Samarinda Division, East Borneo.

—, *ditto, no* 58 (1952) 105 pp.–Revised edition of the latter.

—, *ditto, no* 3 (1949) 61 pp.–*Ditto* from Kapuas-Barito Division, South Borneo.

—, *ditto, no* 62 (1953) 77 pp.–Revised edition of the latter.

—, *ditto, no* 5 (1949) 48 pp.–*Ditto* from Bandjermasin & Hulu Sungei Divisions, Southeast Borneo.

—, *ditto, no* 63 (1953) 62 pp.–Revised edition of the latter.

Hooker, J. D., *Illustrations of the Floras of the Malayan Archipelago and of tropical Africa* (Trans. Linn. Soc. Lond. 23, 1860, 155–172, t. 20–28).–Descr. various new genera and *spp.*

Irmscher, E., *c.s.*, *Beiträge zur Kenntnis der Flora von Borneo* (Mitt. Inst. Allg. Bot. Hamburg 7, 1927–1937, 1–310, 10 tab.).–Listed account of Hans Winkler collection 1925; unfinished.

Keith, H. G., *A preliminary list of North Borneo plant names* (North Borneo For. Rec. *no* 2,

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(1) Including also the Anambas & Natuna Islands, S. China Sea.

1938, 256 pp.; 2nd ed. Hong Kong 1952, 528 pp.).–Check list of vernacular names.

MASAMUNE, G., *Enumeratio Phanerogamarum Bornearum*. Taihoku (1942) 1–739.–Bibliographic enumeration.

MERRILL, E. D., *Bibliography of Botany*. See Chapter 2.

—, *Notes on the Flora of Borneo* (Philip. J. Sc. 11, 1916, Bot. 49–100).–Records and descr. new *spp.*

—, *Alabastra Borneensia* (J. Str. Br. R. As. Soc. *no* 77, 1917, 189–247).–Descr. new *spp.* from a number of families; material from various sources.

—, *Contributions to our knowledge of the Flora of Borneo* (J. Str. Br. R. As. Soc. *no* 76, 1917, 75–117).–*Ditto.*

—, *New species of Bornean Plants* (Philip. J. Sc. 13, 1918, Bot. 67–122).–*Ditto.*

—, *A Bibliographic Enumeration of Bornean Plants* (J. Str. Br. R. As. Soc., special *no*, 1921, 1–637).–Accurate bibliographic list of *spp.* known from the island, with coll. numbers.

—, *Additions to our knowledge of the Bornean Flora I–II* (Philip. J. Sc. 21, 1922, 515–534; *ibid.* 30, 1926, 79–87).–Records and descr. new *spp.*

—, *New or noteworthy Bornean plants I–III* (J. Str. Br. R. As. Soc. *no* 85, 1922, 151–201; *ibid. no* 86, 1922, 312–342; *ibid. no* 87, 1923, 22–45).[1]–Descr. new *spp.*

—, *The Flora of Banguey Island* (Philip. J. Sc. 29, 1926, 341–427; *cf.* also *ibid.* 24, 1924, 113–116).–List with occasional new *spp.*

—, *A collection of plants from Sarawak* (Sarawak Mus. J. 3, 1928, 513–557).–Records & new *spp.*; middle part of p. 537 belongs on p. 534; *Rub.* from p. 534–537 belong halfway p. 555.

—, *Plantae Elmerianae Borneenses* (Univ. Cal. Publ. Bot. 15, 1929, 1–316).–Records & descr. new *spp.* coll. ELMER.

MIQUEL, F. A. W., *Analecta Botanica Indica. Pars 1: Stirpes quaedam borneenses* (Verh. 1e Kl. Kon.-Ned. Inst. Amsterdam ser. 3, vol. 3, 1850, 1–30, t. 1–10).–List of misc. records and new *spp.* from various sources.

RIDLEY, H. N.,[2] *Plants collected at Penrissen* (J. Str. Br. R. As. Soc. *no.* 33, 1900, 22–24).–Small list of records; 2 new *spp.*

—, *Some plants collected on Mr. Moulton's Expedition to Batu Lawi* (J. Str. Br. R. As. Soc. *no* 63, 1912, 59–62).–List; descr. some new *spp.*

—, *New Bornean plants* (Sarawak Mus. J. 1, 1912, 30–38).–*Ditto.*

—, *Contributions to a Flora of Borneo* (*ibid.* 1, 1913, 67–98).–Miscellaneous descr. of new genera & *spp.* from various sources.

—, *Additions to the Flora of Malaya* (Kew Bull. 1926, 469–479).–Descr. new *spp.*

—, *New species from the Malay Peninsula and Borneo* (Kew Bull. 1929, 254–262).–Descr. new *spp.*

—, *New plants from Sarawak* (Sarawak Mus. J. 1, 1931, 31–52).

— & H. K. AIRY SHAW,[1] *c.s.*, *Additions to the Flora of Borneo and other Malay Islands I–XXII* (Kew Bull. 1930–1950).–Valuable series of contributions; records and descr. of new gen. & *spp.*

SMITH, W. W., *Species Borneenses* (Not. R. Bot. Gard. Edinb. 8, 1915, 313–348).–Descr. new *spp.*

STAPF, O., *On the flora of Mount Kinabalu, in North Borneo* (Trans. Linn. Soc. Lond. II, Bot. 4, 1894, 69–263, t. 11–20).–Basic records; descr. new genera & *spp.*

STEENIS, C. G. G. J. VAN, *Botanical results of a trip to the Anambas and Natoena Islands* (Bull. Jard. Bot. Btzg III, 12, 1932, 151–211, fig. 1–11). –Lists with records; a few new *spp.*

—, *Some remarks on the Kinabalu collection of Chaplain J. & M. S. Clemens* (J. Bot. 72, 1934, 1–12).–List of records & new *spp.*

WARBURG, O., *Plantae novae borneensis* (in FEDDE, Rep. 18, 1922, 327–330).–Descr. new *spp.*

WINKLER, HUB., *c.s.*, *Beiträge zur Kenntnis der Flora und Pflanzengeographie von Borneo* (Bot. Jahrb. 44, 1910, 497–571; *ibid.* 48, 1912, 87–118; *ibid* 49, 1913, 349–380; *ibid.* 50, Suppl. 1914, 188–208, t. 3–5).–Records & new *spp.* coll. HUB. WINKLER in SE. Borneo.

Lesser Sunda Islands

BLOEMBERGEN, S., *Verslag van een exploratie-tocht naar de eilanden Timor en Wetar* (Tectona 33, 1940, 101–196).–Report of exploration trip to Timor and Wetar, incl. plant lists; Engl. summary.

BRITTEN, J., W. FAWCETT & H. N. RIDLEY, *c.s.*, *Prodromus Florae Timorensis*; *etc.*, in H. O. FORBES, *A Naturalist's Wanderings, etc.* London (1885) App. VI, 497–523.–List of names, sometimes with reference to numbers; some new *spp.*

DECAISNE, J., *Description d'un herbier de l'île de Timor* (Nouv. Ann. Mus. Paris 3, 1834, 333–501). Also separately issued, under the title '*Herbarii Timoriensis descriptio*' Paris (1835) 1–173.

ENGLER, A., *c.s.*, *Uebersicht über die botanischen Ergebnisse der Gazelle-Expedition* (Bot. Jahrb. 7, 1886, 444–480).–*Cyperaceae, Gramineae, Orchidaceae* were published in *op. cit.* 5 (1884) 89–94; 6 (1885) 233–248; 7 (1885) 435–443.–List of records; also new *spp.*; Timor.

HALLIER, H., *Botanische Ergebnisse der Elbert'sche Sunda-Expedition* (Meded. Rijksherb. Leiden *no* 14, 1912, 1–42; *ibid.* 22, 1914, 1–20; *ibid.* 37, 1918, 1–92).–Lists of plants collected by ELBERT & GRÜNDLER; not finished.

HILDEBRAND, F. H., *List of tree names*, ed. by the For. Res. Inst. Bogor, *no* 2 (1940).–List of tree *spp.* from the islands of Bali and Lombok.

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(1) The third contribution is simultaneously cited: 'J. Roy. As. Soc. Mal. Br. vol. 1'.

(2) Numerous papers by RIDLEY on special groups in Borneo have been inserted in Chapter 6c.

(1) The later contributions are by Mr SHAW only.

—, *ditto, no* 3 (1940).–*Ditto* of Lesser Sunda Islands, excl. Bali & Lombok.

—, *ditto, no* 60 (1953) 51 pp.–*Ditto* of Timor.

Malm, J. von, *Die Phanerogamenflora der Kleinen Sunda-Inseln und ihre Beziehungen* (in Fedde, Rep. 34, 1934, 255–307).–List of records from the Rensch coll.

—, *Einige bemerkenswerte Arten der Steinschen Sammlung aus Timor* (in Fedde, Rep. 41, 1937, 295–296).–Some records and a new *sp.*

Meijer Drees, E., *Distribution, ecology and silvicultural possibilities of the trees and shrubs from the savanna-forest region in Eastern Sumbawa and Timor* (Report For. Res. Inst. Bogor, *no* 33, 1950, 1–145).–List of tree & shrub *spp.* from the islands of Timor and E. Sumbawa, with short descr.; ecol. and distributional data.

—, *List of tree and shrub names from Timor* (Report For. Res. Inst. Bogor *no* 33, 1950, mimeogr. 1–61).–Name index coll. For. Res. Inst.

Moore, S., E. G. Baker, H. N. Ridley, *c.s.*, *Dr H. O. Forbes's Malayan Plants* (J. Bot. 62–64, Suppl. 1924–1926, 1–149).–Contains some data on *spp.* from Timor.

Spanoghe, J. B., *Catalogue of plants found on Timor and the neighbouring islands* (in Hook. Comp. Bot. Mag. 1, 1835, 344–351).–List of plant names.

–*Prodromus Florae Timorensis* (Linnaea 15, 1841, 161–208, 314–350, 476–480).–Records and many new *spp.*

Steenis, C. G. G. J. van, *On the Origin of the Malaysian Mountain Flora III* (Bull. Jard. Bot. Btzg III, 14, 1936, 58–62).–List of temperate mountain plants from the Lesser Sunda Islands and their distribution.

Zollinger, H., *Opgave der planten gezien . . . op het eiland Balie* (Nat. & Geneesk. Arch. Ned. Ind. 2, 1845, 588–595).–List of names only; no numbers or references.

Celebes

Bloembergen, S., *Verslag van een exploratie-tocht naar Midden-Celebes* (Tectona 33, 1940, 377–418).–Lake Lindu & Mt Ngilalaki; incl. lists of trees collected.

Docters van Leeuwen, W. M., *Botanical results of a trip to the Salajar Islands* (Blumea 2, 1937, 239–277; *ibid.* 3, 1939, 236–237).–List of plant names.

Hemsley, W. B., *c.s.*, *Decades Kewenses XXVI–XXVII* (Kew Bull. 1896, 36–42).–Plants of Mt Bonthain, SW. Celebes, coll. Everett.

Hildebrand, F. H., Report For. Res. Inst. Bogor, *no* 43 (1950) 105 pp.–List of tree *spp.* from South Celebes.

—, *ditto, no* 44 (1951) 53 pp.–*Ditto* of North Celebes.

Kawakami, T., *On some Celebes plants* (Bot. Mag. Tokyo, 26, 1912, 49–50).–A few records listed.

Koorders, S. H., *Enumeratio specierum phanerogamarum Minahassae*, in '*Verslag eener botanische dienstreis door de Minahassa*' (Meded. 's-Lands Plantentuin, Buitenzorg, *no* 19, 1898, 253–645).–List of records and new *spp.* from NE. Celebes from the Koorders coll.

Some minor corrections on this book were incorporated in 3 articles by its author (in Natuurk. Tijd. Ned. Ind. 61, 1902, 250–261; *ibid.* 63, 1903, 76–89, 90–99), the 1st in Dutch, the others in German.

—, *Supplement op het eerste overzicht der Flora van N. O. Celebes*, vol. 1, § 1, Batavia (1918) 1–30; § 2, Bull. Jard. Bot. Btzg III, 2 (1920) 245–260; vol. 2, § 1 (1922) 9 + 127 pl.; vol. 3 (1922) 1–60. –Descr. and plates of new records and *spp.*

Koorders-Schumacher, A., *Systematisches Verzeichnis der zum Herbar Koorders, etc.* III. Abt., Celebes (1914) 7–141.–NE. Celebes; list Koorders numbers.

Lam, H. J., *c.s.*, *Contributions to our knowledge of the Flora of Celebes (coll. C. Monod de Froideville) and of some other Malaysian islands* (Blumea 5, 1945, 554–599).

Oliver, D., *Note on a collection of plants made by Mr Riedel of Gorontalo* (J. Linn. Soc. Lond. Bot. 15, 1877, 97–100).–N. Celebes, coll. A. B. Meyer; descr. miscellaneous new *spp.*

Richard, A., in Dumont d'Urville, *Voyage de découvertes de L'Astrolabe, etc.* vol. 2. *Sertum Astrolabianum.* Paris (1834) i–lvi, 1–167; Atlas (1833) t. 1–39.–Records and descr. new *spp. Non vidi.*

Philippines

Ahern, G. P., *Compilation of notes on the most important timber tree species of the Philippine Islands* (1901) 1–112, t. (col.) 1–43.–Descr. plates.

Anonymous, *Bibliographies of the Philippines.* See Chapter 2.

Blanco, M., *Flora de Filipinas, etc.* (1837) i–lxxviii, 1–887; ed. 2 (1845) i–lix, 1–619; ed. 3, directed by Naves & Fernandez-Villar, 1 (1877) i–xxx, 1–350, index, 2 (1878–79) 1–419, index i–viii, 3 (1879) 1–271, index i–vi, 4¹ (1880) i–xvii, 1–108, 4² (1880) i–vi, 1–63, 4³ (1880–83) i–ix, 1–375, t. 1–473.

For dates of publication *cf.* Merrill, E. D., Philip. J. Sc. 12 (1917) Bot. 113–116.

For an evaluation of the works, see Chapter 3.

Brown, W. H., *Minor products of Philippine forests* (Philip. Forestry Bull. 22; 3 vols, Manila 1920–1921).–Illustrated account of useful plants with descr. arranged according to uses; not a phytographic work.

—, *Useful Plants of the Philippines* (Commonwealth of the Philippines, Dep. Agric. & Commerce, Manila, Techn. Bull. *no* 10, 3 vols, 1950: 1–590, fig. 1–253; 1–513, fig. 1–239; 1–507, fig. 1–170).–Useful plants systematically arranged in families; descr. of *spp.*; in some genera also keys. Photo-lithographed in Australia.

Elmer, A. D. E., *c.s.*, *Leaflets of Philippine Botany*, vol. 1–10 (1906–1939).–Accounts of records and new *spp.*; extracted for Chapter 6c.

Gray, A., *Botany, Phanerogamia* (in U.S. Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N., 1854, 1–777, Atlas, 1857, t. 1–100).–Listed records and descr.

Kanehira, R., *A list of plants collected at Davao, P.I.* (Bult. Sci. Fak. Terkult. Kjuŝu Imp. Univ. 7, 1936, 228–238).–List of vascular plants coll. Kanehira in Mindanao; text in Japanese. *Non vidi.*

Merrill, E. D., *Plantae Ahernianae*, in Report on investigations made in Java in the year 1902 (Philip. Bur. For. Bull. 1, 1903, 15–55).–List of Ahern coll.; records and some new *spp.*

—, *Notes on Cuming's Philippine plants in the Herbarium of the Bureau of Government Laboratories* (Govt Lab. Publ. (Philip.) *no* 35, 1905, 69–77).–Evaluation of a number of *spp.*; descr. of some new *spp.*

—, *New or noteworthy Philippine plants I–IV.* (Govt Lab. Publ. Philip. 6, 17, 29, 35, 1904–1905); *ditto V–XVII* (Philip. J. Sc. 1–20, 1906–1922).–Records; descr. new genera and *spp.*

—, *The flora of the Lamao Forest Reserve* (Philip. J. Sc. 1, 1906, Suppl. 1–141).–List; also new *spp.*

—, *Index to Philippine literature.* See Chapter 2.

—, *Some genera and species new to the Philippine Flora* (*ibid.* 2, 1907, Bot. 421–428).–Misc. records and new *spp.*

—, *The Flora of Mt Halcon, Mindoro* (*ibid.* 2, 1907, Bot. 251–309).–List of records and new *spp.*

—,*The Philippine plants collected by the Wilkes United States Exploring Expedition* (*ibid.* 3, 1908, Bot. 73–84, t. 1–4).–Evaluation.

—, *New Philippine plants from the collections of M.S. Clemens I* (*ibid.* 3, 1908, Bot. 129–165). –Descr. of new genera and *spp.*

—, *On a collection of plants from the Batanes and Babuyanes Islands* (*ibid.* 3, 1908, Bot. 385–442).–List of records and new *spp.*

—, *A Flora of Manila.* Manila (1912) 1–490.–Flora with keys.

—, *Nomenclatural and systematic notes on the Flora of Manila* (Philip. J. Sc. 7, 1912, Bot. 227–251).–Records; some new names, new *spp.* and comb.

—, *Sertulum Bontocense: new or interesting plants collected in Bontoc Subprovince, Luzon, by Father Morice Vanoverbergh I* (*ibid.* 7, 1912, Bot. 71–107); *ditto II* (*ibid.* 9, 1914, Bot. 443–459).–Lists of records and new *spp.*

—, *Plantae Wenzelianae* (*ibid.* 8, 1913, Bot. 363–390); *ditto II* (*ibid.* 9, 1914, Bot. 353–389); *ditto III* (*ibid.* 10, 1915, Bot. 265–285).–List of records and new *spp.*

—, *Genera and species erroneously credited to the Philippine flora* (*ibid.* 10, 1915, Bot. 171–194).

—, *New plants from Sorsogon Province, Luzon* (*ibid.* 11, 1916, Bot. 1–35).–Descr. of miscellaneous new *spp.*

—, *New plants from Samar* (*ibid.* 11, 1916, Bot. 175–206).–Descr. new *spp.*

—, *New Philippine shrubs and trees* (*ibid.* 12, 1917, Bot. 263–303).*–Ditto.*

—, *Species Blancoanae.* Manila (1918) 1–423.

—, *An Enumeration of Philippine Flowering Plants.* Manila, 4 vols (1923–1926).–Indispensable reference work; general chapters; bibliography.

—, *New species of Philippine plants collected by A. Loher* (Philip. J. Sc. 27, 1925, 21–59).–Descr. new *spp.*

—, *Additions to our knowledge of the Philippine Flora* (*ibid.* 26, 1925, 447–496); *ditto II* (*ibid.* 29, 1926, 475–497, t. 1); *ditto III* (*ibid.* 30, 1926, 389–430).*–Ditto.*

—, *Nomenclatural notes on Philippine plants* (*ibid.* 35, 1928, 1–9).

—, *Miscellaneous notes on Philippine botany* (*ibid.* 60, 1936, 27–35).–Records and new *spp.*

— & M. L. Merritt, *The Flora of Mt Pulog* (*ibid.* 5, 1910, Bot. 287–401).–Collecting list of records and new *spp.*

— & R. A. Rolfe, *Notes on Philippine Botany* (*ibid.* 3, 1908, Bot. 95–127).–List records and new *spp.*

Naves, A. & C. Fernandez-Villar, *Novissima Appendix ad Floram Philippinarum R. P. Fr. Emmanuelis Blanco, seu enumeratio contracta plantarum philippinensium hucusque cognitarum. Cum synonymis P. P. Blanco, Llanos, Mercado et aliorum auctorum* (in Blanco, Fl. Filip. ed. 3, 4^3, 1880–83, i–ix, 1–375).–List of records, sometimes descr.; some new *spp.*

Perkins, J., *c.s.*, *Fragmenta Florae Philippinae* (1904–1905) pt 1–3, 1–212, t. 1–4.

Presl, C. B., *Reliquiae Haenkeanae, seu descriptiones et icones plantarum, quas in America meridionali et boreali, in insulis Philippinis et Marianis collegit Thaddeus Haenke.* 1 (1825–30) i–xv, 1–356, t. 1–48; 2 (1835–36) 1–152, t. 49–72. Vol. 1 (1825) 1–84, (1827) 85–148, (1828) 149–206, (1830) 207–356. Vol. 2 (1831) 1–56, (1835) 57–152.–List; descr. of gen. and *spp.*

Quisumbing, E., *Medicinal plants of the Philippines.* Manila (1951) 1234 pp.–Synonymy; popular descr.; not a phytographic work.

—, *New or interesting Philippine plants I* (Philip. J. Sc. 41, 1930, 315–371, fig. 1–28, t. 1–3); *ditto II* (*ibid.* 76, 1944, 37–56).–New records and descr.

— & E. D. Merrill, *New Philippine plants I–II* (*ibid.* 37, 1928, 133–213, t. 1–4; *ibid.* 82, 1953, 323–339, t. 1–5).*–Ditto.*

Robinson, C. B., *Alabastra philippinensia I* (Bull. Torrey Bot. Club 35, 1908, 63–75); *ditto II* (Philip. J. Sc. 3, 1908, Bot. 175–218); *ditto III* (*ibid.* 6, 1911, Bot. 319–358).*–Ditto.*

—, *Botanical notes upon the island of Polillo* (*ibid.* 6, 1911, Bot. 185–228).—Records and descr. new *spp.*

Rolfe, R. A., *Supplementary list of Philippine plants* (J. Bot. 23, 1885, 209–216).–List of names of Cuming numbers; some new comb.

Vidal y Soler, S., *Sinopsis de familias y géneros de plantas leñosas de Filipinas. Introdución a la flora forestal del archipiélago filipino* (1883) i–xviii, 1–411, Atlas t. 1–100.*–Non vidi.*

—, *Phanerogamae Cumingianae Philipinarum ó Índice numèrico y catálogo sistemático de las plantas fanerogamas coleccionadas en Filipinas por Hugh Cuming, con caracteristicas de algunas* *especies no descritas y del género Cumingia* (*Malváceas*) (1885) i–xv, 1–217, t. 1.–Name list with descr. new *spp.* in Latin.

—, *Revision de plantas vasculares Filipinas* (1886) i–vi, 1–454, t. 1–2.–List; descr. new *spp.* in Latin; text in Span.

Moluccas

BENTHAM, G., *Enumeration of the plants collected by R. B. Hinds Esq. and Mr Barclay . . . ; to which are added a few species gathered in Amboyna by Mr Barclay* (in HOOK. Lond. J. Bot. 2, 1843, 211–240).–Contains also miscellaneous records from the Philippines, Moluccas, New Guinea, Tanna, and Fiji.

BRITTEN, J., *c.s.*, *List of plants from Timor Laut* (in: FORBES's Wanderings, *etc.* 1885, App. 354–355).–List of plants from the Tenimber Islands (= Timor Laut); coll. FORBES and RIEDEL.

HEMSLEY, W. B., *c.s.*, *The Southeastern Moluccas* (in Rep. Scient. Results H. M. S. Challenger, Botany, vol. 1, pt 3, 1885, 101–226).–Records.

HILDEBRAND, F. H., Report For. Res. Inst. Bogor, *no* 49 (1951) 59 pp.–List of tree *spp.* of Southern Moluccas.

—, *ditto*, *no* 45 (1951) 53 pp.–*Ditto* of Northern Moluccas.

HOLTHUIS, L. B. & H. J. LAM, *A first contribution to our knowledge of the flora of the Talaud Islands and Morotai* (Blumea 5, 1942, 93–256).–List records & new *spp.*

LAM, H. J., *Mianghas* (*Palmas*). Batavia (1932) 1–66.–List of plants of this N. Moluccan islet in App. 2, p. 57–62.

MERRILL, E. D., *Reliquiae Robinsonianae* (Philip. J. Sc. 11, 1916, Bot. 243–249).–Records and new *spp.* from Ambon.

—, *An interpretation of Rumphius's Herbarium Amboinense*. Manila (1917) 1–595, 2 maps.–Evaluation of names based on Rumphian plants.

RANT, A., *Twee botanische reizen naar Ambon* (Nat. Tijd. Ned. Ind. 94, 1934, 100–133).–List of *spp.* from Ambon & Ceram.

RICHARD, A., in DUMONT D'URVILLE, *Voyage de découvertes de L'Astrolabe, etc.* vol. 2. *Sertum Astrolabianum.* Paris (1834) i–lvi, 1–167; Atlas (1833) t. 1–39.–Records and descr. new *spp.* from Buru & Ceram.–*Non vidi.*

RUMPHIUS, G. E., *Herbarium Amboinense.* See Chapter 3.

THISELTON-DYER, W. T., *Report on the botany of Mr H. O. Forbes's expedition to Timor Laut* (J. Linn. Soc. Lond. Bot. 21, 1885, 370–374).–Merely listed names without references or numbers compiled by OLIVER.

WARBURG, O., *Beiträge zur Papuanischen Flora* (Bot. Jahrb. 13, 1891, 230–455).–Records and new descr. of his coll.; incl. also those of the S. Moluccas (Aru & Key Islands).

—, *Vegetationsschilderungen aus Südost Asien* (Bot. Jahrb. 17, 1893, 169–176).–Plants of Ceram Laut (= Gebeh), an islet off SE. Ceram; only names in text; no proper records.

New Guinea

ANONYMOUS, *Bibliography of New Guinean botany.* See Chapter 2.

BAILEY, F. M., *Contributions to the Flora of* (*British*) *New Guinea* (or: *to the Flora of Queensland and* (*British*) *New Guinea*) (Queensl. Agric. J. 1897–1914).–A number of small contributions; records and descr. new *spp.*

—, *etc.*, *Botanical reports in the Appendices of the Annual Reports of British New Guinea* (1897–1909).–*Ditto.*

—, *Contributions to the New Guinea Flora* (Proc. R. Soc. Queensl. 18, 1903, repr. p. 1–5).–List; some new *spp.*

BAKER, E. G., S. MOORE, *c.s.*, *Dr H. O. Forbes's New Guinea plants* (J. Bot. 61, 1923, 53–55 and Suppl. 1–64).–Listed account of the FORBES coll.; records and new genera and *spp.*

BECCARI, O., Malesia (1877–1890).–Contains a great number of records and new *spp.* from New Guinea.

—, *Catalogo delle piante del fiume Fly* (in d'ALBERTIS, Nuova Guinea 1880, 575–577; transl. d'ALBERTIS, New Guinea: *What I did and what I saw*, 2, 1880, 396–400).–List Fly River plants; no new *spp.*

BENTHAM, G., *Enumeration of the plants collected by R. B. Hinds Esq. and Mr Barclay . . . in New Guinea; to which are added a few species gathered in Amboyna by Mr Barclay* (in HOOK. Lond. J. Bot. 2, 1843, 211–240).–Miscellaneous records mixed with those of surrounding islands.

BOERLAGE, J. G., *Bibliography of New Guinea.* See Chapter 2.

DIELS, L., *c.s.*, *Beiträge zur Flora des Saruwaged Gebirges* (Bot. Jahrb. 62, 1929, 452–501).–Records and descr. of coll. KEYSSER.

—, *Descriptions of new species collected in British Papua by L. J. Brass* (J. Arn. Arb. 10, 1929, 75–84).–New *spp.* of some families.

DIJK, L. J. VAN, *Boschbedrijf en Boschbeheer in de Residentie Molukken, in het bijzonder Noord-Nieuw-Guinea* (*eilanden der Geelvinkbaai*). For. Bur., Buitenzorg (1939) mimeogr., 92 pp., many app.–In app. B, p. 1–26, a list of tree *spp.* collected in the islands of Japen and Meos Noem.

ENGLER, A., c.s., *Uebersicht über die botanischen Ergebnisse der Gazelle-Expedition* (Bot. Jahrb. 7, 1886, 444–480).—*Cyperaceae, Gramineae, Orchidaceae* were published in *op. cit.* 5 (1884) 89–94; 6 (1885) 233–248; 7 (1885) 435–443.–List of records; also new *spp.*

GIBBS, L. S., *c.s.*, *A Contribution to the Phytogeography and Flora of the Arfak Mountains, etc.* London (1917) i–iv, 1–226, fig. 1–15, t. 1–4. –Records and descr. new gen. & *spp.*

HEMSLEY, W. B., *c.s.*, *The Admiralty Islands* (in Report Scient. Results H. M. S. Challenger, Botany, vol. 1, pt 3, 1885, 227–275).–Records listed.

—, *c.s.*, *Flora of British New Guinea* (Kew Bull. 1899, 95–126).–Records and descr. new *spp.* coll. ENGLISH, GIULIANETTI, *etc.*

—, *Report on Botanical Collections* (Ann. Report Brit. New Guinea 1897/1898, 1899, 147–150).–List records.

Hildebrand, F. H., *List of tree names* issued by For. Res. Institute, Bogor, *no* 6 (1941).–List of tree *spp.* from West New Guinea.

—, *ditto* (1953) 46 pp.–Revised edition of the latter.

Kanehira, R., *An enumeration of plants collected in the Mandated Territory of New Guinea I–III* (Bot. Mag. Tokyo 52, 1938, 349–357, 409–416; *ibid.* 53, 1939, 8–16).–Records; few new *spp.*

— & Hatusima, S., *c.s.*, *The Kanehira-Hatusima 1940 collection of New Guinea plants I–XXI* (Bot. Mag. Tokyo 55–57, 1941–1943).–Mostly on the flora of Mt Arfak; records and descr. new *spp.*

Kostermans, A. J. G. H., *Notes on New Guinea plants I–III* (Bull. Bot. Gard. Btzg III, 18, 1950, 435–448, fig. 1–3).–Descr. new gen. & *spp.*

Lam, H. J., *Bibliography of New Guinea.* See Chapter 2.

Lane-Poole, C. E., *The Forest Resources of the Territories of Papua and New Guinea.* Parliam. Commonw. Australia (1925) iv + 209 pp., figs.–Contains important field-notes of L.–P.'s coll.

Lauterbach, C., L. Diels & R. Schlechter, *c.s.*, *Beiträge zur Flora von Papuasien* (Bot. Jahrb. onwards of vol. 49, 1912).–Important series of revisions, mostly dealing with the former area, but sometimes covering the whole of New Guinea and incl. data on Melanesia; often keys.

Merrill, E. D. & L. M. Perry, *c.s.*, *Plantae Papuanae Archboldianae I–XVIII* (J. Arn. Arb. 20–30, 1939–1949).–Important series of records and descr. mainly of the Brass collections, continued by Miss Perry in the shape of revisions of families and genera which have been included in Chapter 6c.

—, *Note on some Papuan collections of M. S. Clemens* (*ibid.* 29, 1948, 152–168).–Records and descr. new *spp.*

Miklouho-Maclay, N. de (& F. von Mueller), *List of plants in use by the natives of the Maclay-coast, New Guinea* (Proc. Linn. Soc. N.S.W. 10, 1885, 346–358).–List useful *spp.* with notes.

Moore, S., *New species of Papuan plants* (J. Bot. 67, 1929, 49–51).–Records and some new *spp.* coll. Brass.

Mueller, F. von, *Descriptive notes on Papuan plants.* Parts 1–9 (2 vols): 1 (1875–1877) 1–94; 2 (1877–1890) 1–70.–Records and descr. new *spp.*

—, Numerous small papers in 'Melbourne Chemist and Druggist', 'Australasian Journal of Pharmacy', 'Victorian Naturalist', 'Wing's Southern Science Record', 'Proc. Linnean Soc. New South Wales', 'Trans. Roy. Soc. Victoria', 'Journal of Botany', 'Ann. Rep. Br. N. G.', *etc.* (1884–1896).–Inserted in Chapter 6c as far as suitable.

—, *Report on a small collection of plants from the Aird-River, obtained by Mr Theodore Bevan during his recent expedition* (Proc. Linn. Soc. N.S.W. II, 2, 1887, 419–422, t. 6–7).–List of names; descr. some new *spp.*

—, *Records of observations on Sir William MacGregor's highland plants from New Guinea 1889* (Trans. R. Soc. Victoria 1^2, 1889, 1–45).–Records; descr. new *spp.*

Oliver, D., *List of plants collected in New Guinea by Dr. A. B. Meyer . . .* (J. Linn. Soc. Bot. 15, 1877, 29–30).–Small list with a few new *spp.*

Pulle, A. A., *c.s.*, Nova Guinea, botanical volumes 8, 12, 14, 18 (1911–1936), many plates; new ser. 4 (1940) 109–112, t. 4–11; 133–150, t. 14.–Records and descr. new *spp.*

Rechinger, K., *Plantae novae Papuanae* (in Fedde, Rep. 11, 1912, 179–187).–Descr. new *spp.* from New Guinea (& the Solomons).

—, *Botanische und zoologische Ergebnisse einer wissenschaftlichen Forschungsreise nach den Samoainseln, dem Neuguinea-Archipel und den Salomonsinseln* (Denkschr. Math.-Naturw. Kl. K. Ak. Wiss. Wien 89, 1914, 443–672, 707, t. 1–8).–List of records with new *spp.*; few from New Guinea.

Rehder, A., *c.s.*, *A Supplement to C. T. White, 'Ligneous plants collected in the Territory of Papua (British New Guinea) in 1925–26 by L. J. Brass'* (J. Arn. Arb. 14, 1933, 62–67).–Listed records; no new *spp.*

Ridley, H. N., *On the Monocotyledonous plants of New Guinea collected by Mr H. O. Forbes* (J. Bot. 24, 1886, 321–327, 353–360).–Records with new *spp.*

—, *Plantae novae papuanae* (*ibid.* 52, 1914, 289–296). On Forbes's coll.; records & new *spp.*

—, *c.s.*, *Report on the botany of the Wollaston Expedition to Dutch New Guinea 1912–1913* (Trans. Linn. Soc. Lond. II, Bot. 9, 1916, 1–269, t. 1–6).–Descr. & records of the Boden Kloss coll. from Mt Carstensz.

Salverda, Z., *Rapport van een . . . exploratie in ZW. Nieuw Guinea.* For. Rep. mimeogr., Buitenzorg (1938) 122 pp. + many app.–In App. I, p. 1–12, a list of tree *spp.* collected in West New Guinea, MacCluer Gulf area; in Dutch.

Scheffer, R. H. C. C., *Enumération des plantes de la Nouvelle-Guinée* (Ann. Jard. Bot. Btzg 1, 1876, 1–60, 178–181).–List; descr. new *spp.*

Schumann, K., *Die Flora des Deutschen Ostasiatischen Schutzgebietes* (Bot. Jahrb. 9, 1888, 189–223).–List of records and new *spp.* from New Guinea incl. also Micronesia and Melanesia.

—, *Plantae Bammlerianae* (Notizbl. Berl.-Dahlem 1, 1895, 44–57).–List of plants from Tami Isl., near SE. Huon Peninsula; a few new *spp.*

— & M. Hollrung, *Die Flora von Kaiser Wilhelms Land* (Beih. zu den Nachr. Kais. Wilh. Land 1889, 1–137).–Enum. with records and descr. of new genera & *spp.*

— & C. Lauterbach, *Die Flora der deutschen Schutzgebiete in der Südsee* (1900) i–xvi, 1–613, t. 1–22, map.–Enum.; descr. new *spp.*, incl. also those of Micronesia.

—, *ditto*, Nachträge (1905).–*Ditto.*

SMITH, A. C., *Studies of Papuasian plants I–VI* (J. Arn. Arb. 22, 1941, 60–80, 231–252, 343–374, 497–528; *ibid.* 23, 1942, 417–443; *ibid.* 25, 1944, 104–298).–Revisions of several families; records and descr. new *spp.*; no keys.

STEENIS, C. G. G. J. VAN, *Notes on a number of New Guinean species* (J. Arn. Arb. 28, 1947, 419–423).–Listed records.

VALETON, TH., *Plantae papuanae* (Bull. Dép. Agr. Ind. Néerl. *no* 10, 1907, 1–72).–Records and new *spp.*

WARBURG, O., *Beiträge zur Kenntnis der papuanischen Flora* (Bot. Jahrb. 13, 1891, 230–455).–Account WARBURG coll.; records; new gen. & *spp.*

—, *Bergpflanzen aus Kaiser Wilhelmsland* (*ibid.* 16, 1892, 1–32).–Records and descr. new *spp.*

—, *Plantae Hellwigianae* (*ibid.* 18, 1894, 184–212). –*Ditto.*

WHITE, C. T., *A Contribution to our Knowledge of the Flora of Papua* (Proc. R. Soc. Queensl. 34, 1922, 5–65).–Listed records and new *spp.*

—, *On a small collection of plants from the Rigo District, Papua* (Proc. Linn. Soc. N. S. W. 51, 1926, 296–298, t. 17).–*Ditto.*

—, *c.s.*, *Ligneous plants collected in the Territory of Papua in 1925–1926 by L. J. Brass* (J. Arn. Arb. 10, 1929, 197–274).–*Ditto.*

—, *Ligneous plants from the Solomon Islands* (*and New Guinea*) (*ibid.* 31, 1950, 81–116).–*Ditto.*

— & W. B. FRANCIS, *Plants collected in Papua by C. E. Lane-Poole* (Proc. R. Soc. Queensl. 38, 1927, 225–261, fig. 1–19).–*Ditto.*

—, *Plants collected in the Mandated Territory of New Guinea by C. E. Lane-Poole* (*ibid.* 39, 1928, 61–70, t. 4–5).

c. PROPER TAXONOMIC BIBLIOGRAPHY

ACANTHACEAE

ANDERSON, T., On the identification of the Acanthaceae of the Linnean Herbarium, *etc.* (J. Linn. Soc. Bot. 7, 1863, 111–118).–List.

BREMEKAMP, C. E. B., Materials for a monograph of the Strobilanthinae (Verh. Kon. Ned. Akad. Wet. A'dam sect. 2, 41, *no* 1, 1944, 1–306, t.1–6). –Mainly dealing with *Hemigraphis* and *Strobilanthes*; 43 new genera are segregated! In all genera keys to the Mal. *spp.*

— & N. E. NANNENGA-BREMEKAMP, A premiliminary survey of the Ruelliinae of the Malay Archipelago and New Guinea (Verh. Kon. Ned. Akad. Wet. A'dam sect. 2, 45, *no* 1, 1948, 1–39). –Key to subtribes, genera and *spp.* comprising *e.g.* revisions of *Dipteracanthus* and *Eranthemum.* Two new genera: *Nothoruellia* and *Pararuellia* (*Aporuellia*).

HALLIER *f.*, H., Indonesische Acanthaceen (Nova Acta, Abh. Kais. Leop.-Car. Deut. Akad. Naturf. 70, 1897, 195-224, t. 9–16).–New *spp.* mainly in *Hemigraphis*; revision of *Ptyssiglossis.*

—, Ueber Pseuderanthemum metallicum n. sp. und das System der Acanthaceae (Ann. Jard. Bot. Btzg 15, 1898, 26–37, t. 9).–Descr. new *sp.*; 2 new sections; discussion evaluation of characters.

LINDAU, G., Beiträge zur Systematik der Acanthaceen (Bot. Jahrb. 18, 1893. 36–64, fig. 1–2, t. 1–2). –Tribal and generic delimitation with pollen structure; key to genera by pollen characters.

RADLKOFER, L., Ueber den systematischen Werth der Pollenbeschaffenheit bei den Acanthaceen (Sitz.-Ber. Math. Phys. Kl. Bayer. Akad. Wiss. 13, 1883, 256–314).–Significance of pollen structure in subdividing the family.

VALETON, TH., Ic. Bog. 3 (1908) t. 251–257.–New *spp.* of *Ptyssiglottis*, *Ruellia* and *Rungia.*

Local

Africa: LINDAU, Bot. Jahrb. 17 (1892) 89–113; *ibid.* 20 (1894) 1–76.–List; descr. new *spp.* & gen.

SE. Asia: ANDERSON, J. Linn. Soc. Lond. Bot. 9 (1867) 425–526.–Conspectus generum; enum. of *spp.* in India; no keys.

Bombay: SANTAPAU, Univ. Bombay, Bot. Mem. 2 (1952) i–iii, 1–104, t. 1–6.–Revision Bombay Presid. *spp.*

—, J. Bombay Nat. Hist. Soc. 51 (1953) 349–368. –Addition to latter paper; some new keys to *spp.* of various genera.

Siam: CLARKE (*ed.* HOSSEUS), Bot. Jahrb. 41 (1907) 62–73.–Enum.

IMLAY, Kew Bull. (1939) 109–150.–Critical notes and descr. of new *spp.* & genera from Siam.

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 154–155.–Small list; some new comb.

RIDLEY, J. Fed. Mal. Stat. Mus. 8, 4 (1917) 71–74.–List; several new *spp.*

—, J. Mal Br. R. As. Soc. *no* 87 (1923) 81–83. –List; several new *spp.*

—, Kew Bull. (1925) 87.–New *Sphinctacanthus.*

Malay Peninsula: AIRY SHAW, Kew Bull. 1951 (1952) 370.–*Limnophila viscida* RIDL. reduced to *Staurogyne.*

Java: BACKER, Onkruidfl. Jav. Suiker. (1931) 637–685.

BREMEKAMP, Verh. Kon. Ned. Akad. Wet. A'dam sect. 2, 45, *no* 2, 1948, 1–78.–Extensive critical notes; many new *spp.*; no keys.

— & BACKER, in BACKER, Bekn. Fl. Java (em. ed.) 9 (1949) fam. 198, p. 1–101.–In Dutch; keys!

LINDAU, in FEDDE, Rep. 13 (1915) 550–554.–Descr. 5 new *spp.* from Java, 1 from Sumbawa, 1 from Celebes.

VALETON, Ic. Bog. 4 (1912) t. 326.–*Lamiacanthus viscosus.*

Borneo: VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 398.–New rheophytic *Hygrophila.*

Philippines: BREMEKAMP, Philip. J. Sc. 80 (1951) 11–21.–Descr. new *spp.*

—, *ibid.* 81 (1952) 133–134.–2 new *spp.*

CLARKE, Govt Lab. Publ. Philip. *no* 35 (1905) 89–93.–Misc. descr.

—, Philip. J. Sc. 1 (1906) Suppl. 247–249.–Descr. some new *spp.*

ELMER, Leafl. Philip. Bot. 5 (1913) 1685–1704. –Misc. new *spp.* from Palawan.

—, *ibid.* 10 (1939) 3673–3679.–Misc. new *spp.*

LINDAU, in PERKINS, Fragm. Fl. Philip. (1904) 38–41.–List; no new *spp.*

MERRILL, Philip. J. Sc. 26 (1925) 490–491.–New *Hypoestes.*

—, *ibid.* 27 (1925) 54–55.–2 new *spp.*

—, *ibid.* 29 (1926) 486–489.–5 new *spp.*

—, *ibid.* 30 (1926) 426–428.–2 new *spp.*

—, *ibid.* 41 (1930) 358–361, fig. 23–24.–*Ditto.*

QUISUMBING & MERRILL, Philip. J. Sc. 37 (1928) 199–200.–New *Hallieracantha.*

Celebes: BREMEKAMP, Svensk Bot. Tidskr. 42 (1948) 372–403.–List of KAUDERN & KJELLBERG coll.; new *spp.*

—, *ibid.* 43 (1949) 63–64.–New *Hypoestes* from Saleier Isl.

HEMSLEY, Kew Bull. (1896) 39.–New *Strobilanthes.*

Moluccas: MERRILL, Philip. J. Sc. 11(1916) Bot. 313.–New *Lepidagathis* and *Pseuderanthemum* from Ambon.

New Guinea: LAUTERBACH, Nova Guinea 8 (1910) 333–334.–New *Staurogyne.*

LINDAU, Bot. Jahrb. 19 (1894) Beibl. 48, 3–7.–List; some new *spp.*

—, *ibid.* 50 (1913) 166–170.–Descr. *Strobilanthes n. sp.*; *Ancylacanthus* and *Jadunia n. g.*

—, *ibid.* 55 (1918) 135–136.–Descr. 2 new *spp.*; *Gymnophragma n. g.*

MOORE, J. Bot. 58 (1920) 190–195.–List; descr. new *spp.*; *Hulemacanthus n.g.*

RIDLEY, J. Bot. 52 (1914) 294–296.–Descr. 2 new *spp.*

Genera

Acanthus: VAN STEENIS, Trop. Natuur 26 (1937) 202–207.–Revision Mal. *spp.*; in Dutch; key.

Eranthemum (*Daedalacanthus*): BREMEKAMP & NANNENGA-BREMEKAMP, Verh. Kon. Ned. Akad. Wet. A'dam sect. 2, 45, *no* 1 (1948) 33–39.–Key to endemic *spp.* and var. of Mal.

Hallieracantha: STAPF, J. Linn. Soc. Bot. 38 (1907) 6–17.–Revision; now very incomplete.

Hemiadelphys: MERRILL, Philip. J. Sc. 12 (1917) Bot. 109–110.–Record.

Lepidagathis: NEES AB ESENBECK, Monographia generis Lepidagathis (Nov. Act. Ac. Caes. Leop.-Car. Nat. Cur. 19, Suppl. 2, 1841, xxi–liv; repr. separately under the title: 'Lepidagathis illustratio monographica' 1841, 1–40).–Descr. & synopsis of *spp.*, some new; key to groups.

Pseuderanthemum: HALLIER *f.*, Ann. Jard. Bot. Btzg 15 (1898) 26–37.–Descr. new Sumatran *sp.*; 2 new sections.

Ptyssiglottis: HALLIER *f.*, Nova Acta, Abh. Kais. Leop.-Car. Deut. Akad. Naturf. 70 (1897) 212–224, t. 14–16.–Revision; key.

MOORE, J. Bot. 60 (1922) 355–358.–*Ditto.*

Pycnostachys: BRUCE, Kew Bull. (1939) 563–593, 5 maps.–Complete revision; key; Afr. genus, some *spp.* sometimes cultivated.

Sanchesia: LEONARD, J. Wash. Acad. Sc. 16 (1926) 484–492.–Revision; key.

Sautiera: VALETON, Ic. Bog. 4 (1912) t. 327.—Native of Timor.

Sciaphyllum: BREMEKAMP, Rec. Trav. Bot. Néerl. 37 (1940) 293–300, 1 fig.–Monotypic.

Strobilanthes: BENOIST, Bull. Soc. Bot. Fr. 80 (1933) 730–732.–New *spp.* from Siam and Indo-China.

Strophacanthus: BREMEKAMP, Verh. Kon. Ned. Ak. Wet. A'dam sect. 2, 45, *no* 2 (1948) 43–45.–List.

Thunbergia: BACKER, Trop. Natuur 5 (1916) 136–137.–Native and cultivated Jav. *spp.*; in Dutch; key!

LINDAU, Bot. Jahrb. 17 (1893) Beibl. 41, 31–44. –Revision; no descr.; key!

ACERACEAE

BLOEMBERGEN, S., Fl. Mal. I, 4 (1948) 3–4, 1 fig.

PAX, F., Pflanzenreich Heft 8 (1902) 1–89.

Genera

Acer: FANG, Contr. Biol. Lab. Sc. Soc. China, bot. ser. 11 (1939) ix + 346 pp.–Revision Chin. *spp.*

LI, Pacif. Science 6 (1952) 288–294.–*Spp.* of Formosa and Riukiu Isl.; descr.; key!

VAN STEENIS, Bull. Bot. Gard. Btzg III, 18 (1950) 458–459.–Records from Malaya and Timor.

—, Fl. Mal. 1, 4 (1954) 592.–Proper name of Mal. *Acer* is *A. laurinum* HASSK.

ACTINIDIACEAE

(*incl. also Saurauiaceae*[1])

GILG, E. & E. WERDERMANN, Pflanzenfamilien ed. 2, 21 (1925) 36–45.

Genera

Actinidia: P'EI & LAW, Bot. Bull. Acad. Sinica 2 (1948) 25–33.–*Spp.* of Szechuan & Sikang; key!

DUNN, J. Linn. Soc. Bot. 39 (1911) 394–410.–Revision; key!

LI, J. Arn. Arb. 33 (1952) 1–61.–Revision; key!

VAN STEENIS, Fl. Mal. I, 4 (1948) 37–39, fig. 1.

Saurauia
(*Trematanthera*)

BURTT, B. L., in HOOK. Ic. Pl. 34 (1936) t. 3316.–Descr. of a new *sp.* of the Solomons. Constructive remarks on the structure of the subdivisional affinities (series of DIELS).

BUSCALIONI, L. & MUSCATELLO, G., Malpighia 24–30.–Revision New World *spp.*

GILG, C. & E. WERDERMANN, Pflanzenfamilien ed. 2, 21 (1925) 42–45.

KORTHALS, P. W., in TEMMINCK, Verh. Nat. Gesch. Bot. (1841–42) 120–134, t. 19.–Descr. 6 *spp.*

MIQUEL, F. A. W., Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 106–112.–List; many new *spp.*

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(1) *Saurauia* has been included in several other families (*Dilleniaceae*, *Theaceae*, *etc.*).

Schnarf, K., Sitz. Ber. Ak. Wiss. Wien, Math.-Naturw. Kl. Abt. 1, 122 (1924) 17–28, 22 fig.–Ontogeny and seed structure point to affinity with *Theaceae.*

Vriese, W. H. de, Pl. Ind. Bat. Orient. (1856) 31–57.–List Mal. *spp.*; new *spp.*; no key.

Local

Sumatra: Baker, J. Bot. 56 (1918) 161–167.–Important list; some new *spp.*; key.
Merrill, Contr. Arn. Arb. 8 (1934) 104–106.–List records.
Miquel, Fl. Ind. Bat. Suppl. (1860) 480–482.–New *spp.*
Ridley, J. Mal Br. R. As. Soc. *no* 87 (1923) 53–54.–Records and new *sp.*
—, Kew Bull. (1926) 60.–New *sp.*

Borneo: Merrill, Philip. J. Sc. 13 (1918) Bot. 85–94.–Descr. 11 new *spp.*
—, J. Str. Br. R. As. Soc. *no* 79 (1919) 31–35.–Records and 4 new *spp.*
—, *ibid. no* 86 (1922) 330–331.–New *sp.* and a new comb. in *Actinidia.*
—, Philip. J. Sc. 21 (1922) 529–530.–New *sp.*
—, *ibid.* 29 (1926) 396–397.–New *sp.*
—, Plant. Elm. Born. (1929) 196–197.–Records and new *sp.*
Ridley, Kew Bull. (1929) 262.–New *sp.*
Airy Shaw, Kew Bull. (1940) 248–249.–List records.

Philippines: Elmer, Leafl. Philip. Bot. 10 (1939) 3726–3728.–2 new *spp.*
Merrill, Philip. J. Sc. 9 (1914) Bot. 521–530.–12 new *spp.*
—, *ibid.* 26 (1925) 471.–New *sp.*
—, *ibid.* 27 (1925) 36.–New *sp.*
—, *ibid.* 29 (1926) 396–397.–New *sp.*
Quisumbing, Philip. J. Sc. 41 (1930) 332–337, fig. 9–11.–3 new *spp.*
—, *ibid.* 76 (1944) 48–52.–4 new *spp.*

Celebes: Koorders, Suppl. Flora N. O. Celebes 2 (1922) t. 69–80; *ibid.* 3 (1922) 34–40.–Descr. & plates.

New Guinea: Diels, Bot. Jahrb. 57 (1922) 441–459.–Key to groups and *spp.* of New Guinea.
—, Nova Guinea 14 (1924) 82–84.–Records and new *spp.*
Kanehira & Hatusima, Bot. Mag. Tokyo 57 (1943) 63–74.–Records; 8 new *spp.*
Lauterbach, Nova Guinea 8 (1910) 305–307.–List; 3 new *spp.*
—, *ibid.* 8 (1912) 835–839.–List; 8 new *spp.*
Von Mueller, Vict. Nat. 2 (1886) 134–135.–Descr. *Trematanthera.*
Ridley, Trans. Linn. Soc. Lond. II. Bot. 9 (1916) 14–15.–5 new *spp.*
Smith, A. C., J. Arn. Arb. 22 (1941) 502–524.–List; 18 new *spp.*
White & Francis, Proc. R. Soc. Queensl. 38 (1927) 244–247, fig. 10–11.–List; 3 new *spp.*

AEGINETIACEAE

See Orobanchaceae

AGAVACEAE

See Amaryllidaceae

AIZOACEAE

(*incl. Molluginaceae & Ficoidaceae*)

Backer, C. A., Fl. Mal. I, 4 (1951) 267–275, fig. 1–2.

Pax, F. & K. Hoffmann, Pflanzenfamilien ed. 2, 16c (1934) 179–233.

Local

Java: Backer, Onkruidfl. Jav. Suiker. (1930) 237–242.–In Dutch; key!

New Guinea: Merrill & Perry, J. Arn. Arb. 23 (1942) 386.–2 records.
Pulle, Nova Guinea 8 (1910) 355.—List.

Genera

Mesembryanthemum: Von Poellnitz, in Fedde, Rep. 32 (1933) 1–73.–Segregation of the genus; descr. & keys to segregate genera.

Trianthema: Melville, Kew Bull. (1952) 261–269.–Some critical *spp.* allied to *T. pentandra.*

ALANGIACEAE

Wangerin, W., Pflanzenreich Heft 41^3 (1910) 1–25, fig. 1–6.

Local

China: Melchior, Notizbl. Berl.-Dahlem 10 (1929) 822–830.–Revision; key!
—, & Mansfeld, Bot. Jahrb. 60 (1925) 162–166.–Revision; key.

Genera

Alangium: Bloembergen, Blumea 1 (1935) 241–294, fig. 1–5.–Revision Neth. Ind. *spp.*
—, Bull. Jard. Bot. Btzg III, 16 (1939) 139–235, 10 fig.–Revision of the genus; key!

ALISMATACEAE

Buchenau, F., Pflanzenreich Heft 16^2 (1903) 1–66, fig. 1–19.

Micheli, M., in DC. Mon. Phan. 3 (1881) 29–83.

Miquel, F. A. W., Ill. Fl. Arch. Ind. (1870) 49–51.–Census *Sagittaria* and *Lophotocarpus.*

Local

Java: Backer, Handb. Fl. Java pt 1 (1925) 52–55.–A practically complete Mal. survey; in Dutch; keys!
Kern, Trop. Natuur 32 (1952) 127–129, 1 fig.–Record of a *Sagittaria* newly naturalized in Java; in Dutch.

Genera

Alisma: Samuelsson, Ark. Bot. 24A, *no* 7 (1932) 1–46, t. 1–6.–Revision; key to *spp.* and *sspp.*

Echinodorus (*Ranalisma*): Gagnepain, Bull. Soc. Bot. Fr. 76 (1929) 274–276.–Reduction of *Ranalisma.*
Stapf, in Hook. Ic. Pl. IV, 7 (1901) t. 2652.–*Ranalisma* from Mal. Pen.
Van Steenis, Arch. Hydrobiol. Suppl. 11 (1932) 240.–Recomb.

Elisma: Van Steenis, Trop. Natuur 24 (1935) 54–56.–Record of this European plant in Java.

Van der Werff, Blumea 7 (1954) 599–601.–*Elisma* record from Java is based on a wrongly localized plant.

Lophotocarpus: Smith, J. G., 11th Ann. Rep. Missouri Bot. Gard. (1900) 145-150.–Key to U.S. Am. *spp.*

Sagittaria: Smith, J. G., 6th Ann. Rep. Missourri Bot. Gard. (1895) 27–64, t. 1–29.–Revision N. Amer. *spp.*; descr.; key!

AMARANTHACEAE

Backer, C. A., Fl. Mal. I, 4 (1949) 69–98, 593–594, 8 fig.

Lopriore, G., Ueber die geographische Verbreitung der Amaranthaceae in Beziehung zu ihren Verwandtschaftsverhältnisse (Bot. Jahrb. 30, 1901, 1–38, t. 1).–General discussion.

Moquin-Tandon, A., in DC. Prod. 13, 2 (1849) 231–424, 462–463.

Schinz, H., Pflanzenfamilien ed. 2, 16c (1934) 7–85, fig. 1–46.

Suessenguth, K., Amaranthaceen-Studien (in Fedde, Rep. 44, 1938, 36–48).

Local

Malay Peninsula: Suessenguth, Mitt. Bot. Staatssamml. München, Heft 6 (1953) 194.–*Psilotrichum malaccense n. sp.*; this appears to be *Alternanthera brasiliana*, *cf.* Fl. Mal. I, 4, 594b.

Java: Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 402.–New record of *Gomphrena celosioides.*

Philippines: Merrill, Philip. J. Sc. 29 (1926) 478.–Descr. new var. of *Cyathula.*

New Guinea: Pulle, Nova Guinea 8 (1910) 351–352.–Small list of records.

Genera

Achyranthes: Boerlage, Ned. Kruidk. Arch. II, 5^3 (1889) 420–430, t. 6.–Account specim. at Leyden.
Merrill, Trans. Amer. Phil. Soc. Philad. n.s. 24, ii (1935) 148–149.–Typification.

Amaranthus: Merrill, Amer. J. Bot. 23 (1936) 609–612, 1 fig.–Applic. of the name *A. viridis.*
Willdenow, Historia Amaranthorum (1798) 1–38, t. 1–12.

AMARYLLIDACEAE

(*incl. also Agavaceae & Hypoxidaceae*)

Baker, J. G., A new key to the genera of Amaryllidaceae (J. Bot. 16, 1878, 161–169).–Synopsis; in Latin.

—, A synopsis of Hypoxidaceae (J. Linn. Soc. Bot. 17, 1878, 93–126).–Descr.; keys!

—, Handbook of the Amaryllideae. London (1888) xii + 216 pp.–*Non vidi.*

Pax F. & G. F. Hoffmann, Pflanzenfamilien ed. 2, 15a (1930) 391–430, fig. 163–187.

Traub, H. P. & H. N. Moldenke, Amaryllidaceae: tribe Amarylleae. The Amer. Plant Life Soc. Stanford Cal. 1949, 194 pp., 15 pl.–Elaborate systematic treatment; key to genera.

Local

Malay Peninsula: Ridley, Mat. Fl. Mal. Pen. (Monocot.) 2 (1907) 65–69.–Revision; keys.

Java: Backer, Hand. Fl. Java pt 3 (1928) 81–105.–Practically complete for Malaysia, many cultivated *spp.* included; in Dutch; keys!
Koshimizu, Jap. J. Bot. 27 (1952) 180.–*Crinum gigas* Nakai reduced to *C. asiaticum.*

Philippines: Elmer, Leafl. Philip. Bot. 5 (1913) 1645–1649.–List *Curculigo*, 3 new *spp.*

New Guinea: Hallier, Nova Guinea 8 (1913) 899–902.–Records; 2 new *Crinums.*
Lauterbach, Bot. Jahrb. 50 (1913) 301–305.–List; no new *spp.*; keys!

Genera

Agave: Berger, Die Agaven. Beiträge zu einer Monographie. Jena 1915, vi + 288 pp., 79 fig., 2 pl.–Contr. towards monogr.

Amaryllis: Traub, Hamilton & Uphof, Herbertia 5 (1938) 114–131.–Tentative revision.

Crinum: Baker, Gard. Chron. II, 15 (1881) 763, 786; *ibid.* 16 (1881) 39, 40, 72, 180, 398, 495–496, 588–589, 760, 784–785.–Enum.; *spp.* geographically under subgen. & sect.
Uphof, Herbertia 9 (1942) 63–84 (1943).–Complete list.

Hymenocallis: Sealy, Kew Bull. (1954) 201–240.–Revision; key.

Polianthes: Rose, Contr. U. S. Nat. Herb. 8 (1903) 8–14, fig. 1–4.–Revision; new delimitation; key.

Zephyranthes: Hume, Nat. Hort. Mag. 14 (1935) 258–275.–*Non vidi.*
Sealy, J. Roy. Hort. Soc. 62 (1937) 195–209.–Delimitation against allied genera; lists of *spp.*; no references, syn. or keys.

AMPELIDACEAE

See Vitaceae

ANACARDIACEAE

Barkley, F. A., A key to the genera of the Anacardiaceae (Amer. Midl. Nat. 28, 1942, 465–474).

Engler, A., Ueber die morphologischen Verhältnisse und die geographische Verbreitung der Gattung Rhus, *etc.* (Bot. Jahrb. 1, 1881, 365–427).–Generic delimitation and descr. new gen. & *spp.*

—, in DC. Mon. Phan. 4 (1883) 171–500, t. 4–15.–Now incomplete.

Miquel, F. A. W., De quibusdam Burseraceis et Anacardiaceis Archipelagi Indici (Ann. Mus. Lugd.-Bat 4, 1869, 117–118).–Enum. *spp.*; some new *Buchananias.*

Local

Indo-China: Evrard, Bull. Soc. Bot. Fr. 99 (1952) 131–132.–Some new *Melanorrhoea & Bouea.*

Malay Peninsula: Burkill, Gard. Bull. Str. Settl. 5 (1931) 224–230.–Critical list of *Gluta.*
Corner, Gard. Bull. Str. Settl. 10 (1939) 253–256.–Key to the 3 *Campnospermas.*
Henderson, Gard. Bull. Str. Settl. 3 (1924) 290–291.–Notes on some *Semecarpus.*

—, *ibid.* 7 (1933) 97–99, t. 19.–The first *Pistacia* in Malaysia!

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 91–92.–Critical note on *Rhus chinensis* MILL.

Java: ADELBERT, Blumea 6 (1948) 325–327.–Some notes.

Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 86 (1922) 322–324.–New *spp.* of *Melanochyla* and *Semecarpus*.

—, Plant. Elm. Born. (1929) 166–170.–Several new *spp.*

RIDLEY, Kew Bull. (1933) 193–202.–Numerous new *spp.* and records; *Nothopegia* new for Mal.; *Melanocommia n.g.;* also a *Buchanania* from Aru Isl. (Moluccas).

Philippines: ELMER, Leafl. Philip. Bot. 9 (1934) 3179–3180.–New *Semecarpus*.

—, *ibid.* 10 (1939) 3679–3684.–Several new *spp.*

MERRILL, Philip. J. Sc. 30 (1926) 407–408.–New *Semecarpus* from Samar.

QUISUMBING, Philip. J. Sc. 76 (1944) 43–44.–New *Semecarpus*.

New Guinea: KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 56 (1942) 166–171, fig. 9.–Records; new *spp.* in *Buchanania* and *Koordersiodendron*.

LAUTERBACH, Nova Guinea 8 (1910) 297–299. –Records; 2 new *spp.* in *Rhus*.

—, *ibid.* 8 (1912) 829–830.–Records; new *spp.* in *Semecarpus* and *Buchanania*.

—, Bot. Jahrb. 56 (1921) 345–373, fig. 1–5.–Descr. new *sp.* and 2 new genera; keys!

—, *ibid.* 59 (1924) 536.–New *Semecarpus*.

MERRILL & PERRY, J. Arn. Arb. 22 (1941) 529–541.–Records; many new *spp.* of BRASS coll.

—, *ibid.* 29 (1948) 158–160.–New *spp.* of *Euroschinus* and *Rhus*.

SLIS, Nova Guinea 14 (1924) 97–99, t. 8.–List records; new *Rhus* and 2 *Semecarpus*.

WHITE, Proc. R. Soc. Queensl. 34 (1922) 40–42. –New records; new *sp.* in *Buchanania* and *Semecarpus*.

—, J. Arn. Arb. 31 (1950) 95–96.–New *Mangifera*; record of *Pleiogynium*.

Genera

Bouea (*Tropidopetalum*): FEDTSCHENKO, Svensk Bot. Tidskr. 19 (1926) 493.–Reduction of *Tropidopetalum*.

Campnosperma (*Coelopyrum*): VAN STEENIS, Fl. Mal. Bull. 3 (1948) 74.–*Campnosperma* prop. to be conserved.

Mangifera: MUKHERJEE, S., Lloydia 12 (1949) 73–136.–Revision; key.

Pegia (*Phlebochiton*): COLEBROOKE, Trans. Linn. Soc. Lond. 15 (1827) 364–365.–Type descr.

DIELS, Sunyatsenia 1 (1933) 123.–New *sp.* from China.

HANDEL-MAZZETTI, Sinensia 3 (1933) 186–187. –New *sp.* and recomb.

LECOMTE, Bull. Soc. Bot. Fr. 54 (1907) 525–529. –Revision; no key!

VAN STEENIS, J. Bot. 72 (1934) 10–12.–Revision; key.

Pentaspadon (*Nothoprotium*); HOOKER *f.*, Fl. Br. Ind. 2 (1876) 28–29.

Pleiogynium: LEENHOUTS, Blumea 7 (1952) 159.–New comb. for *P. solandri*.

WHITE, Proc. R. Soc. Queensl. 45 (1933) 27–28, t. 3 (1934).–Descr. new *sp.* Papua.

Rhus: BARKLEY, Ann. Missouri Bot. Gard. 24 (1937) 265–466.–N. & Centr. Am. *spp.*; keys of *Rhus* and allied genera.

MERRILL, J. Arn. Arb. 9 (1928) 1–4, t. 10–11.–Type study Linnean herbarium.

Schinus: BARKLEY, Brittonia 5 (1944) 160–198, fig. 1–20.–Revision; key.

Sorindeja: VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 462–463.–The record for Mal. is based on a cult. plant.

Swintonia (*Anauxanopetalum*): MIQUEL, J. Bot. Néerl. 1 (1861) 368–369.

ANCISTROCLADACEAE

GILG, E., Pflanzenfamilien ed. 2, 21 (1925) 589–592.

STEENIS, C. G. G. J. VAN, Fl. Mal. I, 4 (1948) 8–10, 2 fig.

ANNONACEAE

(excl. Eupomatiaceae & Himantandraceae)

BAILLON, H., Mémoire sur la famille des Anonacées (Adansonia 8, 1868, 162–184, 295–344).–General discussion and synopsis of genera.

BOERLAGE, J. G., Notes sur les Anonacées du Jardin Botanique de Buitenzorg (Ic. Bog. 1, 1899, 79–208, t. 26–75).–Key to Mal. genera; *spp.* enumerated, no new genera, few new *spp.*

CANDOLLLE, A. DE, Mémoire sur la famille des Anonacées (Mém. Soc. Phys. & Hist. Nat. Genève 5, 1832, 177–221, t. 1–5). Enum.; descr. new gen. and *spp.*; no keys.

CORNER, E. J. H., The Annonaceous seed and its four integuments (New Phytologist 38, 1949, 332–364, 31 fig.).–Anat. of seed coat and its interpretation.

DIELS, L., Die Gliederung der Annonaceen und ihre Phylogenie (Sitz.-Ber. Preuss. Akad. Wiss. Phys.-Math. Kl. 1932, 77–85).–Generic alliances.

ENGLER, A. & L. DIELS, Übersicht über die bekannten Gattungen der Anonaceen und Beschreibung einiger neuen Gattungen dieser Familie aus dem tropischen Afrika (Notizbl. Berl.-Dahlem 3, 1900, 45–59, 1 tab.).–Key to the genera.

FRIES, R. E., Revision der Arten einiger Anonaceen-Gattungen I-V (Acta Hort. Berg. 10, 1930–1931, 1–341, t. 1–27; *ibid.* 12, 1934–1939, 1–577, 66 fig., 68 pl.)–Rev. of many genera, mostly neotropical; keys.

—, Einige Gesichtspunkte zur systematischen Gruppierung der Amerikanischen Annonaceen-Gattungen (Ark. f. Bot. 30A, *no* 8, 1943, 1–31, 11 fig.).

HUTCHINSON, J., The genera of Anonaceae (Kew Bull. 1923, 241-261).–Key to the genera.

KING, G., The Anonaceae of British India (Ann. R. Bot. Gard. Calc. 4, 1893, 1–169, t. 1–220).–Magnificent monograph; keys!

MIQUEL, F. A. W., Anonaceae Archipelagi indici

(Ann. Mus. Bot. Lugd.-Bat. 2, 1865, 1–45).–Complete enum. with descr. of new *spp.*

Scheffer, R. H. C. C. ., Nat. Tijd. Ned. Ind. 31 (1869) 2–15; *ibid.* (1870) 338–344; *ibid.* 32 (1873) 387–392.–Misc. new *spp.* and records; some new genera.

—, Sur quelques plantes nouvelles ou peu connues de l'Archipel Indien (Ann. Jard. Bot. Btzg 2, 1885, 1–31).–Important list of records and new *spp.*; new genera: *Ararocarpus*, *Rauwenhoffia*, mostly based on Beccari and Teysmann coll.

Sprague, T. A. & J. Hutchinson, African Anonaceae (Kew Bull. 1916, 145–161).–Key to genera; list; descr. new *spp.*

Local

Siam: Sinclair, Gard. Bull. Sing. 14 (1953) 40–44. –List; corrections and notes; recomb.

India-Burma: Sinclair, *ibid.* 14 (1953) 45–48.–*Ditto.*

Sumatra: Baker, J. Bot. (1924) Suppl. p. 2–5.–Records Forbes coll.; some new *spp.*

Merrill, Contr. Arn. Arb. 8 (1934) 58–60.–Records; new *sp.* in *Disepalum* and *Orophea.*

Ridley, J. Mal. Br. R. As. Soc. *no* 87 (1923) 51–52.–New *Melodorum.*

—, Kew Bull. (1926) 59.–New *Popowia.*

Malay Peninsula: Corner, Gard. Bull. Str. Settl. 10 (1939) 11–15.–Critical records; some new var.

Henderson, Gard. Bull. Str. Settl. 7 (1933) 88–90, t. 15–16.–2 new *spp.*

Java: Backer, Schoolfl. Java (1911) 24–37.

—, Blumea 5 (1945) 491–493.–Critical notes; monotypic *Polyaulax n.g.*

Borneo: Beccari, Nuovo Giorn. Bot. Ital. 3 (1871) 177–193, t. 2–7.–List; descr. new *spp.* and *Eburopetalum*, *Enicosanthum*, *Marcuccia*, and *Mezzettia n.g.*

Diels, Mitt. Inst. Allg. Bot. Hamburg 7 (1927) 77–80.–List coll. Winkler; some new *spp.*

—, Notizbl. Berl.–Dahlem 11 (1931) 80–82, 85–86.–Descr. new *spp.* coll. Beccari.

Merrill, J. Str. Br. R. As. Soc. *no* 85 (1922) 174–189.–Many new records and new *spp.*; monotypic *Woodiella n.g.*

Ridley, Kew Bull. (1912) 382–390.–Many new *spp.*

—, Sarawak Mus. J. 1 (1913) 73–98.–Important list of records; many new *spp.*; *Mezzettiopsis n.g.*

Airy Shaw, Kew Bull. (1939) 275–290.–Enum. coll. Richards! Critical notes on *Enicosanthum*, *Neouvaria n. g.*, and *Uvariella.*

Sinclair, Sarawak Mus. J. *no* 18 (n.s. vol. 5, *no* 3) (1951) 597–609.–Valuable critical notes.

Philippines: Elmer, Leafl. Philip. Bot. 5 (1913) 1705–1750.–Descr. new *spp.*

—, *ibid.* 10 (1939) 3684–3692.–Descr. new *spp.*

Merrill, Philip. J. Sc. 10 (1915) Bot. 227–264.–Important study of Philip. and other *Annon.*

—, *ibid.* 26 (1925) 453–457.–Descr. 4 add. new *spp.*

—, *ibid.* 29 (1926) 479–480.–New *Orophea* and *Papualthia.*

—, *ibid.* 30 (1926) 392–394.–2 new *spp.*

Quisumbing, Philip. J. Sc. 41 (1930) 323–324, fig. 4.–New *Papualthia.*

—, *ibid.* 76 (1944) 39–40.–2 new *spp.*

New Guinea: Burck, Nova Guinea 8 (1910) 427–433, t. 69–70.–List records & new *spp.*

Diels, Nova Guinea 8 (1912) 871–873.–List of records; some new *spp.*

—, Bot. Jahrb. 49 (1913) 113–167, 5 fig.–Keys to gen. & *spp.*; new genera *Papualthia*, *Oncodostigma*, *Oreomitra*, *Schefferomitra.*

—, *ibid.* 52 (1914) 177–186.–Addit. new *spp.* and records.

—, Notizbl. Berl.-Dahlem 11 (1931) 82–83.–Descr. new *spp.*

Kostermans, Reinwardtia 1 (1952) 459–461, fig. 1.–New *Saccopetalum.*

Scheffer, Ann. Jard. Bot. Btzg 1 (1876) 2–5.–List; some new *spp.*

White, J. Arn. Arb. 10 (1929) 212–213.–Small name list.

Genera

Anaxagorea (*Spermabolus*): Fries, Svensk Bot. Tidskr. 34 (1940) 400–408.–Discussion affinity of the genus.

Scheffer, Nat. Tijd. Ned. Ind. 31 (1869) 9.–Reduction *Spermabolus.*

Annona: Fries, Act. Hort. Berg. 10 (1931) 197–315.–Revision; key.

Safford, J. Wash. Acad. Sc. 1 (1911) 118–120.–Sectional division.

—, Contr. U. S. Nat. Herb. 18 (1914) 1–68, t. 1–41.–Key to subdivisions; descr. new *spp.*; no key to *spp.*

Dasymaschalon (*Unona §*): Merrill, Philip. J. Sc. 10 (1915) Bot. 235–239.–Segregation; list of *spp.*; new comb.

Desmos (*Unona auct. pro reg. paleotrop.*): Merrill, Philip. J. Sc. 10 (1915) 234–236.–Delimitation; complete list; new comb.

Safford, Bull. Torr. Bot. Club 39 (1912) 501–508.–Generic delimitation; *Desmos* retained for Old World *spp.* of *Unona*; key to sect.; 16 *spp.* examined; no key to *spp.*

Disepalum: Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 405–406, fig. 2.–Revision; key!

Enicosanthum (*Griffithia* King *non al.*, *Griffithianthus*, *Marcuccia*): Airy Shaw, Kew Bull. (1939) 275–278.–List *spp.*

Eupomatia. See *Eupomatiaceae.*

Fissistigma (*Melodorum auctt. non* Lour., *Pyramidanthe*, *Mitrella*): Merrill, Philip. J. Sc. 15 (1919) 130–137.–Recomb. of all *spp.*

Friesodielsia (*Oxymitra* Hook. *f.* & Th. *non* Bischoff): Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 458.–A new generic name proposed.

Himantandra. See *Himantandraceae.*

Pseuduvaria: Merrill, Philip. J. Sc. 10 (1915) Bot. 254–256.–Delimitation; new comb.

Sageraea: Chatterjee, Proc. Linn. Soc. Lond. sess. 154 (1943) 263–269.–Revision Ind. & Burm. *spp.*; short key; enum. of specimens.

APOCYNACEAE

Blume, C. L., De quibusdam Apocyneis, *etc.* (Rumphia 4, 1848, 25-29, t. 179–181).

Boerlage, J. G., Apocynacées (Bull. Inst. Bot. Btzg 5, 1900, 4–20).–List caoutchouc furnishing *spp.*, some new, coll. Van Romburgh in W. Malaysia.

Hallier *f.*, H., Ueber Kautschuklianen und andere Apocynaceen, nebst Bemerkungen über Hevea (Jahrb. Hamb. Wiss. Anst. 17, 1900, 1–216, t. 1–3).–Contains a census of *spp.* of *Willughbeia*, *Chilocarpus*, *Otopetalum* reduced to *Micrechites*, *Melodinus*, *Leuconotis*, *Hunteria*.

Hasskarl, J. K., Plantarum nonnularum Javanicarum e familiis Asclepiadearum et Apocynearum adumbrationes (Flora 40, 1857, 103–106). –Enum.; descr.

Markgraf, F., Die Gliederung der Asiatischen Tabernaemontanoideen (Notizbl. Berl.-Dahlem 12, 1935, 540–552).–Segregation of some genera; distinction of *Rejoua*, *Pagiantha*, *Oistanthera*, *Ervatamia* (with sections), *Eucorymbia*, and *Voacanga*; key to the genera; enum. *spp.*; descr. new gen. & *spp.*

—, Neue Diagnosen (Mitt. Bot. Staatssamml. München 1, 1950, 26–31).–New comb. & *spp.*

Merrill & Quisumbing, Philip. J. Sc. 82 (1953) 334.–3 new *Alyxias.*

Miquel, F. A. W., Nova genera Apocynearum indicarum (Versl. Kon. Akad. Wet. A'dam 6, 1857, 191–194).–Descr. new genera.

—, in Siebold & de Vriese, Flor. Jard. 2 (1859) 142–144.–Same as above.

—, Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 137–141, t. 5.–Descr.; some new *spp.*

Monachino, J., A resumé of the American Cariseae (Lloydia 9, 1946, 293–309).–Key to the genera.

Pichon, M., Classification des Apocynacées I. Carissées et Ambélaniées (Mém. Mus. Hist. Nat. Paris n.s. 24, 1948, 111–181, t. 1–4).–Keys to tribes, genera & sections.

—, *ditto* V. Cerbéroidées (Not. Syst. 13, 1948, 212–229, t. 1–2).–Treated as a new subfamily; key to genera; generic descr. & syn.

—, *ditto* IX. Rauvolfiées. Alstoniées, Allamandées, et Tabernaemontanoidées (Mém. Mus. Hist. Nat. Paris n.s. 27, 1948, 153–251, t. 10–20). –Keys to tribes and genera.

—, *ditto* XVI. Clef des genres d'Ecdysanthérées (Bull. Mus. Hist. Nat. Paris II, 20, 1948, 296–303). –Key; *Parameriopsis n.g.*

—, *ditto* XIX. Le rétinacle des Echitoidées (Bull. Soc. Bot. Fr. 95, 1948, 211–216, fig. 1).–Structure of stamens.

—, *ditto* XXV. Echitoidées (Mém. Mus. Hist. Nat. Paris. n.s. B. Bot. 1, 1950, 1–143, t. 1–10). –Keys to genera, generic descr. & syn.; sometimes keys to *spp.*

—, *ditto* XXVI. Détermination des échantillons fleuris des Plumérioidées (Bull. Mus. Hist. Nat. Paris II, 21, 1949, 140–146).–Key to groups and genera by aid of floral characters.

—, *ditto* XXVII. Détermination des graines des Plumérioidées et des Cerbéroidées (Bull. Mus. Hist. Nat. Paris II, 21, 1949, 226–269).–Keys based on seed characters.

—, *ditto* XXVIII. Supplément aux Plumérioidées (Mém. Mus. Hist. Nat. Paris. n.s. Bot. 1, 1950, 145–172, t. 11).

—, *ditto* XXXIII. Les sous-tribus des Carissées (Not. Syst. 14, 1952, 310–315).–Key to subtribes.

—, *ditto* XXXV. Monographie des Landolphiées (Mém. Inst. Fr. Afr. Noire *no* 35, 1953, 1–437). –None native in Malaysia.

—, Les glandes nodales des Apocynacées et leurs modifications (Bull. Mus. Hist. Nat. Paris II, 21, 1949, 467–473).

Woodson, R. E., Observations on the inflorescence of Apocynaceae (Ann. Missouri Bot. Gard. 22, 1935, 1–48).–Special reference to Amer. genera of *Echitoideae.*

—, The American genera of Echitoideae (*ibid.* 22, 1935, 153–306).–Keys!

Local

Siam: Kerr, Kew Bull. (1937) 40–44, 87–94.–Descr. new *spp.*

China & Malaysia: Tsiang, Notes on Asiatic Apocynales I (Sinensia 3, 1932, 157–160).–Various notes, with occasional mention of Malaysian specimens!

—, *ditto* II (Sunyatsenia 2, 1934, 89–174).–*Ditto.*

—, *ditto* III (*ibid.* 3, 1936, 121–160).–*Ditto.*

—, *ditto* IV (*ibid.* 4, 1939, 31–54).–*Ditto.*

—, *ditto* V (*ibid.* 6, 1941, 109–120).–*Ditto.*

Sumatra: Lütjeharms & van Ooststroom, Blumea 3 (1938) 102–105.–2 new *spp.* of *Tabernaemontana* (= *Ervatamia*).

Merrill, Contr. Arn. Arb. 8 (1934) 139–144.–Critical notes; new *sp.*

—, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 188–189.–New *Chilocarpus* & *Urceola.*

Moore, J. Bot. (1923) Suppl. 31–34.–Descr. *Clitandropsis n.g.*; new *spp.* coll. Forbes.

Ridley, Kew Bull. (1925) 84–85.–New *Lyonsia.*

—, *ibid.* (1926) 73–74.–List and new *Chilocarpus.*

Malay Peninsula: Henderson, Gard. Bull. Str. Settl. 5 (1930) 78–79.–New *Kopsia.*

—, *ibid.* 7 (1933) 108–109.–New *Urceola.*

Java: Bakhuizen van den Brink Jr, in Backer, Bekn. Flora Java (em. ed.) 7 (1948) fam. 172, 1–50.

—, Blumea 6 (1950) 384–393.–Critical notes; some new *spp.*, one new genus.

Borneo: Hallier *f.*, Bot. Jahrb. 49 (1913) 371–375. –List of critical notes.

Markgraf, Mitt. Bot. Staatssamml. München 1 (1950) 26–30.–New *spp.*

Merrill, J. Str. Br. R. As. Soc. *no* 77 (1917) 237–238.–New *Alyxia.*

—, Philip. J. Sc. 21 (1922) 531–532.–New *Tabernaemontana.*

—, J. Mal. Br. R. As. Soc. 1 (1923) 27–29.–New *Epigynum*; notes and new *sp.* of *Willughbeia.*

—, Philip. J. Sc. 29 (1926) 411–413.–List; new *Kopsia.*

Ridley, Kew Bull. (1934) 123–124.–Records; 2 new *spp.*

Schwartz, Mitt. Inst. Allg. Bot. Hamb. 7 (1931) 258.–New *Alyxia.*

Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 407–409.–Descr. *Neokeithia n.g.*; distr. *Eucorymbia*; record of *Spirolobium.*

Philippines: Elmer, Leafl. Philip. Bot. 4 (1912) 1445–1467.–Descr. new *spp.*

—, *ibid.* 10 (1939) 3692–3699.–Descr. new *spp.*

Merrill, Philip. J. Sc. 7 (1912) Bot. 242–243.–New *Tabernaemontana.*

—, *ibid.* 13 (1919) 52–55.–Some new *spp.*

—, *ibid.* 27 (1925) 50–53.–Some new *spp.*

—, *ibid.* 29 (1926) 483–484.–2 new *spp.*

—, *ibid.* 30 (1926) 423–424.–New *Kibatalia.*

—, & Quisumbing, *ibid.* 82 (1953) 334–336, t. 4–5.–3 new *Alyxias.*

Quisumbing & Merrill, Philip. J. Sc. 37 (1928) 191–195.–4 new *spp.*

New Guinea: Kanehira & Hatusima, Bot. Mag. Tokyo 55 (1941) 489–504.–List; many new *spp.* specially in *Alyxia* and *Parsonsia.*

Markgraf, Bot. Jahrb. 61 (1927) 164–222, t. 10.–Revision; keys!

—, Nova Guinea 14 (1927) 278–291, t. 31–32.–List; many new *spp.*; 3 new genera *Discalyxia*, *Lamechites*, and *Papuechites.*

—, Notizbl. Berl.-Dahlem 10 (1930) 282.–Record of an *Excavatia.*

—, Brittonia 2 (1936) 139–140.–New *Parsonsia* and *Clitandropsis.*

—, Notizbl. Berl.-Dahlem 15 (1940) 130–131.–New *Alyxia* & *Clitandropsis.*

—, J. Arn. Arb. 21 (1940) 199–200.–New *Excavatia.*

Merrill & Perry, J. Arn. Arb. 24 (1943) 210–217.—List records; some new *spp.*; reinstatement of *Bleekeria*, a segregate of *Ochrosia.*

—, *ibid.* 29 (1948) 163–164.–Some records & a new *sp.*

Schlechter, Die Guttapercha- und Kautschuk-Exp., *etc.* (1911) 13, 126, 127.–Some new *spp.*

Genera

Aganosma: Tsiang, Sunyatsenia 4 (1939) 31–42.–Critical list of *spp.*

Allamanda: Holttum, M. A. H. A. Mag. 11 (1941) 54–58, fig. 1.–Key to 3 *spp.* cult. in Malaya.

Alstonia (*Amblyocalyx*): Monachino, Pac. Sc. 3 (1949) 133–182.–Complete revision with keys to *spp.*; complete for Mal.

Pichon, Bull. Mus. Hist. Nat. Paris II, 19 (1947) 294–298.–Subdivision; no key to *spp.*; *Blaberopus* treated as a separate genus (*cf. l. c.* p. 300–301).

Carissa: Haines, Ind. For. 45 (1919) 375–388, t. 17–20.–Revision Indian *spp.*; key.

—, *ibid.* 47 (1921) 377–379.–Some addit. notes.

Cerbera: Blake, Proc. R. Soc. Queensl. 59 (1948) 161–162.–New *sp.* closely allied to *C. floribunda.*

Corner, Wayside Trees Malaya (1940) 143–144.

Valeton, Ann. Jard. Bot. Btzg 12 (1895) 238–248, t. 26–27.

Chonemorpha: Chatterjee, Kew Bull. (1947) 47–52; *ibid* (1948) 68.–Revision; key; 1 new *sp.*

Furtado, Gard. Bull. Str. Settl. 9 (1935) 113-117.–Revision; key!

Seshagiri, J. Ind. Bot. Soc. 32 (1953) 34–45, 4 fig.–Revision; new *sp.*; key.

Corymbia: Pichon, Bull. Mus. Hist. Nat. Paris II 21 (1949) 270–271, fig. 1.–Belongs to the *Echitoideae* of trib. *Ichnocarpeae*, allied to *Epigynum.*

Dyera: Hooker *f.*, J. Linn. Soc. Bot. 19 (1882) 291–293.–Type descr.; 2 *spp.*

Monachino, Lloydia 9 (1946) 174–202.–Revision; 2 *spp.*; key!

Pichon, Bull. Mus. Hist. Nat. Paris II, 21 (1949) 600–602.–Descr. fruit structure.

Symington, Mal. Forester 4 (1935) 82–85, 1 pl. –*D. costulata.*

Ervatamia (segr. of *Tabernaemontana sens. lat.*): Hallier *f.*, Bot. Jahrb. 49 (1913) 372–375.–Critical remarks on generic segregation of the genus.

Markgraf, Nova Guinea 14 (1927) 278–281.

—, Notizbl. Berl.-Dahlem 12 (1935) 547–548. –Sect. & *spp.* enum.

Merrill, Contr. Arn. Arb. 8 (1934) 139–144.–Author expresses doubt about the generic distinction from *Tabernaemontana*!

Holarrhena: Chevalier, Rev. Int. Bot. Appl. & Agr. Col. 29 (1948) 115–120.

Hunteria: Pichon, Bol. Soc. Brot. II, 27 (1953) 88–112, 149–150.–Revision; key!

Hymenolophus: Tsiang, Sunyatsenia 4 (1939) 28–29.–Monotypic; Sumatra.

Kentochrosia: Merrill & Perry, Philip. J. Sc. 76 (1941) 19–21.–Discussion of the genus; no descr.; enum. of material present in Arn. Arb. Herb.

Kibatalia (*Kickxia*, *Vallaris auct.*, *Paravallaris*): Pichon, Mém. Mus. Hist. Nat. Paris n.s. 1 (1950) 70–73.–Key to *spp.*

Woodson, Philip. J. Sc. 60 (1936) 209–227, t. 1. –Revision; key!

Lepinia: Hosokawa, Tokyo Bot. Mag. 48 (1934) 528–530, 1 fig.–Revision; key!

Lepiniopsis: Valeton, Ann. Jard. Bot. Btzg 12 (1895) 249–253, t. 28.–Monotypic.

Mixantum: Pichon, Bull. Mus. Hist. Nat. Paris II, 20 (1948) 382.–Monotypic, *aff. Beaumontia*; from Puket.

Neokeithia: Pichon, Bull. Mus. Hist. Nat. Paris II, 21 (1949) 375–377.–Descr. seed structure.

Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 407–408.–Type descr.; Borneo.

Neuburgia = *Crateriphytum* = Couthovia (*Loganiaceae*).

Ochrosia: Merrill & Perry, J. Arn. Arb. 24 (1943) 213–214.–Raising *Bleekeria*, a subgenus of *Ochrosia*, to generic rank.

Pichon, Bull. Mus. Hist. Nat. Paris II, 19 (1947) 205–212.–Sections & series; keys to *spp.* studied.

Valeton, Ann. Jard. Bot. Btzg 12 (1895) 233–237, t. 22–25.–Revision; no key.

Parameria: Moldenke, Revista Sudamer. Bot. 6 (1940) 176–178.–*P. barbata* should be named *P. laevigata* (Juss.) Mold.

Parsonsia (*Helygia*, *Lyonsia*): Blake, Proc. R. Soc. Queensl. 59 (1948) 164–167.–Nomencl. ot. Austral. *spp.*

Merrill, Brittonia 1 (1933) 233–237.–Nomencl.

Pichon, Not. Syst. 14 (1950) 4–21.–Partly with keys.

lumeria: Van Steenis, Trop. Natuur 26 (1937) 63–66.–Key Mal. *spp.*

Woodson, Ann. Missouri Bot. Gard. 25 (1938) 202–224.–Revision; key!

Rauwolfia (*Huntera*); Hallier *f.*, Meded. Rijksherb. Leiden 1 (1910) 26.–*Huntera* reduced.

Pichon, Bull. Soc. Bot. Fr. 94 (1947) 31–39.–14 sections; descr.; syn. of listed species.

Rendle, Proc. Linn. Soc. Lond. 149th session, pt 3 (1937) 106–109, 1 fig.–Identity Linnean *spp.*; syn.

Valeton, Ic. Bog. 4 (1913) 207–210, t. 367.–Critical notes on *R. densiflora* Bth.

trophanthus: Franchet, Nouv. Ann. Mus. Hist. Nat. Paris IV, 5 (1893) 221–294, t. 7–17.

Monachino, Phytologia 3 (1951) 366–373, pl. 1–3.–New sect.

Pax, Bot. Jahrb. 15 (1893) 362–386, t. 10–11.–Revision; key!

Staner & Michotte, Bull. Jard. Bot. Brux. 13 (1934) 23–56.–African *spp.*

Toxopeus, Meded. Alg. Proefst. Landb. Btzg *no* 74 (1948) 1–22.–Biology of fruit setting in *S. gratus*.

Wit, Landbouw 17 (1941) 98–105.–*Ditto.*

abernaemontana: Hallier *f.*, Bot. Jahrb. 49 (1913) 372–375.–Critical remarks on generic segregation of the genus.

Markgraf, Nova Guinea 14 (1927) 278–281.

—, Notizbl. Berl. Dahlem 12 (1935) 550.

Merrill, Contr. Arn. Arb. 8 (1934) 139–144.–Author expresses doubt about the generic distinction of *Ervatamia*.

Pichon, Not. Syst. 13 (1948) 230–254.–Genus subdivided into 8 subgen., each with mostly several sect.

ievetia: Pichon, Bull. Mus. Hist. Nat. Paris II, 22 (1950) 291–294.–Descr. fruit structure.

achelospermum: Pichon, Bull. Mus. Hist. Nat. Paris II, 20 (1948) 190–192.–Subdiv.; no key.

Tsiang, Sunyatsenia 4 (1939) 29–30.–New *sp.* rom Java.

Woodson, Sunyatsenia 3 (1936) 65–105.–Reision Asiat. *spp.*; key.

ariopsis: Woodson, Philip. J. Sc. 60 (1938) 28–229.–Monotypic; Mal. Pen.

ca: Pichon, Bull. Mus. Nat. Hist. Nat. Paris I, 23 (1951) 439–444.–Revision; key.

acanga (*Orchipeda*, *Pootia*): Miquel, Ann. Mus. ot. Lugd.-Bat. 1 (1864) 316–317.

ichon, Bull. Mus. Hist. Nat. Paris II, 19 (1947) 09–416.–Key to African *spp.*

olfe, J. Bot. 21 (1883) 201–202.–Nomencl. *pp.*

ightia: Pichon, Not. Syst. 14 (1951) 77–87.–With keys to *spp.*

Tsiang, Sunyatsenia 4 (1939) 42–54.–Critical ist of *spp.*

APONOGETONACEAE

Local

Asia: Camus, Not. Syst. 2 (1912) 202–204.–Key to Asiat. *spp.*

New Guinea: Martelli, Nuovo Giorn. Bot. Ital. II, 3 (1897) 472–473, t. 8.–Descr.

Van Steenis, J. Arn. Arb. 28 (1947) 419.

Genera

Aponogeton: Camus, Bull. Soc. Bot. Fr. 70 (1923) 670–676.–Revision; key!

Engler, Bot. Jahrb. 8 (1887) 261–274, f. A, t. 6.–Revision; key!

Krause, Pflanzenreich Heft 24 (1906) 1–24, fig. 1–9.

Van Steenis, Fl. Mal. I, 4 (1948) 11–12, fig. 1.

APOSTASIACEAE

Blume, C. L., Apostasieae (in Hoeven & De Vriese, Tijd. Nat. Geschied. & Phys. 1, 1834, 137–142).–Census; in Latin; no keys.

Pfitzer, E., Orchidaceae-Pleonandrae (Pflanzenreich Heft 12, 1903, 1–9).

Rolfe, R. A., A morphological and systematic review of the Apostasiaceae (J. Linn. Soc. Bot. 25, 1889, 211–243, t. 48).–Revision; *ssp.* enumerated.

Local

Indo-China: Gagnepain, Bull. Soc. Bot. Fr. 80 (1933) 348–353.–A new genus; some new *spp.*

Sumatra: Holttum, Orchids of Malaya (1953) 59–65.–Keys!

Smith, in Fedde, Rep. 32 (1933) 129–131.–List.

Malay Peninsula: Ridley, J. Linn. Soc. Bot. 32 (1896) 415–416.–List.

—, Mat. Fl. Mal. Pen. (Monoc.) 1 (1907) 231–233.–Keys.

Java: Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 240, p. 1–3.

Borneo: Smith, J. J., Mitt. Inst. Allg. Bot. Hamburg 7 (1927) 10–11.–New *sp.* and var. of *Apostasia.*

Celebes: Smith, J. J., Bot. Jahrb. 65 (1933) 449–450.–New *Apostasia.*

New Guinea: Ridley, J. Bot. 24 (1886) 355–356, t. 271–New *Neuwiedia.*

Smith, J. J., Nova Guinea 8 (1911) 522–523, t. 80.–New *Neuwiedia.*

Genera

Adactylus: Cretziou, J. Jap. Bot. 17 (1941) 407–408, map 2.–Two new comb.

Neuwiedia: Smith, J. J., Bull. Jard. Bot. Btzg II, *no* 4 (1914) 1–8.–Critical new descr. *spp.*; subdiv. genus.

Schoenomorphus = Tropidia (*Orchidaceae*).

AQUIFOLIACEAE

Loesener, Th., Vorstudien zu einer Monographie der Aquifoliaceen (Verh. Ver. Prov. Brandenburg 33, 1892, 1–45, fig. 1–12).–General morphol.; biol.; anat.; key to subdiv. of *Ilex.*

—, Monographia Aquifoliacearum (Nova Acta

Acad Caes. Leop.-Car. Nat. Cur. 78, 1901, viii + 570 pp.; *ibid* 89, 1908, 313 pp.).

—, Pflanzenfamilien ed. 2, 20b (1942) 36–86.

Local

Sumatra: Merrill, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 162–163.–3 new *spp.*

Borneo: Merrill, Sarawak Mus. J. 3 (1928) 526–527.–New *Ilex*.

—, J. Arn. Arb. 20 (1939) 222–224.–2 new *spp.* of *Ilex* with opposite leaves.

Ridley, Kew Bull. (1931) 34.–New *Ilex*.

—, *ibid.* (1939) 409–411 (*sphalm.* 509–511).–List; new *Ilex spp.*

Philippines: Elmer, Leafl. Philip. Bot. 5 (1913) 1663–1669.–List *Ilex*; 4 new *spp.*

Merrill, Philip. J. Sc. 26 (1925) 468–469.–New *Ilex*.

—, *ibid.* 27 (1925) 31.–New *Ilex*.

Celebes: Capitaine, Bull. Soc. Bot. Fr. 57 (1910) 234–236, t. 10.–New *Ilex*.

New Guinea: Loesener, Bot. Jahrb. 59 (1924) 80–83.–Key.

Merrill & Perry, J. Arn. Arb. 20 (1939) 333–334.–Descr. new *spp.*; records.

—, *ibid.* 22 (1941) 258–260.–*Ditto*.

—, *ibid.* 30 (1949) 40.–*Ditto*.

Genera

Ilex: Comber, Not. R. Bot. Gard. Edinb. 18 (1933) 37–62.–List Chin. & Himal. *spp.*; several new.

Hallier *f.*, Rec. Trav. Bot. Néerl. 15 (1918) 66. –Reduction *Octas*.

Hu, J. Arn. Arb. 30 (1949) 233–344, 348–387.–Revision of Chin. *spp.*

—, *ibid.* 31 (1950) 39–80, 214–263.–*Ditto*.

—, *ibid.* 34 (1953) 138–162.–*Spp.* from Formosa & Riu Kiu; key!

Loesener, Mitt. Deut. Dendr. Ges. 28 (1919) 1–66. –Subdiv. of *Aquifoliaceae*; key to genera; infrageneric key to *Ilex;* key to *spp.* cult. in Europe.

Maximowicz, Mém. Acad. Imp. St Pétersb. VII, 29^3 (1881) 14–53.–Annot. in *Ilex*.

Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 389–390.–Occurrence of stipules.

Sphenostemon (*Idenburgia*, *Nouhuysia*): Gibbs, Contr. Fl. Phytogr. Arfak Mts (1917) 136–140, fig. 10–11.–Descr. *Idenburgia*.

Lauterbach, Nova Guinea 8 (1912) 843–844.–Descr. *Nouhuysia*.

Van Steenis, Acta Bot. Neerl. 1 (1952) 94–98, fig. 2.–Reduction *Idenburgia*.

—, Svensk Bot. Tidskr. (*in the press*).–Reduction.

ARACEAE

Alderwerelt van Rosenburgh, C. R. W. K. van, New or noteworthy Malayan Araceae I (Bull. Jard. Bot. Btzg III, 1, 1918, 359–389); *ditto* II (*ibid.* 4, 1922, 163–229); *ditto* III (*ibid.* 4, 1922, 320–347).–Practical key to Mal. genera; addit. descr. of new *spp.*

Brown, N. E., On some new Aroideae; with observations on other known forms. Part 1 (J. Linn. Soc. Bot. 18, 1880, 242–263, t. 4–6).–Misc. notes and records.

Engler, A., in DC. Mon. Phan. 2 (1879) 1–681.

—, Neue Araceen vom Indischen Archipel (Bot. Jahrb. 1, 1881, 179–186).–Notes and descr.

—, Aracee della Malesia e della Papuasia raccolte da O. Beccari (Malesia 1, 1885, 259–304, t. 16–28).–Important treatments; descr. and some keys. In Latin.

—, Araceae novae Asiae tropicae et subtropicae (Bot. Jahrb. 25, 1898, 1–28).–List records & descr.

—, Beiträge zur Kenntniss der Araceae X (*ibid.* 37, 1906, 110–143).–*Ditto*.

—, Pothoideae (Pflanzenreich Heft 21, 1905, 1–330, fig. 1–88); additamentum (*ibid.* Heft 37, 1908, 2–3, 138–139).–*Acorus*, *Anadendron*, *Anthurium*, *Pothoideum*, *Pothos*.

—, Lasioideae (*ibid.* Heft 48, 1911, 1–130, fig. 1–44).–*Amorphophallus*, *Cyrtosperma*, *Lasia*, *Podolasia*.

—, Philodendroideae – Anubiadeae, Aglaonemateae, Dieffenbachieae, Zantedeschieae, Typhonodoreae, Peltandreae (*ibid.* Heft. 64, 1915 1–78, fig. 1–34).–*Aglaodorum*, *Aglaonema*, *Dieffenbachia*, *Zantedeschia*.

—, Aroideae – Pistioideae (*ibid.* Heft 73, 1920, 1–274, fig. 1–64).–*Arisaema*, *Arum*, *Pistia*, *Sauromatum*, *Typhonium*.

—, & K. Krause, Monsteroideae (*ibid.* Heft 37, 1908, 4–138, fig. 1–56).–*Amydrium*, *Epipremnum*, *Holochlamys*, *Monstera*, *Raphidophora*, *Scindapsus*, *Spathiphyllum*.

—, Philodendroideae – Philodendreae – Homalomeninae, Schismatoglottidinae (*ibid.* Heft 55, 1912, 1–134, fig. 1–77).–*Bucephalandra*, *Diandriella*, *Gamogyne*, *Homalomena*, *Microcasia*, *Piptospatha*, *Schismatoglottis*.

—, Colocasioideae (*ibid.* Heft 71, 1920, 1–139, fig. 1–29).–*Alocasia*, *Aridarum*, *Caladium*, *Colocasia*, *Remusatia*, *Schizocasia*, *Syngonium*, *Xanthosoma*.

—, Araceae, pars generalis et index familiae generalis (*ibid.* Heft 74, 1920, 1–71).–General considerations; system of the family.

Krause, K., Philodendroideae-Philodendreae-Philodendrinae (*ibid.* Heft 60, 1913, 1–143, fig. 1–45).–*Philodendron*.

Miquel, F. A. W., in de Vriese, Pl. Ind. Bat. Or. (1856) 148–153.–List; descr. new *spp.*

—, Mantissa Aroidearum indicarum (Ann. Mus. Bot. Lugd.-Bat. 3, 1867, 79–82).

Schott, H. W., Synopsis Aroidearum, *etc.* (1856) 1–140.–Enum.; many descr.

—, Genera Aroidearum exposita. Vienna (1858) 1–101, t. 1–98.–Plates and descr. of genera; no key to these.

—, Aroideenskizzen (Bonplandia 7, 1859, 30–31, 164).–Descr. new *spp.* of *Homalomena* and *Chamaecladon*.

—, Prodromus systematis Aroidearum (1860) 1–602.–Monograph; no keys!

—, in Miquel, Ann. Mus. Bot. Lugd.-Bat. 1 (1863–64) 122–131, 221, 278–286.–Records; list; new *spp.*

Local

Sumatra: Merrill, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 152.–New *Homalomena.*

—, J. Mal. Br. R. As. Soc. *no* 87 (1923) 104–106. –List; new *Pothos* and *Homalomenas.*

—, Kew Bull. (1925) 92–93.–List; 2 new *spp.*

—, *ibid.* (1926) 92–93.–New *Pothos.*

De Vriese, in Miquel, Pl. Jungh. (1852) 99–106.–List; several new *Pothos.*

Malay Peninsula: Furtado, Gard. Bull. Str. Settl. 8 (1935) 145–158.–New descr. and reductions in *Cryptocoryne, Pothos, Rhaphidophora, Scindapsus.*

—, M. A. H. A. Mag. 10 (1941) 11–17.–Key to edible aroids.

Ridley, Mat. Fl. Mal. Pen. (Monocot.) pt 3 (1908) 1–52.–Keys.

Java: Backer, Trop. Natuur 9 (1920) 1–4, 19–32. –Key to Jav. *Amorphophallus.*

Koorders, Bull. Jard. Bot. Btzg III, 1 (1919) 159–161.–Note on *Cyrtosperma merkusii.*

—, *ibid.* III, 1 (1919) 162–167, t. 5–7.–Descr. new *Alocasia.*

Miquel, Berl. Bot. Zeit. 14 (1856) 561–565.–Descr.

Van Steenis, Bull. Jard. Bot. Btzg III, 17 (1948) 403.–New comb. in *Typhonium.*

—, *ibid.* III, 17 (1948) 447–456.–Key to Jav. *Arisaema.*

—, *c.s.*, Blumea 6 (1950) 359.–New comb. in *Homalomena.*

Borneo: Brown, J. Bot. 20 (1882) 195–196.–Descr. *Gamogyne.*

Engler, Bull. Soc. Tosc. Ort. (1879) 265–271; 295–302.–Misc. descr. coll. Beccari.

— & Krause, Bot. Jahrb. 48 (1912) 93–95.–List; some new *Homalomenas* and *Schismatoglottis.*

Furtado, Gard. Bull. Str. Settl. 8 (1935) 145–158.–New *spp.* and critical remarks in *Pothos, Rhaphidophora, Schismatoglottis,* and *Scindapsus.*

Merrill, J. Str. Br. R. As. Soc. *no* 85 (1922) 159–160.–New *Schismatoglottis.*

—, Philip. J. Sc. 29 (1926) 353–354.–List; new *Scindapsus.*

Ridley, J. Str. Br. R. As. Soc. *no* 44 (1905) 169–188.–List; many new *spp.*

—, J. Bot. 51 (1913) 201–202, t. 527.–*Aridarum n.g.*; critical remarks on *Piptospatha* and *Gamogyne.*

De Wit, Webbia 9 (1954) 455–458, fig.1.–Descr. neotype *Cryptocoryne longicauda* Becc. & Engl.

Celebes: Bok & Lam, Blumea 2 (1936) 33, 1 fig.–New *Amorphophallus.*

Krause, Notizbl. Berl.-Dahlem 11 (1932) 331–332.–New *Rhaphidophora.*

Philippines: Elmer, Leafl. Philip. Bot. 10 (1938) 3611–3635; *ibid.* 10 (1939) 3699–3704.–New *spp.*

Krause, Bot. Jahrb. 44 (1910) Beibl. 101, p. 11–12.–Some new *Rhaphidophora.*

—, *ibid.* 45 (1911) 657–660.–Descr. new *spp.*

—, Notizbl. Berl.-Dahlem 5 (1912) 266–267.–Descr. 2 new *spp.*

—, in Elmer, Leafl. Philip. Bot. 6 (1914) 2284–2285.–Descr. 2 new *Rhaphidophoras.*

Merrill, Philip. J. Sc. 21 (1922) 516.–New *Pothos.*

—, *ibid.* 26 (1925) 451–452.–New *Rhaphidophora & Aglaonema.*

Quisumbing & Merrill, Philip. J. Sc. 37 (1928) 136.–New *Schismatoglottis.*

Schott, Bonplandia 10 (1862) 148.–Descr. *Alocasia.*

New Guinea: Engler, Bull. Soc. Tosc. Ort. (1879) 265–271, 295–302.–Misc. descr. coll. Beccari.

—& Krause, Nova Guinea 8 (1910) 247–252.

—, *ibid.* 8 (1912) 805–809, t. 147–148.

—, Bot. Jahrb. 49 (1912) 90–99.

—, *ibid.* 54 (1916) 74–91.–New *spp.*; no keys.

Krause, Bot. Jahrb. 45 (1911) Beibl. 104, p. 84. –New *Epipremnum.*

—& Van Alderwerelt van Rosenburgh, Nova Guinea 14 (1924) 210–220.–List; new *spp.*

Genera

Alocasia: Furtado, Gard. Bull. Str. Settl. 11 (1941) 244–257.–*A. macrorrhiza* and its varieties.

Amorphophallus: Blume *ex* Decaisne, Nouv. Ann. Mus. Paris 3 (1834) 366.[1]

Winkler, Ber. Deut. Bot. Ges. 49 (1931) 91–101, t. 6–11.–Details on *A. titanum.*

Arisaema: Buchet, Not. Syst. 1 (1911) 366–375.–New *spp.*

Colocasia: Hill, Bot. Mus. Leafl. Harv. 7 (1939) 113–118.–Nomencl. *C. esculenta*; varieties.

Cryptocoryne: Engler, in Beccari, Malesia 1 (1883) 296–300.–Key!

Petch, Ann. R. Bot. Gard. Peradeniya 11 (1928) 11–26, t. 2–5.–Notes on some Ceylon *spp.*

Epipremnum: Engler, in Beccari, Malesia 1 (1885) 272–275.–Key!

Homalomena: Furtado, Gard. Bull. Str. Settl. 10 (1939) 183–238.–Synopsis Indo-Mal. *spp.*; no key.

Piptospatha (*Gamogyne*): Engler, Pflanzenreich Heft 71 (1920) 2.–Reduction.

Rhaphidophora: Engler, in Beccari, Malesia 1 (1885) 266–272.–Key!

Schismatoglottis: Engler, in Beccari, Malesia 1 (1885) 284–288.–Key!

Scindapsus: Engler, in Beccari, Malesia 1 (1885) 275–278.–Key!

ARALIACEAE

Miquel, F. A. W., in de Vriese, Pl. Ind. Bat. Or. (1856) 81–92.

—, Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 1–27,

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(1) The first legitimate description of *Amorphophallus* has been referred bij Blume to 'Bat. Courant 1825', and this source has always been copied. However, the instalment of this Government issue of Nov. 23rd, 1825, contained only a short, clear description in Dutch of an aroid which Blume claims to represent a new genus and which he expects to describe and name in a future paper. As far as we can trace the name *Amorphophallus* was first mentioned in 1834.

219–220.–Descr. new gen. & *spp.*; list; no keys!

SEEMANN, B., Revision of the natural order Hederaceae (J. Bot. 2, 1864, 235–250, 289–309; *ibid.* 3, 1865, 73–81, t. 27, 173–181, 265–276, 361–363, t. 41; *ibid.* 4, 1866, 293–299, 352–353; *ibid.* 5, 1867, 236–239, 285–286; *ibid.* 6, 1868, 52–58, 129–142, 161–165).

—, A revised reprint of the same work (1868) 107 pp.

VIGUIER, R., Sur les Araliacées du groupe de Polyscias (Bull. Soc. Bot. Fr. 52, 1905, 285–314).

—, Recherches anatomiques sur la classification des Araliacées (Ann. Sc. Nat. Bot. IX, 4, 1906, 1–210).–New system of the family; see critics by HARMS, Bot. Jahrb. 40 (1907) Lit.-Ber. 22–27.

—, Nouvelles recherches sur les Araliacées (*ibid.* IX, 9, 1909, 305–405).

Local

North America: SMITH, A. C., Brittonia 2 (1936) 247–261.–List.

China: LI, Sargentia 2 (1942) 1–134, fig. 1–14.–Survey of Chin. *Aral.*; keys.
—, Proc. Acad. Nat. Sc. Philad. 96 (1944) 249–277, map.–Phytogeogr. div. of China based on distr. of *Aral.*

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 116–121.–New *Trevesia* and *Scheffleras.*
—, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 177–179.–3 new *Scheffleras.*
—, *ibid.* 23, 1937 (1938) 186–187.–New *Schefflera.*
RIDLEY, J. Mal. Br. R. As. Soc. *no* 87 (1923) 64.–List; new *Aralia.*
DE VRIESE, Ned. Kruidk. Arch. 1 (1846) 15–19.–Some descr. of *Aralia* and *Arthrophyllum.*

Malay Peninsula: HENDERSON, Gard. Bull. Str. Settl. 7 (1933) 105–106, t. 22–23.–New *Schefflera* and *Acanthopanax.*
RIDLEY, Kew Bull. (1929) 124.–Second *sp.* of *Hederopsis.*

Java: BAKHUIZEN VAN DEN BRINK & VAN OOSTSTROOM, in BACKER, Bekn. Fl. Java (em. ed.) afl. 7 (1948) fam. 159, p. 1–19.–In Dutch; keys.
KOORDERS, Bull. Jard. Bot. Btzg III, 1 (1919) 181–186, t. 16–17.–New *Pentapanax.*
MIQUEL, Plant. Jungh. (1855) 420–426.–Many new *spp.* and new gen.

Borneo: MERRILL, Philip. J. Sc. 13 (1918) Bot. 99–103.–4 new *Scheffleras.*
—, J. Str. Br. R. As. Soc. *no* 79 (1919) 27–31.–New *spp.* of *Schefflera*; no key.
—, Sarawak Mus. J. 3 (1928) 537–538.–Two new *Scheffleras.*
PHILIPSON, J. Bot. 78 (1940) 116–119.–List CLEMENS records; new *sp.* in *Polyscias* and *Gilibertia.*

Philippines: ELMER, Leafl. Philip. Bot. 6 (1914) 2325–2341.–New *spp.* Mindanao.
—, *ibid.* 10 (1938) 3637–3648, 3704–3705.–New *spp.* of *Schefflera*; no key.
MERRILL, Philip. J. Sc. 10 (1915) Bot. 195–205.–New *Scheffleras.*
—, *ibid.* 26 (1925) 483–484.–New *Schefflera.*

Celebes: HARMS, Ann. Jard. Bot. Btzg 19 (1904) 12, 17–18.—New *Tetraplasandra*, 2 *Scheffleras.*
—, in FEDDE, Rep. 3 (1907) 23–24.–New *Schefflera.*

New Guinea: HARMS, Nova Guinea 8 (1910) 271–277, t. 62–64.
—, Bot. Jahrb. 56 (1920) 374–414, f. 1–4.–Revision; keys!
—, *ibid.* 69 (1938) 277–283.–Descr.
—, J. Arn. Arb. 20 (1939) 321–323.
—, Bot. Jahrb. 72 (1942) 205–207.–3 new *Scheffleras.*
PHILIPSON, Bull. Br. Mus. Nat. Hist. Bot. 1 (1951) 9–18.–New *spp.* from New Guinea & Solomons.
RIDLEY, J. Bot. 52 (1914) 290–291.–2 new *Scheffleras.*

Solomon Islands: HARMS, Notizbl. Berl.-Dahlem 15 (1942) 677–680.–List coll. WATERHOUSE; 3 new *spp.*

Genera

Acanthopanax: HARMS, Mitt. Deut. Dendr. Ges. 27 (1918) 1–39, t. 1–8b.–Keys.

Acanthophora: VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 390–391.–Distr.

Aralia: HARMS, Bot. Jahrb. 23 (1896) 1–20.–Revision; list; no key.
VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 391–395, fig. 1.–Critical notes.

Boerlagiodendron (*Eschweileria, Osmoxylon*): BECCARI, Malesia 1 (1878) 193–198.–Census.
BOERLAGE, Ned. Kruidk. Arch. 4 (1886) 1–15.–Remarks.
—, Ann. Jard. Bot. Btzg 6 (1887) 112–125, t. 13–16.–Key!
HARMS, Bot. Jahrb. 56 (1921) 377–384.–Nearly a revision; key.

Dendropanax (*Gilibertia* R. & P. *non al.*): MERRILL, Brittonia 4 (1941) 129–134.–List of Old World *spp.*
PHILIPSON, Bull. Br. Mus. Nat. Hist. Bot. 1 (1951) 18–19.–Critical remarks.
SMITH, A. C., Trop. Woods *no* 66 (1941) 1–3.–*Dendropanax* should be conserved; new comb.

Harmsiopanax (*Horsfieldia non* WILLD., BL.): HARMS, Bot. Jahrb. 56 (1920) 413.

Macklinlaya (*incl. Anomopanax*): HARMS, Ann. Jard. Bot. Btzg 19 (1904) 13–16.–Enum.
PHILIPSON, Bull. Br. Mus. Nat. Hist. Bot. 1 (1951) 3–9.–Revision; key!

Nothopanax: MERRILL, Philip. J. Sc. 7 (1912) Bot. 241–243.–List.
SPRAGUE & GREEN, Kew Bull. (1933) 154–155.–Nomencl.

Panax: HARMS, Bot. Jahrb. 23 (1896) 1–23.–Delimitation against *Aralia.*

Peekeliopanax: HARMS, Notizbl. Berl.-Dahlem 9 (1929) 478–484.–*Spp.* from New Britain.

Pentapanax: HARMS, Bot. Jahrb. 23 (1896) 20–22.–Some critical remarks.
KOORDERS, Bull. Jard. Bot. Btzg III, 1 (1919) 181–186, t. 16–17.–New *sp.* from Java.

Schefflera (*Sciodaphyllum*): Smith, A. C., Trop. Woods *no* 66 (1941) 3–6.–Nomencl.

Tetraplasandra: Harms, Ann. Jard. Bot. Btzg 19 (1904) 12.–New *sp.* from Celebes.

Sherff, in Sherff, Bot. Leafl. *no* 6 (1952) 19–41.–Descr. Pac. *spp.*

—, *ibid. no* 8 (1953) 1–13.–Further notes.

Trevesia: Boerlage, Ned. Kruidk. Arch. 4 (1886) 1–15.–Remarks; new *sp.*

—, Ann. Jard. Bot. Btzg 6 (1887) 106–112, t. 11–12.–Key!

ARAUCARIACEAE

See Coniferae

ARISTOLOCHIACEAE

Schmidt, O. C., Pflanzenfamilien ed. 2, 16b (1935) 204–242, fig. 103–123.

Local

Sumatra: Merrill, Pap. Mich. Acad. Sc. Arts & Lett. 23, 1937 (1938) 178.–New *Apama.*

Java: Backer, Trop. Natuur 7 (1918) 177–183; *ibid.* 8 (1919) 133–138, 150–155, 161–168.–Key to wild & cult. *spp.* in last ref.

—, Bull. Jard. Bot. Btzg III, 2 (1920) 320–322.–2 new *Aristolochias.*

Philippines: Merrill, Philip. J. Sc. 29 (1926) 478.–New *Aristolochia.*

Quisumbing, Philip. J. Sc. 41 (1930) 322–323.–New *Thottea.*

Warburg, in Perkins, Fragm. Fl. Philip. (1905) 169–170.–2 new *Aristolochias.*

New Guinea: Lauterbach, Bot. Jahrb. 52 (1914) 104–107.–Key.

Merrill & Perry, J. Arn. Arb. 23 (1942) 383–384.–Descr.

—, *ibid.* 29 (1948) 152–154.–Descr.

Schmidt, Bot. Jahrb. 58 (1923) 488–491.–New *spp.*

—, in Fedde, Rep. 23 (1927) 298–299.–New comb. & record.

Genera

Apama (*Bragantia*): Valeton, Ic. Bog. 3 (1908) 153–154, t. 160.–New *sp.* from Sumatra.

Aristolochia: Masters, J. Linn. Soc. Bot. 14 (1875) 387–495.

Schmidt, in Fedde, Rep. 30 (1932) 72–75.–Austral. *spp.*; key!

Thottea: Beccari, Nuovo Giorn. Bot. Ital. 2 (1870) 5–8, t. 1.–2 new *sp.* from Borneo.

Van Steenis, Bull. Jard. Bot. Btzg III, 12 (1932) 204–207.–New *sp.* from Natuna Isl.

Valeton, Ic. Bog. 3 (1908) 155–156, t. 161.–New *sp.* from Borneo.

ASCLEPIADACEAE

Blume, C. L., Mus. Bot. Lugd.-Bat. 1 (1849) 43–46, 57–60, 125–126; *ibid.* (1850) 146–150.–Descr.

Good, R., An atlas of the Asclepiadaceae (New Phytol. 51, 1952, 198–209, maps 1–17).–Distr. of tribes and some genera.

Lückhoff, C. A., The Stapelieae of South Africa (1952) 283 pp., t. 1–5, photographs.

Schlechter, R., Beiträge zur Kenntnis der Asclepiadaceen des Monsun-Gebietes (Bot. Jahrb. 40, 1908, Beibl. 92, 1–19).–Misc. new *spp.*; *Oistonema, Anatropanthus n.g.*

—, Beih. Bot. Centralbl. 34 Abt. 2 (1917) 1–18.–Misc. new gen. & *spp.*

— & Warburg, O., Asclepiadaceae novae Asiae australis et orientalis (in Fedde, Rep. 3, 1907, 305–315, 339–347).–New *spp.*

White, A. & B. L. Sloane, *c.s.*, The Stapelieae. 2nd ed. Pasadena, Cal. (1937) 3 vols, 1233 fig., 39 col. pl.–Revision; keys.

Local

North America: Woodson, Ann. Missouri Bot. Gard. 28 (1941) 193–244.—Keys to genera & sections.

Asia: Tsiang, Sunyatsenia 2 (1934) 174–202; *ibid.* 3 (1936) 160–240; *ibid.* 4 (1939) 54–94; *ibid.* 6 (1941) 169.–Various notes.

India: Wight, Contr. Bot. India (1834) 29–67.–Revision; partial keys.

Siam: Kerr, Kew Bull. (1938) 445–454.–Descr. new *spp.*

—, *ibid.* (1939) 456–465.–*Ditto.*

—, Fl. Siam. En. 3 (1951) 1–51.–List.

Sumatra: Ridley, J. Fed. Mal. Stat. Mus. 8, 4 (1917) 62–63.–New *Hoya*, *Dischidia*, and *Hoyella n.g.*

—, J. Mal. Br. R. As. Soc. *no* 87 (1923) 77–78.–New *Hoya* and *Dischidia.*

—, Kew Bull. (1925) 85–86.–New *Hoya.*

—, *ibid.* (1926) 74.–List; new *Hoya.*

Malay Peninsula: Henderson, Gard. Bull. Str. Settl. 7 (1933) 109–113, t. 26–27.–New *Tylophora* and 2 *Toxocarpus.*

Java: Backer, Ic. Bog. 3 (1908) 157–159, t. 262.–Critical notes on *Hoya densifolia.*

Bakhuizen van den Brink, in Backer, Bekn. Fl. Java (em. ed.) 8 (1949) 1–65.–In Dutch; keys!

—, Blumea 6 (1950) 368–382.–Critical notes; new *spp.* in *Cynanchum*, *Toxocarpus*, *Tylophora*, *Dischidia*, *Hoya*, and *Heynella n.g.*

Borneo: Merrill, Philip. J. Sc. 13 (1918) Bot. 120–121.–New *Ceropegia.*

Schwarz, Mitt. Inst. Allg. Bot. Hamburg 7 (1931) 259–262.–List; new *spp.* in *Hoya* and *Dischidia.*

Philippines: Elmer, Leafl. Philip. Bot. 10 (1938) 3543–3599.–List; descr.; no keys.

Koorders, Philip. J. Sc. 15 (1919) 263–265.–Some remarks on a *Hoya.*

Merrill, Philip. J. Sc. 7 (1912) Bot. 243.–New comb. in *Telosma* (*Pergularia*).

—, *ibid.* 27 (1925) 53–54.–New *Tylophora.*

—, *ibid.* 60 (1936) 33.–New gen. name.

Schlechter, Philip. J. Sc. 1 (1906) Suppl. 295–303, 453–472.

—, in Fedde, Rep. 13 (1915) 537–544; *ibid.* 554–566.

Celebes: Koorders, Bull. Jard. Bot. Btzg III, 2 (1920) 245–254, t. 4–6.–Critical note on *Hoya maxima.*

New Guinea: Markgraf, J. Arn. Arb. 10 (1929) 84.–1 *n. sp.* from Papua.

Norman, Brittonia 2 (1937) 328.–2 new *Hoyas.*

Ridley, J. Bot. 52 (1914) 293–294.–3 new *Hoyas.*

Schlechter, Bot. Jahrb. 50 (1913) 81–164.–Enum. NE. New Guinea; many new *spp.*; *Astelma n.g.*

Van Steenis, Blumea 7 (1954) 596.–Records of both *Phyllantheras.*

Genera

Asclepias: Woodson, Ann. Missouri Bot. Gard. 41 (1954) 1–211, 261, 114 fig.–Monogr.; key!

Ceropegia: Tsiang, Sunyatsenia 4 (1940) 290.–Nomencl. note.

Dischidia (*Conchophyllum*): Beccari, Malesia 2 (1878) 248–274, t. 60-63.–Synopsis; descr.; no key.

Gomphocarpus: Bullock, Kew Bull. (1952) 405–410.–Critical list Afr. *spp.*; no key.

Hoya: Blume, Rumphia 4 (1849) 29–33, t. 182–188.–Some nice plates; enum. *spp.*

Parsonsia: Merrill, Brittonia 1 (1933) 233–237.—Syn. of *P. helicandra.*

Pentasacme (*Spiladocorys*): Schlechter, J. Bot. 34 (1896) 15–16.–Reduction; revision; no key.

Pergularia-Telosma: Brown, Kew Bull. (1907) 323–325.–Nomencl.

Phyllanthera: Van Steenis, Bull. Bot. Gard. Btzg III, 18 (1950) 459.–Key.

Quisumbingia (*Schlechterianthus*, *Petalonema*): Merrill, Philip. J. Sc. 60 (1936) 33.–Nomencl.

Sarcostemma (*incl. Oxystelma*): Woodson, Ann. Missouri Bot. Gard. 37 (1950) 477–560.

Wattakaka (*Dregea § Wattakaka*): Stapf, Bot. Mag. (1922) 4 pp., t. 8976.–Java.

AVICENNIACEAE

See Verbenaceae

BALANOPHORACEAE

Harms, H., Pflanzenfamilien ed. 2, 16b (1935) 282–296.

Hooker, J. D., On the structure and affinities of Balanophoraceae (Trans. Linn. Soc. Lond. 22, 1859, 1–68, t. 1–16).–Synopsis of the family; no keys.

Junghuhn, F., Über Javan'sche Balanophoreen (Nova Acta Acad. Caes. Leop.-Car. Nat. Cur. 18, Suppl. 1841, 201–228, t. 1–2).–Survey Jav. *spp.* and descr. *Rhopalocnemis.*

Setchell, W. A., Balania harlandii (Hook. f.) Tiegh. of the Hong Kong region and its relatives (Hong Kong Naturalist Suppl. 1, 1932, 2–14, t. 1–9).–Discussion subdiv. in *Balanophora*, creating a new genus; E. Asiat. *sp.*; no Mal. *spp.*

—, Acroblastum vs. Polyplethia: a complex of the Balanophoraceae (Univ. Calif. Publ. Bot. 19, 1935, 141–158, t. 16–19).–Segregation of *Acroblastum* from *Balanophora*; incl. several Mal. *spp.*

Local

Java: Junghuhn, Nova Acta Acad. Caes. Leop.-Car. Nat. Cur. 18, Suppl. 1841, 201–228, t. 1–2.–Descr.

Van Steenis, Arch. Hydrobiol. Suppl. 10 (1932) 301–302.–Reduction *Balanophora alutacea*; descr. *B. abbreviata.*

Borneo: Beccari, Atti Soc. Ital. Sc. Nat. 11 (1868) repr. p. 2–3.–Descr. *Balanophora reflexa.*

—, Nuovo Giorn. Bot. Ital. 1, 1869, repr. 1–20, t. 2–4.–Descr. new *sp.*; general considerations on *Balanophoraceae*; bibliogr.; enum. *Balanophora spp.*

Hooker *f.*, Trans. Linn. Soc. 22 (1859) 426–427, t. 75.–New *Balanophora.*

Philippines: Elmer, Leafl. Philip. Bot. 5 (1913) 1659–1662.–List; 3 new *Balanophoras.*

Warburg, in Perkins, Fragm. Fl. Philip. (1905) 169.–New *Balanophora.*

Moluccas: Ridley, J. Str. Br. R. As. Soc. *no* 39 (1903) 207.–New *sp.* from Tenimber Isl.

New Guinea: Merrill & Perry, J. Arn. Arb. 23 (1942) 383.–Record.

—, *ibid.* 29 (1948) 152.–Record.

Schlechter, Bot. Jahrb. 50 (1913) 68–69, fig. 1.–Descr. new *sp.*

Valeton, Nova Guinea 8 (1913) 919–921, t. 161.–Descr. new *sp.*

Micronesia: Hosokawa, J. Soc. Trop. Agric. Taihoku Imp. Univ. 6 (1934) 572.–List; one new *sp.*

Genera

Balanophora: Fawcett, Trans. Linn. Soc. II, 2, Bot. (1886) 233–238, t. 33–36.–Synopsis; new *spp.* from Sumatra, Java, Saleier; key.

Göppert, Nova Acta Acad. Caes. Leop.-Car. Nat. Cur. 18 (1842) Suppl. 231–272, t. 1–3.–Anat.

Lotsy, Ann. Jard. Bot. Btzg 16 (1899) 174–185, t. 16–19.–Embryol. *B. globosa.*

Exorhopala: Van Steenis, Handel. 6e N. I. Natuurwet. Congr. (1931) 464–473 (1932).

Rhopalocnemis: Göppert, Nova Acta Acad. Caes. Leop.-Car. Nat. Cur. 22 (1847) 119–158, t. 11–15.–Structure; anat.

Lotsy, Ann. Jard. Bot. Btzg 17 (1901) 73–101, t. 3–14.–Morph.; embryology.

Van Steenis, Handel. 6e N. I. Natuurwet. Congr. (1931) 464–473 (1932).–Descr.; ecol.

BALSAMINACEAE

Miquel, F. A. W., Ill. Fl. Arch. Ind. (1871) 92–104.–Census; descr.

Local

Malay Peninsula: Henderson, Gard. Bull. Str. Settl. 5 (1930) 72–73, fig.–New *Impatiens.*

Hooker *f.*, Kew Bull. (1909) 1–12; *ibid.* (1911) 249–250.–Mal. Pen. & Indo-Chin. *spp.*

Sumatra: Hooker *f.*, Kew Bull. (1920) 246.—New *Impatiens.*

—, J. Bot. (1924) Suppl. 27–29.–Descr. new *spp.*

Miquel, Fl. Ind. Bat. Suppl. (1861) 161–162, 395–398.–Descr.

—, Choix (1864) t. 5.–Descr. of a *sp.*

Ridley, J. Fed. Mal. St. Mus. 8, pt 4 (1917) 23–25.–Several new *Impatiens.*

Ridley, Kew Bull. (1925) 78.–New *sp.*

Java: Backer, Bull. Jard. Bot. Btzg III, 16 (1939) 109–110.–New *sp.*

Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 384–387.–Key.

Borneo: Hooker *f.*, Kew Bull. (1910) 74–76.–Descr. 3 new *Impatiens.*

Philippines: Hooker *f.*, Kew Bull. (1909) 281–289.–Revision; key to Philip. *Impatiens.*

New Guinea: Hooker *f.*, Bot. Mag. (1909) t. 8247; (1911) t. 8396.

Ridley, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 23–24.–New *sp.*

Schlechter, Bot. Jahrb. 55 (1918) 114–120, fig. 1.–Key.

Genera

Impatiens: Hooker *f.*, J. Linn. Soc. Lond. Bot. 37 (1904) 22–32.–Interpretation of the *spp.* in the Wallichian herb. of the Linn. Soc. London.

Hooker *f.*, Rec. Bot. Surv. Ind. 4 (1904–06) 1–10, 11–36, 37–59.–Epitome of Indian *spp.*

Semeiocardium: Backer, Gard. Bull. Str. Settl. 9 (1935) 70–73, t. 2.

BARRINGTONIACEAE

See Lecythidaceae

BASELLACEAE

Backer, C. A., Bekn. Fl. Java (em. ed.) 4A (1942) fam. 64, 1–2.–In Dutch; key.

Ulbrich, E., Pflanzenfamilien ed. 2, 16c (1934) 263–291.

Genera

Boussingaultia: Hauman, Anal. Mus. Nac. Hist. Nat. Buenos-Aires Bot. 33 (1925) 347–359.–Revision of the genus; key.

BEGONIACEAE

Benecke, F., Beitrag zur Kenntnis der Begoniaceen (Bot. Jahrb. 3, 1882, 288–318).

Candolle, A. de, Mémoire sur la famille des Bégoniacées (Ann. Sc. Nat. Bot. IV, 11, 1859, 93–149).–Census; subdiv. of family; descr. sections and new *spp.*

Irmscher, E., Die Verteilung der Geschlechter in den Infloreszenzen der Begoniaceen unter Berücksichtigung der morphologischen Verhältnisse (Bot. Jahrb. 50, Suppl. 1914, 556–577).

—, Pflanzenfamilien ed. 2, 21 (1925) 548–588, fig. 251–268.

—, Über eine Abänderung des Zahlenverhältnis zwischen männlichen und weiblichen Blüten bei der monoecischen Begonia wallichiana (Mitt. Inst. Alg. Bot. Hamburg 6, 1927, 149–158).—Variability in floral numbers.

—, Neue Begoniaceen von O. Beccari in Malesien gesammelt (Webbia 9, 1954, 469–509, fig. 1–8).–Descr. new *spp.* mainly from Borneo and New Guinea.

Klotzsch, J. F., Begoniaceengattungen und Arten (Abh. Akad. Wiss. Berlin 1854, 121–255, t. 1–12).

Local

East Asia: Irmscher, Mitt. Inst. Allg. Bot. Hamburg 6 (1927) 343–360.–Descr. new *spp.*

Sumatra: Ridley, J. Fed. Mal. Stat. Mus. 8 (4) (1917) 37–41.–Descr. new *spp.*

—, J. Mal. Br. R. As. Soc. 87 (1923) 62–63.–Records; 2 new *spp.*

—, Kew Bull. (1925) 83.–Records; new *sp.*

Malay Peninsula: Burkill, J. Str. Br. R. As. Soc. 79 (1918) 103.–New *sp.* Langkawi Isl.

Irmscher, Mitt. Inst. Alg. Bot. Hamburg 8 (1929) 86–160.–Revision; key.

Ridley, Kew Bull. (1929) 258.–New *sp.*

Borneo: Irmscher, Webbia 9 (1954) 469–508, fig. 1–8.–Descr. new *spp.* coll. Beccari.

Merrill, J. Str. Br. R. As. Soc. *no* 86 (1922) 334.–New *sp.*

—, Sarawak Mus. J. 3 (1928) 529–532.–Records; 3 new *spp.*

Ridley, Sarawak Mus. J. 2 (1916) 177–178.–New *sp.*

Warburg, in Fedde, Rep. 18 (1922) 329.–New *sp.*

Celebes: Hemsley, Kew Bull. (1896) 37.–New *sp.*

Irmscher, Bot. Jahrb. 50 (1913) 335–383.–Descr. new *spp.*

Philippines: Elmer, Leafl. Philip. Bot. 10 (1939) 3706–3709.–New *spp.*

Merrill, Philip. J. Sc. 6 (1911) Bot. 369–406.–Revision; key.

—, *ibid.* 26 (1925) 477–483.–Addit. new *spp.*

—, *ibid.* 30 (1926) 413–414.–New *sp.*

—& Quisumbing, Addisonia 17 (1932) 57–58, t. 573.–New *sp.*

Quisumbing & Merrill, Philip. J. Sc. 37 (1928) 172–175.–New *sp.*

New Guinea: Irmscher, Bot. Jahrb. 50 (1913) 335–383, fig. 1–5.–Descr. new *spp.*; no key.

—, Notizbl. Berl.-Dahlem 7 (1917) 102–103.–New *sp.*

—, Webbia 9 (1954) 469–509, fig. 1–8.–Descr. new *spp.* coll. Beccari.

Merrill & Perry, J. Arn. Arb. 24 (1943) 41–59, 7 fig.

—, *ibid.* 29 (1948) 160.

Ridley, J. Bot. 52 (1914) 289–290.–New *sp.*

—, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 58–62.–Descr. new *spp.*

Smith, J. J., Bull. Dép. Agr. Ind. Néerl. *no* 2 (1906) 47–48.–New *sp.*

Genera

Begonia: Dryander, Trans. Linn. Soc. 1 (1791) 155–173.

Fotsch, K. A., Die Begonien, ihre Beschreibung, Kultur, Züchtung und Geschichte. Stuttgart 1933, 254 pp., 87 fig., t. 1–5.–A sort of key to cult. *spp.* not complete and not scientific; descr. of *spp.* mentioned; some of Malaysia.

BERBERIDACEAE

Koch, K., in Miq. Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 252.–List Mal. *spp.*

Tischler, G., Die Berberidaceen und Podophyllaceen. Versuch einer morphologisch-biologischen Monographie (Bot. Jahrb. 1 1902, 596–727, fig. 1–30).–Morph.; key to genera.

Local

India: CHATTERJEE, Rec. Bot. Surv. India 16 (1953) 1–86.–Keys!

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 55–56, t. 1.–New *sp.*

Genera

Berberis: AHRENDT, J. Bot. 79 (1941) Suppl. 1–80; (1942) 81–104; (1944) 105–112; (1945) 113–116. –Revision of the genus in Asia; keys.
SCHNEIDER, Bull. Herb. Boiss. II, 5 (1905) 33–48, 133–148, 391–403, 449–464, 655–670, 800–831; *ibid.* 8 (1908) 192–204, 258–266.–Precursory to monograph; key to *spp.*
—, Mitt. Deut. Dendrol. Ges. 55 (1942) 1–60 (1943).–Revision *sect. Wallichianae*; key.

Epimedium: STEARN, J. Linn. Soc. Lond. Bot. 51 (1938) 409–536, t. 24–31.–Monogr.; key.

Mahonia: FEDDE, Bot. Jahrb. 31 (1901) 30–133.–Revision; key.
TAKEDA, Not. R. Bot. Gard. Edinb. 6 (1917) 209–245, t. 1–37.–Old World *spp.* with descr.; no keys.

BETULACEAE

WINKLER, HUB., Pflanzenreich Heft 19 (1904) 1–149, fig. 1–28, t. 1–2 (maps).

Genera

Alnus: O. KUNTZE, Rev. Gen. Pl. (1891) 639–640. –Key.

Carpinus: HUB. WINKLER, Bot. Jahrb. 50 (1914) 488–508.

Corylus: BEIJERINCK, Jaarb. Ned. Dendr. Ver. 1948–1949 (1951) 67–107.–Revision; in Dutch.

BIGNONIACEAE

BUREAU, E., Monographie des Bignoniacées, *etc.* Thèse, Paris (1864) 1–215, t. 1–31.

DOP, P., Contribution à l'étude des Bignoniacées (Bull. Soc. Bot. Fr. 62, 1926, 887–891, fig. 1–4). –Descr. *Haplophragma n.g.*; key to some As.–Afr. genera of *Tecomeae*.

MIQUEL, F. A. W., Animadversiones in nonnullas Bignoniaceas (Ann. Mus. Bot. Lugd.-Bat. 1, 1864, 197–202).–Survey; descr.; no key.

SEEMANN, B., Synopsis Crescentiacearum: an enumeration of all the Crescentiaceous plants at present known (Trans. Linn. Soc. 23, 1860, 1–22).–Keys to genera, not to *spp.*

—, Revision of the natural order Bignoniaceae (Ann. Mag. Nat. Hist. III, 10 1862, 29–33).–Subdiv. of family; enum. of genera; descr. of *Aistanthus & Campsidium.*

—, Revision of the natural order Bignoniaceae (J. Bot. 1, 1863, 18–23, 87–91, 225–228, 257–258; *ibid.* 3, 1865, 329–333; *ibid.* 5, 1867, 371–375; *ibid.* 8, 1870, 145–149, 337–341, 379–383).–Precursory to revisions of some genera.

SEIBERT, R. J., The use of glands in a taxonomic consideration of the family Bignoniaceae (Ann. Missouri Bot. Gard. 35, 1948, 123–136, t. 3–7).

STEENIS, C. G. G. J. VAN, Malayan Bignoniaceae, their taxonomy, origin, and geographical distribution (Rec. Trav. Bot. Néerl. 1927, 787–1049, fig. 1–16, map).–Rev. Mal. *spp.*; keys.

—, The Bignoniaceae of the Netherlands Indies (Bull. Jard. Bot. Btzg III, 10, 1928, 173–290, fig. 1–13).–Revision Neth. Ind. *spp.*; keys.

Local

India & Burma: CHATTERJEE, Bull. Bot. Soc. Beng. 2 (1948) 62–79.

Indo-China: DOP, Bull. Mus. Hist. Nat. Paris (1926) 182–185, 233–235.–Descr. new *spp.*

Malay Peninsula: HOLTTUM, M. A. H. A. Mag. 11 (1941) 3–11.–Cultivated *spp.*; key.

Java: MERRILL, Philip. J. Sc. 19 (1921) 381.—Discussion ident. *Crescentia ovata* BURM.

Borneo: VAN STEENIS, J. Bot. 72 (1934) 5–6.–New *Radermachera.*

Philippines: ELMER, Leafl. Philip. Bot. 10 (1939) 3709–3711.–New *Radermachera.*
MERRILL, Philip. J. Sc. 3 (1908) Bot. 331–338.–Rev. *Radermachera*; key.
—, *ibid.* 26 (1925) 489.–New *Radermachera.*

New Guinea: DIELS, Bot. Jahrb. 57 (1922) 496–500. –Descr. *Neosepicaea n.g.*; new *spp.*; key to *Tecomanthe.*
GIBBS, Fl. Phyt. Arfak Mts (1917) 179–180.–New *sp.*
LAM & MEEUSE, Blumea 3 (1938) 201.–Reduction.
MOORE, J. Bot. (1923) Suppl. 38–39.–2 new *Tecomanthes.*
VAN STEENIS, Nova Guinea 14 (1927) 293–303, t. 33–34.–Revision; keys to *spp.*
—, J. Arn. Arb. 28 (1947) 423.–Records *Neosepicaea.*

Qeensland: VAN STEENIS, Proc. R. Soc. Queensl. 41 (1929) 39–58, fig. 1–2.–Revision; keys.

Genera

Bignonia: BLAKE & SPRAGUE, J. Bot. 61 (1923) 191–193.–Further notes on generic typification.
SPRAGUE, *ibid.* 60 (1922) 236–238, 363–364.–Generic typification.

Campsis: SEEMANN, J. Bot. 5 (1867) 371–374.–Enum.: no key.

Catalpa: PACLT, Candollea 13 (1952) 241–285.–Revision; key.

Deplanchea (*Diplanthera* F. v. M. *non al.*): VON MUELLER, J. Bot. 5 (1867) 212–213.
SCHEFFER, Nat. Tijd. Ned. Ind. 31 (1870) 332–337.–Revision; no key.

Dolichandrone: SPRAGUE, Kew Bull. (1919) 302–314.–Revision; key.

Nyctocalos: MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 249, t. 8.–Revision.
SEEMANN, J. Bot. 8 (1870) 147–149.–Incl. *Haussmannia*; key.

Radermachera: MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 250.–Revision.
SEEMANN, J. Bot. 8 (1870) 145–147.–Enum.

Spathodea: SEEMANN, J. Bot. 1 (1863) 225; *ibid.* 3 (1865) 332; *ibid.* 8 (1870) 339–341.–New defin.; list epithets.

Tecoma (*Stenolobium*): MELCHIOR, Ber. Deut. Bot. Ges. 59 (1941) 18–31.–Critical remarks on some *spp.*
REHDER, Mitt. Deut. Dendr. Ges. 22 (1913) 262. –Generic typification.
SEEMANN, J. Bot. 1 (1863) 87–91.–List; key.
SPRAGUE, J. Bot. 60 (1922) 364.–Generic typification.

Tecomanthe: BLUME, Rumphia 4 (1849) 34–36, t. 190.–Enum. (under *Tecoma*).

Tecomaria: SEEMANN, J. Bot. 1 (1863) 19–23.–Enum.

Wightia. See *Scrophulariaceae.*

BIXACEAE

in the restricted sense

BACKER, C. A., Fl. Mal. I, 4 (1951) 239–241, 2 fig.
PILGER, R., Pflanzenfamilien ed. 2, 21 (1925) 313–315, fig. 139.

BOERLAGELLACEAE

LAM, H. J., Bull. Jard. Bot. Btzg III, 7 (1925) 250–252.

BOMBACACEAE

BAKHUIZEN VAN DEN BRINK, R. C., Revisio Bombacacearum (Bull. Jard. Bot. Btzg III, 6, 1924, 161–240, t. 26–38).–Family revision; keys.
—, *ibid.* 241–254.–Rev. Indonesian *spp.*; keys.
BECCARI, O., Le Bombaceae Malesi descritte ed illustrate (Malesia 3, 1889, 201–280, t. 12–36).–Revision Mal. *spp.*; keys.
MASTERS, M. T., Monographic sketch of the Durioneae (J. Linn. Soc. Bot. 14, 1875, 495–508, t. 14–16).–Synopsis; descr. gen. & *spp.*; no key.

Local

Malay Peninsula: CORNER, Gard. Bull. Str. Settl. 10 (1939) 302–308.—Revision Mal. Pen. *Durio*; key.
FURTADO, Gard. Bull. Str. Settl. 4 (1929) 421–425.—Key to *spp.* of *Neesia.*
WYATT-SMITH. See under *Durio.*

Borneo: KOSTERMANS, Trop. Natuur 33 (1953) 31–35, 3 fig.–Biol. notes; new comb. in *Durio.*
MERRILL, Philip. J. Sc. 29 (1926) 393–394.–New *Durio* from Banguey Isl.
RIDLEY, Kew Bull. (1938) 221.–New *sp.*
WYATT-SMITH. See under *Durio.*

Philippines: MENDOZA, Philip. J. For. 4 (1941) 27–35, 2 pl.–Notes on *Durio* in Palawan.

New Guinea: VAN STEENIS, J. Arn. Arb. 28 (1947) 422.–Record of *Papuodendron.*
WHITE. See under *Papuodendron.*

Genera

Adansonia: HOCHREUTINER, Ann. Cons. Jard. Bot. Genève 11–12 (1908) 136–143, t.–New *sp.*; revision of the genus; key.

Bombax, Gossampinus, Pseudobombax, Salmalia (*typification*, chronol.): BAKHUIZEN VAN DE BRINK, Bull. Jard. Bot. Btzg III, 6 (1924) 161.
ALSTON, Handb. Fl. Ceylon 6 (Suppl.) (1931) 30.
FURTADO, Gard. Bull. Str. Settl. 10 (1939) 173–181.
DUGAND, Caldasia 6 (1943) 47–68.
CHATTERJEE & RAIZADA, Ind. For. 76 (1950) 139, 154–155.–*Non vidi.*
—, Taxon 3 (1954) 102.

Camptostemon (*Cumingia*): TROLL, Flora 128 (1933) 348–360.–Key; distr.

Ceiba: TOXOPEUS, Meded. Alg. Proefst. Landb. Btzg *no* 56 (1948) 1–19, map.–Discussion origin *Ceiba* in Afr., Asia & Mal.

Durio (*Boschia, Heteropyxis, Lahia*): WYATT-SMITH, Kew Bull. (1953) 513–532 (1954).–Some new comb.; valuable notes on Mal. Pen. & Bornean *spp.;* key to Malayan *spp.*

Neesia (*Boschia*): KORTHALS, in TEMMINCK, Verh. Nat. Gesch. Bot. (1844) 257–258, t. 69.
MERRILL, J. Arn. Arb. 29 (1948) 201.–*Glabraria* L. (1771) is the oldest name for *Boschia* KORTH. (1842).

Ochroma: PIERCE, Trop. Woods *no* 69 (1942) 1–2. –*O. pyramidale.*
—, *ibid. no* 70 (1942) 20–23.–Critical study of ROWLEE's types; syn. of *O. lagopus.*
ROWLEE, J. Wash. Acad. Sc. 9 (1919) 157–167. –Synopsis.

Papuodendron: WHITE, J. Arn. Arb. 27 (1946) 272–274, t. 1.–Placed by C. T. WHITE in *Malvaceae.*

BORRAGINACEAE

BRAND, A., Cynoglosseae (Pflanzenreich 78, 1921, 1–183, fig. 1–22).
JOHNSTON, I. M., Studies in the Boraginaceae III (Contr. Gray Herb. n. s. 73, 1924, 42–78).–Genera; specially p. 68 *Plagiobothrys.*
—, *ditto* XI (J. Arn. Aib. 16, 1935, 145–205).–Key to *Tournefortia*, *Messerschmidia* and *Havilandia.*
—, *ditto* XX. Representatives of 3 subfamilies in Eastern Asia (J. Arn. Arb. 32, 1951, 1–26, 99–122).–*Cordioideae* and *Heliotropoideae* from China, Northern Indo-China, Hainan, Formosa, Riukius and Japan. Full keys & elaborate notes on *Cordia*, *Coldenia*, *Rotula*, *Ehretia*, *Heliotropium*, *Tournefortia*, *Messerschmidia.*

Local

Formosa: DING HOU, Taiwania 1 (1950) 197–223. –Revision; keys.

Siam: FLETCHER & KERR, Flora Siam. Enum. 3 (1951) 77–88.–Enum.

Java: HOCHREUTINER, C. R. Soc. Phys. Hist. Nat. Genève 44 (1927) 74.–Record of *Cynoglossum australe* in E. Java.

Philippines: ROBINSON, Philip. J. Sc. 4 (1909) Bot. 687–698.–Revision; keys.

New Guinea: JOHNSTON, J. Arn. Arb. 33 (1952) 68–69.–New *Trigonotis.*
PULLE, Nova Guinea 8 (1910) 399.–Records.
—, *ibid.* 8 (1912) 683.–*Ditto.*

Genera

Cordia: HALLIER *f.*, Meded. Rijksherb. Leiden *no* 36 (1918) 3.–Some critical notes on synonymy of some *spp.*
HUTCHINSON, Kew Bull. (1918) 217–222, fig. 1–2.—C. *myxa* & 2 allied *spp.*; key.

Johnston, Contr. Gray Herb. *no* 92 (1930) 1–65. –Amer. *spp.*; keys.

—, J. Arn. Arb. 21 (1940) 336–355.–Key to Centr. Amer. *spp.* of *sect. Pilicordia.*

Ehretia: Nakai, J. Arn. Arb. 5 (1924) 36–41.–Rev. some *spp.* allied to *E. acuminata*; key.

Lithospermum: Johnston, J. Arn. Arb. 33 (1952) 299–363, t. 1–3.–Revision; key.

Mertensia: Williams, Ann. Missouri Bot. Gard. 24 (1937) 17–159.–Monogr.; keys to N. Amer. *spp.*

Myosotis: Stroh, Beih. Bot. Centralbl. 61B (1941) 317–345.–Enum.; synon.; no keys; no descr.

Pteleocarpa: Beccari, Malesia 1 (1877) 130–131. –Under *Icacin.*

Sleumer, Pflanzenfamilien ed. 2, 20b (1942) 400. –Comment.

Williams, Bull. Herb. Boiss. II, 5 (1905) 225.–Places it close to *Peripterygium* (*Icacin.*)

Rotula (*Rhabdia*): Bunting, J. Bot. 47 (1909) 269–270.–Reduction; revision; monotypic.

Johnston, J. Arn. Arb. 32 (1951) 14–16.–Revision; 2 *spp.*

Kuhlmann, Arq. Inst. Biol. Veg. Rio de Janeiro 1 (1934) 113–114, fig. 1–14.–Descr. new Braz. *Rhabdia.*

Tournefortia: Johnston, Contr. Gray Herb. *no* 92 (1930) 66–89.–Sect.; key to Amer. *spp.*

Trigonotis (*Havilandia, Zoelleria*): Johnston, J. Arn. Arb. 21 (1940) 57–63.–Descr. new Pap. *spp.*; key to part of Mal. *Trigonotis*; reduction 2 genera and discussion of generic delimitation.

BROMELIACEAE

Harms, H., Pflanzenfamilien ed. 2, 15a (1930) 65–159, fig. 31–54.

Mez, C., in DC. Mon. Phan. 9 (1896) 1–990.

—, Pflanzenreich Heft 100 (1932) 1–437.

Local

Java: Backer, Handb. Fl. Java 3 (1924) 8–18.–Only cultivated.

BUDDLEIACEAE

See Loganiaceae

BURMANNIACEAE

Beccari, O., Malesia 1 (1878) 240–254, t. 10–15.–Synopsis Indo-Austr. *spp.*; no key.

Jonker, F., A monograph of the Burmanniaceae. Thesis, Utrecht (1938) 1–279, fig. 1–20.–Keys!

—, Fl. Mal. I, 4 (1948) 13–26, fig. 1–11.

Schlechter, R., Die Thismieae (Notizbl. Berl.-Dahlem 8, 1921, 31–45).–Revision; new genera and *spp.*; keys.

Local

Sumatra: Jonker, Blumea 3 (1938) 108–110, fig.–New *Burmannia* from Enggano Isl.

Smith, J. J., Bull. Jard. Bot. Btzg III, 9 (1927) 220–222, 1 fig.–New *Thismia.*

Malay Peninsula: Ridley, J. Str. Br. R. As. Soc. 22 (1890) 331–339.

—, Ann. Bot. 9 (1895) 323–326, t. 12.–2 new *Thismias.*

—, Mat. Fl. Mal. Peninsula (Monocot.) 2 (1907) 69–75.–Keys.

Borneo: Warburg, in Fedde, Rep. 18 (1922) 330. –New *Burmannia.*

Philippines: Schlechter, Philip. J. Sc. 1 (1906) Suppl. 305.–New *Burmannia.*

New Guinea: Schlechter, Bot. Jahrb. 49 (1912) 100–108, fig. 1.–List descr.; no key.

—, *ibid.* 55 (1918) 202–203, fig. 1.–New *Thismia.*

Smith, J. J., Nova Guinea 8 (1909) 193–195, t. 49.–List some new *spp.*

—, *ibid.* 8 (1912) 895–896, t. 159.–New *Burmannia.*

Genera

Gymnosiphon: Schlechter, in Fedde, Rep. 17 (1921) 253–258.–Distinction against *Ptychomeria*; enum.

BURSERACEAE

Cretziou, P., Burseraceae malayanae (in Fedde, Rep. 36, 1934, 265–267).–Ident. Vienna sheets; listed records.

Engler, A., in DC. Mon. Phan. 4 (1883) 1–169, t. 1–3.

—, Pflanzenfamilien ed. 2, 19a (1931) 405–456, fig. 191–220.

Husson, A. M. & H. J. Lam, Scandent Burseraceae (Dacryodes and Canarium) (Blumea 7, 1952, 163–167, fig. 1).–New *Dacryodes* from Borneo.

Lam, H. J., Bull. Jard. Bot. Btzg III, 12 (1933) 282–561.–Revision; keys.

Miquel, F. A. W., Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 116–117.–List *Garuga, Canarium.*

Local

Indo-China: Guillaumin, Bull. Soc. Bot. Fr. 55 (1908) 611–618.–New *Canariums* from Indo-China.

Sumatra: Ridley, Kew Bull. (1925) 79.–New *Santiria.*

Borneo: Merrill, Philip. J. Sc. 30 (1926) 81–82.–New *Canarium.*

Ridley, Kew Bull. (1930) 80–87.–New *Canarium & Santiria.*

—, *ibid.* (1931) 493.–A new *Canarium.*

Philippines: Elmer, Leafl. Philip. Bot. 3 (1911) 1077–1088.–*Canarium* of Mt Apo.

—, *ibid.* 10 (1939) 3711–3714.–Two new *Canariums.*

Quisumbing & Merrill, Philip. J. Sc. 37 (1928) 155.–New *Canarium.*

Celebes: Lam, Blumea 3 (1938) 111–113.–New *Haplolobus.*

Moluccas: Lam, Blumea 5 (1942) 197–198.–List Talaud & Morotai *spp.*

New Guinea: Husson & Lam, Blumea 7 (1952) 167–170, fig. 1.–New *Dacryodes.*

Lauterbach, Bot. Jahrb. 56 (1920) 317–340.–Keys.

—, Nova Guinea 8 (1910) 295.–Records.

—, *ibid.* 8 (1912) 827.–*Ditto.*

—, *ibid.* 14 (1924) 135.–*Ditto.*

Solomons: White, J. Arn. Arb. 31 (1950) 91–93.–New *Haplolobus.*

Melanesia: Rechinger, in Fedde, Rep. 11 (1912) 184.–New *Canarium.*

Genera

Canarium: King, J. As. Soc. Bengal 62, ii (1893) 184–188, t. 10–13.–List descr. some Ind. *Canariums.*

Dacryodes: Kalkman, Blumea 7 (1954) 500–522. –Revision; key.

Garuga: Kalkman, Blumea 7 (1953) 459–472, fig. 1–3.–Revision; key.

—, *ibid.* 7 (1954) 498–499.–Additional note.

Haplolobus: Husson & Lam, Blumea 7 (1953) 413–458, fig. 1–15.–Revision; key.

Protium: Leenhouts, Blumea 7 (1952) 154–160, fig. 1.–Rev. Mal. *spp.*; key.

Swart, Rec. Trav. Bot. Néerl. 39 (1942) 211–395. –Monogr.; key.

Santiria: Kalkman, Blumea 7 (1954) 522–552.–Revision; key.

Scutinanthe: Leenhouts, Blumea 7 (1952) 160–163, fig. 1.–Rev. Mal. *spp.*; key.

Triomma: Kalkman, Blumea 7 (1954) 499–500.–Revision.

BUTOMACEAE

Buchenau, F. G. Ph., Beiträge zur Kenntnis der Butomaceen, Alismaceen und Juncaginaceen (Bot. Jahrb. 2, 1882, 465–510.)–Notes and additions to Micheli's monograph.

—, Pflanzenreich Heft 16 (1903) 1–12.

Micheli, M., in DC. Mon. Phan. 3 (1881) 84–93.

Steenis, C. G. G. J. van, Fl. Mal. I, 5 (1954) 118–120, fig. 1.

Local

Java: Backer, Handb. Fl. Java 1 (1925) 56–57.

BUXACEAE

Local

Java: Smith, J. J., in Koorders & Valeton, Bijdr. Booms. Java 12 (1910) 3–8.

Malay Peninsula: Ridley, Kew Bull. (1926) 475–476.–New *Buxus.*

Genera

Buxus: Hatusima, J. Dep. Agr. Kyushu Imp. Univ. 6 (1942) 261–342.–Revision; key to Asiatic *spp.*

Sarcococca: Sealy, in Hook. Ic. Pl. 35 (1947) t. 3469–3471, p. 1–10.–Descr. and discussion of several *spp.*

—, J. R. Hort. Soc. 74 (1949) 301–306.–Key to cultivated *spp.*

CACTACEAE

Britton, N. L. & J. N. Rose, Descriptions and illustrations of the Cactus family (Carnegie Inst. Washington Publ. 248, 1, 1919, vii + 236; 2, 1920, vii + 239; 3, 1922, vii + 255; 4, 1923, viii + 318).

Vaupel, F., Pflanzenfamilien ed. 2, 21 (1925) 594–651.

Local

Java: Backer, Bekn. Fl. Java (em. ed.) 4B (1944) fam. 92, p. 1–9.–In Dutch; key.

Genera

Cereus: Berger, Missouri Bot. Gard. Report 16 (1905) 57–86, t. 1–12.–Key to and descr. of subgenera; specific names listed.

Opuntia: Burkill, Rec. Bot. Surv. Ind. 4 (1911) 287–322.–*Opuntia* in India; key.

CAESALPINIACEAE

See Leguminosae

CALLITRICHACEAE

Backer, C. A., Fl. Mal. I, 4 (1950) 251–252, fig. 1.

Pax, F. & G. F. Hoffmann, Pflanzenfamilien ed. 2, 19c (1931) 236–240.

Local

New Guinea: Merrill & Perry, J. Arn. Arb. 22 (1941) 258.–New *sp.*

—, *ibid.* 29 (1948) 158.–Record of *C. verna.*

Genera

Callitriche: Samuelsson, Veröff. Geob. Inst. Rübel 3 (1925) 603–628.–Critical study Swiss *spp.*

CAMPANULACEAE

(*incl. Lobeliaceae*)

(*excl. Pentaphragmataceae & Sphenocleaceae*)

Candolle, A. de, Monographie des Campanulées. Paris (1830) i–viii, 1–384, t. 1–20.–Partial keys.

Presl, C. B., Prodromus monographiae Lobeliacearum (Abh. Böhm. Ges. Wiss. n.s. 4, 1836, 1–52).–Enum. genera and *ssp.*; subdivisions of genera, hardly partial keys.

Wimmer, F., Campanulaceae-Lobelioideae (Pflanzenreich Heft 106, 1943, 206 pp.).–For Malaysia only containing *Pratia.*

—, Vorarbeiten zur Monographie des Campanulaceae-Lobelioideae II. Trib. Lobelieae (Ann. Naturh. Mus. Wien 56, 1948, 317–374).

Local

Sumatra: Merrill, Not. Nat. Acad. Nat. Sc. Philadelphia *no* 47 (1940) 9.–New *Lobelia.*

Celebes: Fischer, Kew Bull. (1928) 141.–New *Lobelia.*

Skottsberg. See under *Lobelia.*

Wimmer, in Fedde, Rep. 38 (1935) 78–79.–New *Lobelia.*

Philippines: Elmer, Leafl. Philip. Bot. 9 (1934) 3180.–New variety.

New Guinea: Diels, Bot. Jahrb. 55 (1918) 121–125, fig. 1.–Records; *Phyllocharis n.g.*

—, 62 (1929) 493.–Record of *Pratia.*

Gibbs, Contr. Fl. Phytog. Arfak Mts (1917) 183.–New *Lobelia.*

Merrill & Perry, J. Arn. Arb. 22 (1941) 385–387.–New *sp.* in *Lobelia* & *Phyllocharis*; new records in *Lobelia.*

—, *ibid.* 30 (1949) 59–60.–New *sp.* in *Pratia* and *Lobelia.*

Moore, Trans. Linn. Soc. Lond. Bot. II, 9 (1916) 88–89.–Two *n. spp.* of *Pratia.*

Genera

Campanumaea: Chipp, J. Linn. Soc. Bot. 38 (1908) 391.–Generic synonyms.
Merrill, Pap. Mich. Acad. Sc. 20 (1934) 111 (1935).–*C. lancifolia.*

Lobelia: Kurz, Flora 30 (1872) 302.–*L. dopatrioides* from Lower Burma.
Skottsberg, Acta Hort. Gothob. 4 (1928) 1–26. –Arborescent Asiatic *spp.*

Wahlenbergia (*Campanulopsis*): Brown, Gard. Chron. 54 (1913) 316–317.–Austral.–N. Caled. *spp.*
Lothian, Proc. Linn. Soc. N.S.W. for 1946, 71 (1947) 201–236.–Prov. rev. Old World *spp.*
Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 463.–Reduction *Campanulopsis.*

CANNACEAE

Kränzlin, F., Pflanzenreich Heft 56 (1912) 1–77, fig. 1–16.

Winkler, Hub., Pflanzenfamilien ed. 2, 15a (1930) 640–654, fig. 290–295.

Genera

Canna (Java): Backer, Onkruidfl. Jav. Suiker. (1928) 194–197.–Key to 3 Jav. *spp.*

CANNABINACEAE

Backer, C. A., Fl. Mal. I, 4 (1951) 222–223, fig. 1.

Prain, D., On the morphology, teratology and diclinism of the flowers of Cannabis (Sc. Mem. Off. Med. & Sanit. Dep. Govt India, Calcutta n.s., *no* 12, 1904, 1–32, t. 1–5).–Monographical; morph.

CAPPARIDACEAE

Miquel, F. A. W., Ill. Fl. Arch. Ind. (1870) 19–36, t. 11–19.–List Mal. repres.

Pax, F. & G. F. Hoffmann, Pflanzenfamilien ed. 2, 17b (1936) 146–223.

Woodson, R. E., Gynandropsis, Cleome, and Podandrogyne (Ann. Missouri Bot. Gard. 35, 1948, 139–146, t. 8).–Relation of these genera; key to *Podandrogyne.*

Local

Argentine: Gómez, Lilloa 26 (1953) 279–341, fig. 1–12, map 1–4, 1 pl.–Revision; keys; in Spanish.

Sumatra: Jochems, Trop. Natuur 17 (1928) 80–82, fig. 1–2.–Record of *Cleome ciliata.*

Malay Peninsula: Burkill, Gard. Bull. Str. Settl. 3 (1924) 280–281.–New record of *Cleome.*
Merrill, Gard. Bull. Str. Settl. 8 (1935) 132.–New record of *Cleome.*

Java: Backer, Bekn. Fl. Java (em. ed.) 4 (1942) fam. 45, p. 1–11.–In Dutch; keys.

Borneo: Hallier *f.*, Bull. Herb. Boiss. 6 (1898) 216.

New Guinea: Lauterbach, Bot. Jahrb. 52 (1915) 108–114, fig. 1.–Rev.; keys.

Genera

Capparis: Gagnepain, in Morot, J. de Bot. 21 (1908) 53–65. Essay in classification; key to Asiat. *spp.*
—, Bull. Soc. Bot. Fr. 55 (1908) 209–215, 269–270, 322–325.–Descr. new *spp.* and new gen.; mainly Indo-China.
Radlkofer, Sitz. Ber. K. Bayer. Akad. Wiss. Math.-Phys. Cl. 14 (1884) 101–182; *ibid.* 17 (1887) 365–422.–Critical taxon. notes; syn.; anat.; *etc.*; no keys.

Crataeva: Corner, Gard. Bull. Str. Settl. 10 (1939) 15–21.–Critical notes.
Gagnepain, Not. Syst. 8 (1939) 211–213.–Indo-Chin. *spp.*; key.
Kurz, J. Bot. 12 (1874) 193–196, t. 147–148.–Indian *spp.*; key.

Stixis: Hallier *f.*, Beih. Bot. Centralbl. 39, ii (1921) 34.–Syn. *Covilhamia.*
Pierre, Bull. Soc. Linn. Paris 1 (1887) 652–656.

CAPRIFOLIACEAE

Kern, J. H. & C. G. G. J. van Steenis, Fl. Mal. I, 4 (1951) 175–194, fig. 1–5.

Local

Sumatra: Merrill, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 199.–New *sp.* of *Lonicera.*
Ridley, J. Mal. Br. R. As. Soc. *no* 87 (1923) 64–65.–New *Lonicera.*

Malay Peninsula: Henderson, J. Fed. Mal. Stat. Mus. 11 (1924) 187–188.–New *Lonicera.*

Philippines: Elmer, Leafl. Philip. Bot. 9 (1934) 3181–3182.–New *Viburnum.*
Merrill, Philip. J. Sc. 26 (1925) 491–492.–New *Viburnum.*

Genera

Carlemannia: Bremekamp, Rec. Trav. Bot. Néerl. 36 (1939) 372.–Discussion taxon. position.

Lonicera: Rehder, Rep. Missouri Bot. Gard. 14 (1903) 27–232, t. 1–20.–Synopsis of genus; keys.
Van Steenis, J. Arn. Arb. 27 (1946) 442.–Preliminary revision Mal. *spp.*; key.
—, Blumea 6 (1948) 243–244.–Critical notes on distr. & synonymy of Mal. *spp.*

Sambucus: Hutchinson, Kew Bull. (1909) 191–193.–Notes on Indian *spp.*
Von Schwerin, Mitt. Deut. Dendr. Ges. (1920) 194–231.–Revision.

Symphoricarpus: Jones, J. Arn. Arb. 21 (1940) 201–252.–Revision; key.

Viburnum: Kern, Reinwardtia 1 (1951) 107–170, 10 fig.–Revision Mal. *spp.*; keys.
—, *ibid.* 2 (1952) 131–132, 1 fig.–Add. note on *V. clemensae.*
Rehder, in Sargent, Trees and Shrubs 2 (1908) 81–116, t. 138–150 (new *spp.* republ. in Fedde, Rep. 9, 1911, 179–186).–Descr. & pl. of mostly Chin. *spp.*

CARICACEAE

Harms, H., Pflanzenfamilien ed. 2, 21 (1925) 510–522, fig. 235–241.

Mello, J. C. & R. Spruce, Notes on Papayaceae (J. Linn. Soc. Bot. 10, 1869, 1–15, t. 1).–Discussion and notes.

Solms-Laubach, H., in Mart. Fl. Bras. 13, 3 (1889) 174–195, t. 49–52.–Key.

Genera

Carica: Heilborn, O., Ark. Bot. 17, *no* 12 (1922) 1–16, t. 1.–Tax. & Cytol. of Ecuador *spp.*

CARYOPHYLLACEAE

Mattfeld, J., Biologische und morphologische Blütenformen bei den Caryophyllaceen (Notizbl. Berl.-Dahl. 14, 1939, 470–482, fig. 1–15).–Interpr. floral morph.

Pax, F. & G. F. Hoffmann, Pflanzenfamilien ed. 2, 16c (1934) 275–367.

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1934) 180.–List Mal. mountain *spp.*

Local

Java: Backer, Bekn. Fl. Java (em.ed.) 4A (1942) *no* 56, p. 1–16.
Fenzl, in Zollinger, Syst. Verz. Heft 2 (1854) 141–142.–List.

New Guinea: Mattfeld, Bot. Jahrb. 62 (1929) 475–479.–New *Sagina* and 2 *Cerastiums.*
—, *ibid.* 69 (1938) 267–273.–Revision; key to *Cerastiums* and *Saginas*; new comb. in *Scleranthus.*
—, *ibid.* 70 (1940) 468.–New *Sagina.*
Merrill & Perry, J. Arn. Arb. 23 (1942) 386–388.–Records.
—, *ibid.* 30 (1949) 39–40.–New *Sagina.*
Warburg, Bot. Jahrb. 16 (1892) 21.–New *Sagina.*

Genera

Arenaria: Williams, Bull. Herb. Boiss. 3 (1895) 593–603.–Sections.
—, J. Linn. Soc. Bot. 33 (1898) 326–437.–Revision; no keys.

Cerastium: Gartner, in Fedde, Rep. Beih. 113 (1939) 1–96, fig. 1–101, t. 1–19.–Monograph.
Möschl, Mem. Soc. Brot. 7 (1951) 15–119, maps, fig.–Revision Afr. *spp.* S. of the Sahara; map of *C. indicum.*
Williams, Bull. Herb. Boiss. 6 (1898) 893–904. Provisional enum.; *spp.* in key.

Dianthus: Williams, J. Linn. Soc. Lond. Bot. 29 (1893) 346–478.–Monograph.

Drymaria: Wiggins, Proc. Calif. Ac. Sc. IV, 25 (1944) 189–214, t. 20–22.–Key to Sonora desert *spp.*; incl. also some *spp.* introd. into Malaysia.

Gypsophila: Lawrence, Baileya 1 (1953) 16–18, fig. 5–12.–Key to cult. *spp.*
Williams, J. Bot. 27 (1889) 321–329.–Revision; no keys.

Lychnis: Lawrence, Baileya 1 (1953) 105–111, fig. 52–56.–Cult. *spp.*; key.

Polycarpaea: Gagnepain, in Morot, J. de Bot. 21 (1908) 275–280.–Revision; key.

Saponaria: Simmler, Denkschr. Akad. Wiss. Wien Math.-Naturw. Kl. 85 (1910) 433–510, t. 1–2.–Monograph; partial keys.

Silene: Williams, J. Linn. Soc. Lond. Bot. 32 (1896) 1–196.–Revision; partial keys.

Stellaria: Briquet, Ann. Cons. Jard. Bot. Genève 13–14 (1909–11) 378–380.–Critical notes.
Sprague, Kew Bull. (1920) 308–318.–Nomenclature *Stellaria versus Alsine.*

Tunica: Williams, J. Bot. 28 (1890) 193–199.–Revision; partial keys.

CASTANEACEAE

See Fagaceae

CASUARINACEAE

Diels, L. & E. Pritzel, Bot. Jahrb. 35 (1905) 122–130.–Revision W. Austral. *spp.*; key.

Macklin, E. D., The Casuarina distyla complex (Kew Bull. 1931, 145–151).–Key to the Austral. *spp.* of the *C. distyla* complex.

Miquel, F. A. W., Revisio critica Casuarinarum (Verh. Ned. Inst. 1. Kl. 13, 1848, 1–84).

—, Synopsis specierum Casuarinae (Flora 48, 1865, 17–24).

—, in DC. Prod. 16^2 (1868) 332–344.

—, Ill. Fl. Arch. Ind. (1870) 8–11, t. 7–8.–Descr.

Vriese, W. H. de, Sur les Casuarinacées des Iles de la Sonde et des Moluques (in De Vriese, Pl. Nov. Ind. Bat. Or. 1845, 1–4, t. 1).–Descr.

Local

Sumatra: De Vriese, Tijd. Nat. Gesch. & Phys. 11 (1844) 113–117.–New *sp.*

New Guinea: Moore, J. Bot. 61 (1923) Suppl. 53.–New *sp.*
Pulle, Nova Guinea 8 (1910) 347.–Records.
—, *ibid.* (1911) 621.–Records.

Solomons: Van Steenis, J. Arn. Arb. 20 (1939) 220–221.–Distr. *C. rumphiana*; reduced to *C. nodiflora.*

CELASTRACEAE

(*incl. Siphonodontaceae*)

Loesener, Th., Über die geographische Verbreitung einiger Celastraceen (Bot. Jahrb. 24, 1897, 197–201).–First record of *Microtropis* in New World; reduction of a Chin. *Ilex* to *Perrottetia* and discussion of the distr. of the latter genus.

—, Celastraceae novae, *etc.* (Notizbl. Berl.-Dahlem 13, 1936, 220–225).–New tribe *Lophopetaleae*; key to its genera; census of *Solenospermum*; new *sp.* in *Lophopetalum* and *Solenospermum* from Borneo and New Guinea.

—, *ibid.* 13 (1937) 563–564.–Discuss. affinity *Celastraceae* and *Hippocrateaceae.*

—, Pflanzenfamilien ed. 2, 20b (1942) 87–197.

Local

China: Loesener, Bot. Jahrb. 30 (1901–02) 446–474.–Survey Chin. *spp.*; key to genera; partial keys to *spp.*

Formosa: Hou, Taiwania 1 (1950) 169–195.–Key.

Indo-China: Tardieu-Blot, Fl. Gén. I.-C. Suppl. 1 (1948) 781–812, fig. 94–99.–Keys!
—, Not. Syst. 14 (1950) 43–49.–Misc. descr. new or noteworthy *spp.*

Sumatra: Merrill, Contr. Arn. Arb. 8 (1934) 92–93.–List; new *Evonymus.*
Ridley, J. Mal. Br. R. As. Soc. *no* 87 (1923) 56–57.–New *Celastrus.*

Java: Amshoff, Blumea 5 (1945) 517.–New record of a *Celastrus.*
Van Steenis, Trop. Natuur 22 (1933) 175–176,

fig. 1.—Remarks on a climbing form of *Evonymus japonicus.*
—, Bull. Bot. Gard. Btzg III, 17 (1948) 400.–*Ditto*, addit. remarks.

Borneo: Merrill, J. Str. Br. R. As. Soc. *no* 76 (1917) 93.–Record of an *Elaeodendron.*
Ridley, Kew Bull. (1931) 36–39.–Descr. new *spp.* in *Evonymus*, *Microtropis* and *Lophopetalum.*
—, *ibid.* (1938) 235–237.–Descr. new *spp.*
Rolfe, Kew Bull. (1918) 47–48.–Critical note on a *Lophopetalum.*
Airy Shaw, Kew Bull. (1949) 162.–2 records.

Philippines: Loher, Ic. Bog. 1 (1897) 55–56, t. 16.–New *Lophopetalum.*
Merrill, Philip. J. Sc. 16 (1920) 449–451, t. 1.–New comb. in *Elaeodendron* and record of an *Evonymus.*
—, *ibid.* 26 (1925) 466–467.–New *Glyptopetalum* from Palawan.
—, *ibid.* 27 (1925) 32–33.–New *Kokoona* and new *var.* in *Siphonodon.*

New Guinea: Loesener, Nova Guinea 8 (1910) 279–280.-New *Celastrus* and *Lophopetalum.*
—, Notizbl. Berl.-Dahlem 12 (1934) 36–38.–2 new *Perrottetias.*
Merrill & Perry, J. Arn. Arb. 20 (1939) 335–337.–New *sp.* in *Gymnosporia*, *Kurrimia* and *Elaeodendron.*
—, *ibid.* 22 (1941) 260–262.–New *sp.* in *Celastrus* & *Perrottetia.*

New Caledonia: Guillaumin, Bull. Soc. Bot. Fr. 73 (1926) 429–433.–Key to genera and to *spp.* of *Elaeodendron* and *Gymnosporia.*
Loesener, Bot. Jahrb. 39 (1907) 158–171.–Revision; keys.

Genera

Alcineanthus = Neoscortechinia (*Euphorbiaceae*).
Cremnobates = Schizomeria (*Cunoniaceae*).

Evonymus (*Conocarpus*): Blakelock, Kew Bull. (1948) 237–244.–*E. frigidus* and its allies.
—, *ibid.* (1951) 210–290.–Revision with keys.

Glyptopetalum: Prain, J. As. Soc. Bengal 60, ii (1891) 206–210 (repr. in Nov. Ind.).–Revision; key.

Microtropis: Merrill & Freeman, Proc. Amer. Acad. Arts & Sc. 73 (1940) 271–310.–Revision Old World *spp.*; key.

Perrottetia (*Caryospermum*): Koorders & Valeton, Ic. Bog. 2 (1904) 137–138, t. 127.–Jav. *sp.*; reduction *Caryospermum.*

Siphonodon (*Capusia*): Croizat, Lilloa 13 (1947) 31–43, 8 fig.–Raises *Siphonodon* to subfamily rank.
Hooker *f.*, Trans. Linn. Soc. Lond. 22 (1857) 133–139, t. 26.–Morph. struct.
Merrill, J. Arn. Arb. 21 (1940) 108–109.–Reduction *Capusia* from Indo-China.
Tardieu-Blot, Not. Syst. 14 (1951) 101–104.–Raises *Siphonodon* to family rank.

Solenospermum (*Lophopetalum p.p.*): Loesener, Notizbl. Berl.-Dahlem 13 (1936) 220–226.–List.
Valeton, Ic. Bog. 1 (1901) t. 90, p. 43–46.–Descr. Jav. *sp.* with discussion on generic delimitation of the genus from *Kokoona.*

CENTROLEPIDACEAE

Gilg, E. & C. Benedict, Pflanzenfamilien ed. 2, 15a (1930) 27–32.

Hieronymus, G., Beiträge zur Kenntnis der Centrolepidaceen (Abh. Naturf. Ges. Halle 12, 1873, 115–222, t. 1–4).–Monogr.; no key.

—, Über Blüte und Blütenstand der Centrolepidaceen (Bot. Jahrb. 7, 1886, 319–330).–Monogr.; diagr.

Steudel, E. G., Enumeratio plantarum Glumacearum pars II. Stuttgart (1855) 266–267.–Enum.; descr. in Latin.

Genera

Centrolepis: Van Steenis, Bull. Jard. Bot. Btzg III, 13 (1934) 181.–List Mal. *spp.*

CERATOPHYLLACEAE

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1933) 102–103.–Revision Mal. *spp.*

—, Fl. Mal. I, 4 (1949) 41–42, fig. 1.

Local

New Guinea: Merrill & Perry, J. Arn. Arb. 23 (1942) 390.–Record.

Genera

Ceratophyllum: Muenscher, Amer. J. Bot. 27 (1940) 231–233, 2 fig.–Descr. fruit & seedlings.

CHAILLETIACEAE

See Dichapetalaceae

CHENOPODIACEAE

Backer, C. A., Fl. Mal. I, 4 (1949) 99–106, fig. 1.

Ulbrich, E., Pflanzenfamilien ed. 2, 16c (1934) 379–584, 587.

Ungern-Sternberg, F., Salicorniearum synopsis (Atti Congr. Int. Bot. Firenze 1874 (1876) 259–343, synopsis).–Monograph of tribe *Salicornieae;* incl. are *e.g.* revisions of *Salicornia* and *Arthrocnemum*; keys to genera and *spp.*; in Latin.

Local

Java: Backer, Onkruidfl. Jav. Suiker. (1930) 214–215.–Descr. *Suaeda maritima.*

New Guinea: Merrill & Perry, J. Arn. Arb. 29 (1948) 154.–Record *Chenopodium carinatum.*
Pulle, Nova Guinea 8 (1910) 349.–Records.
Valeton, Bull. Dép. Agric. Ind. Néerl. 10 (1907) 9.–Records *i.a.* of *Tecticornia.*

Australia & New Zealand: Aellen, Bot. Jahrb. 68 (1938) 347–434; *ibid.* 71 (1940) 228–232.–Revision; keys.
—, Candollea 12 (1949) 153–155.–*Ditto.*

Genera

Arthrocnemum: Moss, J. S. Afr. Bot. 20 (1954) 1–22.–Revision S. Afr. *spp.*; keys; one new comb.

Chenopodium: Aellen & Just, Amer. Midl. Nat. 30 (1943) 47–76, 1 pl.–Key to Amer. *spp.*

CHLORANTHACEAE

Cordemoy, C. J. de, Monographie du groupe des Chloranthacées (Adansonia 3, 1863, 280–310).–Key to genera; descr. of *spp.*

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1934) 182–184.–Enum. Mal. *spp.* of *Ascarina* & *Hedyosmum.*

Local

China: Groff, Lingn. Sc. J. 11 (1932) 94–97.–Kwantung *spp.*; key.
P'ei, Bot. Bull. Acad. Sin. 1, *no* 2 (1947) 111–117.–Keys to genera and *spp.* of Eastern China.

Sumatra: Ridley, J. Mal. Br. R. As. Soc. *no* 87 (1923) 89.–New variety.

Borneo: Heine, in Fedde, Rep. 54 (1951) 226.–Record.
Merrill, Philip. J. Sc. 13 (1918) Bot. 103–105.–Two new *spp.*

Philippines: Merrill & Quisumbing, Philip. J. Sc. 82 (1953) 324.–Nomencl. notes; reduction of a *Chloranthus.*
Robinson, Philip. J. Sc. 4 (1909) Bot. 69–70.–Revision; key.

New Guinea: Kanehira & Hatusima, Bot. Mag. Tokyo 55 (1941) 388–389.–Record.
Pulle, Nova Guinea 8 (1911) 623.–Record.

Genera

Chloranthus: P'ei, Sinensia 6 (1935) 665–688.–Descr. & key to Chinese *Chloranthus.*
— & Renhwa San, Contr. Biol. Lab. Sc. Soc. China 10 (1938) 207–212.–Study of *Chloranthus* in China.

Hedyosmum: Merrill, Lingn. J. Sc. 5 (1927) 59.–Record of Jamaican *sp.* in Hainan.
Victorin, Contr. Inst. Bot. Univ. Montreal 63 (1948) 5–10.–Cuban *spp.*; key!

CLETHRACEAE

Turczaninow, N., Quelques observations sur les espèces du genre Clethra (Bull. Soc. Nat. Moscou 36^2, 1863, 228–235).

Local

Asia: Dop, Bull. Soc. Bot. Fr. 75 (1928) 729–733.–Key to 8 *spp.*

Sumatra: Merrill, Contr. Arn. Arb. 8 (1934) 121–122.–Record.
—, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 179–181.–Two new *spp.*
Ridley, J. Mal. Br. R. As. Soc. *no* 87 (1923) 75.–New *sp.*
Smith, J. J., Ic. Bog. 4 (1910) 65–66, t. 319.–New *sp.*

Java: Koorders, Bull. Jard. Bot. Btzg III, 1 (1918) 148–152, t. 10.–Note on *Clethra javanica.*

Celebes: Koorders, Bull. Jard. Bot. Btzg III, 2 (1920) 255–257.–Note on *Clethra canescens.*
Miquel, Ann. Mus. Lugd.-Bat. 1 (1863) 41.–Record.
Smith, J.J., Bull. Jard. Bot. Btzg III, 1 (1920) 398–399, t. 47.–New *sp.*
—, *ibid.* 4 (1922) 240.–New name for the above.

Philippines: Elmer, Leafl. Philip. Bot. 9 (1934) 3182–3184.–New *sp.*

New Guinea: Schlechter, Bot. Jahrb. 52 (1915) 219–220.–Enum.; new *sp.*
—, *ibid.* 55 (1918) 194.–New comb.
Smith, J. J., Nova Guinea 12 (1914) 169–170.–Descr. new *sp.*

COCHLOSPERMACEAE

Pilger, R., Pflanzenfamilien ed. 2, 21 (1925) 316–320.

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1936) 519–524, fig. 1.–Rev. Mal. *spp.*

—, Fl. Mal. I, 4 (1949) 61–63, fig. 1.

Local

New Guinea: Bailey, Queensl. Agric. J. 24 (1910) 20.–Record.
Baker, J. Bot. (1923) Suppl. p. 4.–New var.
White, Proc. R. Soc. Queensl. 34 (1922) 45.–Record.
— & Francis, Proc. R. Soc. Queensl. 38 (1927) 248.–Record.

COMBRETACEAE

Candolle, A. de, Mémoire sur la famille des Combrétacées (Mém. Soc. Phys. Hist. Nat. Genève 4, 1828, 1–41).–Discussion family affinitities; descr. some new *spp.*, mostly Indian.

Exell, A. W., The genera of Combretaceae (J. Bot. 69, 1931, 113–128).–Key to and syn. of genera.

—, Fl. Mal. I, 4 (1954) 533–589, fig. 1–33.

Slooten, D. F. van, Bijdrage tot de kennis der Combretaceeën en Flacourtiaceeën van Nederlandsch-Indië. Thesis, Utrecht (1919) 5–54.–Rev. Indonesian *spp.*; keys.

—, The Combretaceae of the Dutch East Indies (Bull. Jard. Bot. Btzg III, 6, 1924, 11–64).–Rev. Indonesian *spp.*

Local

Malay Peninsula: Ridley, Kew Bull. (1931) 449.–New *Terminalia.*

Java: Miquel, Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 115.–Descr. new *Combretum.*

Borneo: Exell, Blumea 7 (1954) 557.–New *Combretum.*

Philippines: Merrill, Philip. J. Sc. 30 (1926) 414–415.–New *Terminalia.*

New Guinea: Diels, Bot. Jahrb. 57 (1922) 427–430.—List; key for *Terminalias.*
Exell, Brittonia 2 (1936) 137–138.–New *Terminalias.*
—, J. Arn. Arb. 20 (1939) 317–320.–List Brass coll.; one new *sp.*
Lauterbach, Nova Guinea 8 (1910) 317.–Record.
—, *ibid.* 8 (1912) 847.
Van Slooten, Nova Guinea 14 (1927) 196–198.–List Dutch New Guinean *spp.*; no key.
White, Proc. R. Soc. Queensl. 34 (1922) 46–47.–List.

—, J. Arn. Arb. 31 (1950) 100.–Reduction of a *Terminalia*.

Genera

Combretum: DON, G., Trans. Linn. Soc. Lond. 15 (1827) 412–441.–Review of the genus; descr. new *spp.*; partial keys.

Lumnitzera: VAN SLOOTEN, Trop. Natuur 11 (1922) 51–56, 65–70, 4 fig.–Discussion distr.
—, Blumea Suppl. 1 (1937) 163–175.–*Ditto*.

Quisqualis: EXELL, J. Bot. 69 (1931) 119–120.–Key to all *spp.*

Terminalia: BLATTER, J. Ind. Bot. Soc. 8 (1929) 245–262.–Revision of Indian *spp.*; complete synon.; descr.; key.
EXELL, Blumea 7 (1953) 322–328.–Descr. new *spp.*
PARKINSON, Indian For. Rec. n.s., Bot. 1 (1937) 1–28, t. 1–3.–Indian *spp.* of § *Pentaptera*; key.

COMMELINACEAE

BRÜCKNER, G., Zur speziellen Systematik der Commelinaceae (Notizbl. Berl.-Dahlem 10, 1927, 55–61).–For Mal. only important nomenclaturally as many new comb. are proposed in passing through splitting of the genera *Aneilema* and *Pollia*.

—, Pflanzenfamilien ed. 2, 15a (1930) 159–181, fig. 55-66.

CLARKE, C.B., in DC. Mon. Phan. 3 (1881) 113–324, t. 1–8.

HASSKARL, J. K., Commelinaceae Indicae, imprimis Archipelagi indici adjectis nonnullis hisce terris alienis (1870) 1–182.–Monograph; no keys.

PICHON, M., Sur les Commélinacées (Not. Syst. 12, 1946, 217–242).–*Cartonema* is segregated as a separate family; segregation of *Tradescantia* into various other, partly new, genera; key to all genera of the family, arranged according to a new system.

WOODSON, R. E., Commentary on the North American genera of Commelinaceae (Ann. Missouri Bot. Gard. 29, 1942, 141–154).–Key to genera.

Local

India: CLARKE, Commelinaceae et Cyrtandraceae Bengalenses. Calcutta (1874) 1–62, t. 1–42.–Descr. & pl.

Sumatra: RIDLEY, J. Mal. Br. R. As. Soc. *no* 87 (1923) 102–103.–List; 2 new *Forrestias*.

Malay Peninsula: RIDLEY, Mat. Fl. Mal. Pen. (Monocot.) 2 (1907) 113–125.–Keys.

Java: BACKER, Handb. Fl. Java 3 (1924) 18–39.–In Dutch; keys.
BAKHUIZEN VAN DEN BRINK, Blumea 6 (1950) 398–399.–List; various new comb.

Philippines: ELMER, Leafl. Philip. Bot. 9 (1934) 3184–3185.–New *Commelina*.
—, *ibid.* 10 (1939) 3714–3715.–New *Cyanotis*.

Moluccas: VAN STEENIS, Blumea 7 (1954) 598.–First record of a *Cartonema*.

New Guinea: HALLIER *f.*, Nova Guinea 8 (1913) 905–908.–List; one new *Pollia*.
LAUTERBACH, Bot. Jahrb. 50 (1913) 54–65.–Rev.; keys; some new *spp.*

Genera

Belosynapsis (*Dalzellia* HASSK. *non* WIGHT): SPRAGUE & FISCHER, Kew Bull. (1928) 252–254.–Census; new comb.; segregate of *Cyanotis*.

Cyanotis: LIVERA, Ceylon J. Sc. A. Bot. (Ann. Bot. Gard. Perad.) 9 (1924) 185–190.–Revision Ceylon *spp.*; key.

Forrestia: HASSKARL, Flora (Bot. Zeit.) 47 (1864) 625–631.–Revision; key.

Spatholirion: DUNN, Kew Bull. (1911) 161–162.–Revision; key.
RIDLEY, J. Bot. (1896) 329–330, t. 360.–Type description.

Tradescantia: ANDERSON & WOODSON, Contr. Arn. Arb. 9 (1935) 1–132, t. 1–12.–Account of indig. *spp.* of U.S.A.; key.

COMPOSITAE

BENTHAM, G., Notes on the classification, history, and geographic distribution of the Compositae (J. Linn. Soc. Lond. Bot. 13, 1873, 335–577, t. 8–11).–General; interrelations within the family; distrib. notes; no descr.; no keys.

BOERLAGE, J. G., Handl. Fl. Ned. Ind. 2¹ (1891) 165–170.–Key to genera.

CLARKE, C. B., Compositae Indicae descriptae et secus genera Benthamii ordinatae. Calcutta (1876) xxiv + 347 + xlv pp.–Synopsis; no keys.

KOSTER, J. TH., The Compositae of the Malay Archipelago. Vernonieae-Eupatorieae (Blumea 1, 1935, 351–536).–Rev.; keys. *Spp.* from New Guinea, the Philippines, and the Malay Peninsula are not treated.

MARTELLI, U., Le Composite raccolte dalla Dottore O. Beccari nell' Archipelago Malese e nelle Papuasia (Nuovo Giorn. Ital. 15, 1883, 281–305).–List.

ROBINSON, B. L., Records preliminary to a general treatment of the Eupatorieae I (Contr. Gray Herb. Harv. Univ. 64, 1921, 1–21); *ditto* II (*ibid.* 65, 1922, 46–54); *ditto* III (*ibid.* 68, 1923, 3–43); *ditto* IV (*ibid.* 73, 1924, 3–31); *ditto* V (*ibid.* 75, 1925, 3–15); *ditto* VI (*ibid.* 77, 1926, 1–62); *ditto* VII (*ibid.* 80, 1928, 1–42); *ditto* VIII (*ibid.* 90, 1930, 3–36); *ditto* IX (*ibid.* 96, 1931, 1–27); *ditto* X (*ibid.* 100, 1932, 1–69); *ditto* XI (*ibid.* 104, 1934, 1–71).

STEBBINS Jr, G. L., A new classification of the tribe Cichorieae (Madroño 12, 1953, 65–89).

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 184.–List of *spp.* of Mal. mountain genera.

Local

India: DE CANDOLLE, in WIGHT, Contr. Bot. India (1834) 1–27.–Revision; partial keys.

Japan: KITAMURA, Mem. Coll. Sc. Kyoto Imp. Univ. ser. B 13 (1937) 1–421, t. 1–35.–Monograph *Cynareae, Inuleae, Eupatorieae, Astereae*; keys.
—, *ibid.* ser. B 15³ (1940) 285–446, t. 1–11.–

Ditto; this second part of the monogr. contains the *Vernonieae*, *Mutisieae*, and *Anthemideae*.

—, *ibid.* ser. B 16 (1942) 155–292, t. 1–8.–Tribes *Senecioneae*, *Heliantheae* and *Ambrosieae*.

Formosa: Kitamura, Acta Phytotax. & Geobot. 10 (1941) 15–37.–Revision; no descr.; keys.

Sumatra: Boerlage, in Veth, Midden-Sumatra 4^2 (1884) 20–21.–New *Senecio*.

Koster, Blumea 7 (1953) 362.–Reduction of *Erechthites petiolata* Bth.

Merrill, Pap. Mich. Acad. Sc. Arts & Lett. 24 (1939) 90–92.–List; new *Ainsliaea*.

Ridley, J. Mal. Br. R. As. Soc. *no* 87 (1923) 72–74.–List; new *sp.* in *Blumea* & *Gynura*.

Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 403.–Record of *Blumeopsis*.

Java: Backer, Bull. Jard. Bot. Btzg II, *no* 12 (1913) 39–40.–New *Chrysanthellum*; key.

—, Trop. Natuur 7 (1918) 58–59, fig. 11.–*Launaea pinnatifida var. javanica*.

—, Rec. Trav. Bot. Néerl. 36 (1939) 449–459.–Rev. of *Gynura* & *Crassocephalum*.

Koster, in Backer, Bekn. Fl. Java (em. ed.) 13A (1953) fam. 178, p. 1–145.–Revision; in Dutch; keys.

Van Steenis, Blumea 6 (1948) 245.–Note on *Carpesium*.

Lesser Sunda Islands: Gagnepain, Bull. Soc. Bot. Fr. 67 (1920) 87–88.–Record of *Pterocaulon redolens* from Timor.

Koster, in Fedde, Rep. 34 (1933) 1–29.–List Elbert coll.; various *n. spp.*

—, Blumea 7 (1952) 288–289.–Various notes; a new *Vernonia*.

Van Steenis, Blumea 6 (1948) 246.–*Gerbera* from Bali.

Borneo: Koster, Blumea 7 (1953) 362.–Record of *Spilanthes chamaecaula*; reduction of a *Lactuca*.

Merrill, J. Str. Br. R. As. Soc. *no* 77 (1917) 245–247.–New *sp.* in *Lactuca* and *Lagenophora*.

Van Steenis, Blumea 6 (1948) 246.–Record *Rhynchospermum*.

Celebes: Hemsley, Kew Bull. (1896) 38.–New *Senecio* from Mt Bonthain.

Philippines: Elmer, Leafl. Philip. Bot. 1 (1906) 83–186.–Manual of Philip. *Compos.*; keys.

—, *ibid.* 10 (1939) 3715–3716.–New *Gynura*.

Klatt, Flora (Bot. Zeit.) 68 (1885) 203–204.–A new *Vernonia*.

Merrill, Philip. J. Sc. 12 (1917) Bot. 117–123, t. 2–3.–*Fenixia*, *Guerreroia n.g.*; 2 new *Gynuras* and some records.

—, *ibid.* 29 (1926) 495–496.–New *Blumea*.

—, *ibid.* 30 (1926) 429–430.–New *Wedelia*.

—, *ibid.* 60 (1936) 35.–*Acanthospermum*.

— & Quisumbing, Philip. J. Sc. 82 (1953) 336.–Record 3 weeds.

Quisumbing, Philip. J. Sc. 41 (1930) 368.–Record of *Galinsoga*.

Moluccas: Merrill, Philip. J. Sc. 11 (1916) Bot. 319–320.–List weeds, mostly from Ambon.

New Guinea: Lauterbach, Nova Guinea 8 (1910) 335–338.

—, *ibid.* (1912) 863–866.

Mattfeld, Bot. Jahrb. 62 (1929) 386–451.–Full important treatment; keys.

—, *ibid.* 494–501.–Saruwaged *spp.*; new *spp.*, records & comb.

—, *ibid.* 67 (1937) 248–268.–Many new *spp.*; revisions *Keysseria* and *Olearia* in Papua.

—, *ibid.* 69 (1938) 283–294.–New records & *spp.*; *Arrhenechthites n.g.*

—, *ibid.* 70 (1940) 470–482.–New *spp.*; first record of *Raoulia*.

Moore, in Gibbs, Contr. Fl. Phytog. Arfak Mts (1917) 183–184.–List; new *Lactuca*.

White, Proc. R. Soc. Queensl. 34 (1922) 59–60.–List; mostly weeds.

—, *ibid.* 38 (1927) 260–261, fig. 19.–New *Olearia*.

Micronesia: Kitamura, Acta Phytotax. & Geobot. 10 (1941) 70–74.–List; no new *spp.*

Genera

Acanthospermum: Blake, Contr. U.S. Nat. Herb. 20 (1921) 383–393.–Revision.

Ageratum: Robinson, Proc. Am. Ac. Arts & Sc. 49 (1913) 454–483.–Monograph; key.

Ainsliaea: Beauverd, Bull. Soc. Bot. Genève II, 1 (1900) 364–388, *ibid.* II, 2 (1910) 36–51.–Monograph.

Anaphalis-Gnaphalium: Gamble, Kew Bull. (1921) 315–316.–Generic distinction.

Koster, Blumea 4 (1941) 483–484.–Various notes.

Arrhenechthites: Mattfeld, Bot. Jahrb. 69 (1938) 288–292.–Rev. of this Pap. end.; key.

Artemisia: Keck, Proc. Cal. Ac. Sc. IV, 25 (1946) 421–468.–Revision *A. vulgaris* complex in N. Am.

Athroisma: Mattfeld, Notizbl. Berl.-Dahlem 13 (1936) 300–303.–Revision.

Bidens: Sherff, Field Mus. Nat. Hist. (Chicago) bot. ser. 16 (1937) 1–709, t. 1–189.

Blainvillea: Burkill, Gard. Bull. Str. Settl. 5 (1930) 123.

Koster & Philipson, Blumea 6 (1950) 349–354.

Blumea: Koster, Blumea 4 (1941) 485–490.–Various notes; new var. & forms.

—, *ibid.* 6 (1948) 264–265.–Study of some types.

Blumeopsis: Gagnepain, Bull. Mus. Hist. Nat. Paris 26 (1920) 75–76.–Monotypic.

Merrill, J. Arn. Arb. 19 (1938) 70.–Record from Sumatra.

Brachycome: Davis, Proc. Linn. Soc. N.S.W. 73 (1948) 142–241.–Rev. Austr. *spp.*

Calotis (*Tolbonia*); Davis, J. Linn. Soc. N.S.W. 76 (1951) 146–188.–Revision.

Merrill, Bull. Soc. Bot. Fr. 77 (1930) 340–341.

Chrysanthellum: Koster, in Backer, Bekn. Fl. Java (em. ed.) 13A (1953) 92–93.–Key to 2 *spp.*

Milne-Redhead, Kew Bull. (1948) 466.—*Chr. indicum* DC. = *Chr. americanum* (L.) Vatke; syn. & distr.

Coreopsis: Sherff, Field Mus. Nat. Hist. (Chicago) bot. ser. 11 (1936) 279–475.–Revision.

Cosmos: Burkill, Gard. Bull. Str. Settl. 5 (1930) 118–120.–Some notes on *spp.* cult. in Malaya.

Sherff, Field Mus. Nat. Hist. (Chicago) bot. ser. 7 (1932) 401-447.–Revision.

Crepis: BABCOCK, Univ. Calif. Publ. Bot. 14 (1929) 323–333.–New *spp.* from contin. SE. Asia.
—, Univ. Calif. Publ. Bot. 21 (1947) xii + 197. –Distr.; cytol.
—, *ibid.* 22 (1947) 199–1030, fig. 1–304, t. 1–36. –Monogr.; keys.

Elephantopus: BAKER, Trans. Acad. Sc. St Louis 12 (1902) 43–56.–Key to allied gen. & *ssp.*
PHILIPSON, J. Bot. 76 (1938) 299–305.–African *spp.*; key.

Emilia: GARABEDIAN, Kew Bull. (1924) 137–144.–With key.

Eschenbachia (*Conyza*): KOSTER, Blumea 7 (1952) 290.–Recomb. Mal. *spp.*

Eupatorium: KOSTER, Blumea 1 (1935) 492–503.–Key.
—, *ibid.* 4 (1941) 491–492.–Two records.
VAN STEENIS, Reinwardtia 1 (1952) 478–479.–Notes on *E. odoratum.*

Glossogyne: VAN STEENIS, Bull. Jard. Bot. Btzg III, 12 (1932) 168–169.–New record from Natuna Isl.

Gynura (incl. *Crassocephalum*); BACKER, Rec. Trav. Bot. Néerl. 36 (1939) 449–459.–Only Jav. *spp.*

Helianthus: WATSON, Pap. Mich. Acad. Sc. Arts & Lett. 9 (1928) 305–475 (1929).–Contr. to monograph.

Ixeris: MATTFELD, Bot. Jahrb. 62 (1929) 447–450. –Key to 6 *spp.* under *Lactuca § Ixeris.*
STEBBINS, J. Bot. 75 (1937) 43–51.–Critical notes; enum. of *spp.*

Keysseria (*Hecatactis, Myriactis § Hecatactis*): MATTFELD, Bot. Jahrb. 67 (1937) 249–253.–Papuan genus; revision; key.

Lactuca: STEBBINS, J. Bot. 75 (1937) 12–18.–Critical notes on *Lactuca* and related genera.

Lagenophora: DAVIS, Proc. Linn. Soc. N.S.W. 75 (1950) 122–132.–Revision Austral. *spp.*

Launaea: MERRILL & CHUN, Sunyatsenia 2 (1935) 328.

Melampodium: ROBINSON, Proc. Amer. Ac. Arts & Sc. 36 (1901) 455–466.–Revision; key.

Mikania: ROBINSON, Contr. Gray Herb. Harv. Univ. 104 (1934) 55–71.

Montanoa: ROBINSON & GREENMAN, Proc. Am. Ac. Arts & Sc. 34 (1899) 508–521 (repr. in Contr. Gray Herb. new ser. 16).–Revision; key.

Moonia: BROWN, Bern. P. Bish. Mus. Bull. 130 (1935) 340–345, fig. 61–62.–*Moonia* is merged with *Chrysogonum* L. and emended.

Olearia: MATTFELD, Bot. Jahrb. 67 (1937) 253–262.–Revision; key Pap. *spp.*
—, *ibid.* 70 (1940) 470–472.–New *spp.*

Porophyllum: ROBINSON & GREENMAN, Proc. Am. Ac. Arts Sc. & Lett. 32 (1896) 31–33 (repr. in Contr. Gray Herb. new ser. 10).–Provis. partial key to *spp.* N. of Panama.

Prenanthes: STEBBINS, Bull. Jard. Bot. Brux. 14 (1937) 333–352, fig.–List scandent *spp.* of *Prenanthes* and *Lactuca* in Africa.

Pterocaulon: GAGNEPAIN, Bull. Soc. Bot. Fr. 67 (1920) 87–88.–Timor.
MERRILL & CHUN, Sunyatsenia 2 (1935) 329–330.

Soliva: CABRERA, Not. Mus. La Plata 14 (1949) Bot. *no* 70, p. 123–139, fig. 1–2.–Revision; key.
HEALY, Trans. R. Soc. New Zeal. 81 (1953) 23–26.–Key to 4 introd. *spp.* in New Zealand; key.

Sphaeranthus: ROBIJNS, Kew Bull. (1924) 177–199. –Revision.

Spilanthes: KOSTER & PHILIPSON, Blumea 6 (1950) 349–354.–Preliminary key to Mal. *spp.*
MOORE, Proc. Amer. Acad. Arts & Sc. 42 (1907) 521–569.–Revision.

Tithonia: BLAKE, Contr. U.S. Herb. 20 (1921) 423–436.–Revision.

Tridax: ROBINSON & GREENMAN, Proc. Am. Ac. Arts Sc. & Lett. 32 (1896) 3–10 (repr. in Contr. Gray Herb. new ser. 10).–Revision; keys.

Verbesina: ROBINSON & GREENMAN, Proc. Am. Ac. Arts & Sc. 34 (1899) 534–566 (repr. in Contr. Gray Herb. new ser. 16).–Revision; key.

Vernonia: KOSTER, Blumea 1 (1935) 380–455.–Keys.
—, Blumea 4 (1941) 490–491.–Various additions.

Xanthium: WIDDER, in FEDDE, Rep. Beih. 20 (1923) 1–221.–Revision.

Youngia (segregate from *Crepis*): BABCOCK & STEBBINS, Carn. Inst. Washington *no* 484 (1937) 1–106.–Revision.

Zinnia: ROBINSON & GREENMAN, Proc. Am. Ac. Arts Sc. & Lett. 32 (1896) 14–20 (repr. in Contr. Gray Herb. new ser. 10).–Revision; key.

CONIFERAE

(*incl. Araucariaceae, Cupressaceae, Pinaceae, Podocarpaceae,* and *Taxaceae*)

BOER, P. DE, De Coniferis Archipelagi Indici. Groningen (1866) 1–54, t. 1–3.–Revision; no keys.

—, in MIQ. Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 255.–Some additions; no new *spp.*

DALLIMORE, W. & A. B. JACKSON, A handbook of Coniferae, *etc.* (1923) i–xi, 1–570, t. 1–32, fig. 1–120.–Keys to genera and sometimes to *spp.*; of little importance for Malaysia.

FITZPATRICK, H. M., Coniferae; keys to the genera and species, with economic notes (Proc. Dublin Soc. 19, 1929, 189–260, t. 9–15).–Partial keys to genera and *spp.*

HUTCHINSON, J., Kew Bull. (1924) 49–66, maps.–Key to the tribes & genera of *Cycadaceae, Taxaceae* and *Pinaceae* with maps of distr.

MASTERS, M. T., The genera of Taxaceae and Coniferae (J. Linn. Soc. Lond. Bot. 30, 1893, 1–42).–Distr.; keys to genera.

PILGER, R., Pflanzenreich Heft 18 (1903) 1–124, fig. 1–24.–Revision of *Dacrydium, Podocarpus, Phyllocladus,* and *Taxus.*

—, Kritische Übersicht über die neuere Literatur betreffend die Familie der Taxaceae (Bot. Jahrb. 54, 1916, 1–43).–*Taxac.* in the old wide sense.

—, Pflanzenfamilien ed. 2, 13 (1926) 121–407, fig. 109–215.

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 184–193.–List Mal. *spp.* of mountain genera.

WARBURG, O., Monsunia 1 (1900) 182–194.–Synopsis of *Agathis*, *Araucaria*, *Libocedrus*, *Podocarpus*, *Dacrydium*, *Phyllocladus*, with new *spp.*

Local

Formosa: LI, Taiwania 1 (1950) 285–310.–Key to Formosan *spp.*

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 14–15.–List.

MIQUEL, Pl. Jungh. (1851) 1–6.–List; 2 new *spp.*

DE VRIESE, Pl. Nov. Ind. Bat. Or. (1845) 5–8, t. 2.–Descr. *Pinus merkusii.*

Malay Peninsula: CORNER, Gard. Bull. Str. Settl. 10 (1939) 239–247, t. 5–10.–*Dacrydium*; one new *sp.*; key; notes on *Agathis.*

—, *ibid.* 10 (1939) 251–252.–Notes on some *Podocarpus.*

—, Wayside trees of Malaya (1940) 713–725.

RIDLEY, J. Str. Br. R. As. Soc. *no* 60 (1911) 53–68.–Complete account; no key.

Java: BACKER, DANSER & WASSCHER, Bekn. Fl. Java (em. ed.) 2 (1940) fam. 17–21.–Also cult. *spp.*; in Dutch; keys.

Borneo: STAPF, in GIBBS, J. Linn. Soc. Lond. Bot. 42 (1914) 191–195.–List; new *Dacrydium* from Mt Kinabalu.

Philippines: FOXWORTHY, Philip. J. Sc. 6 (1911) Bot. 132–172, t. 28–31.–Complete account; keys.

New Guinea: BECCARI, Malesia 1 (1877) 178–181.–List.

GIBBS, Contr. Fl. Phytog. Arfak Mts (1917) 78–87, fig. 3–6b.–List & new *Dacrydium* and *Libocedrus.*

KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 55 (1941) 385–387.–List.

KOORDERS, Nova Guinea 8 (1909) 177–182.–*Taxaceae.*

—, *ibid.* (1912) 613–616.–Pinaceae, Taxaceae.

LAUTERBACH, Bot. Jahrb. 50 (1913) 46–53, fig. 1–2.–Revision; keys to *Libocedrus* and *Araucaria.*

MERRILL & PERRY, J. Arn. Arb. 30 (1949) 39.–*Dacrydium sp.*

PILGER, Bot. Jahrb. 54 (1917) 207–211.–*Taxaceae*; keys to *Podocarpus* and *Phyllocladus spp.*

—, *ibid.* 68 (1937) 244–247.–*Podocarpaceae*; list; new *Podocarpus.*

—, *ibid.* 69 (1938) 252–253.–New *Dacrydium* and *Podocarpus.*

RIDLEY, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 158–159.–New *Podocarpus.*

WHITE, J. Arn. Arb. 28 (1947) 259–260.–Critical notes; a new section of *Araucaria.*

Genera

Agathis: FOXWORTHY, Philip. J. Sc. Sect. A, 5 (1910) 173–175.–*A. alba.*

MEIJER DREES, Bull. Jard. Bot. Btzg III, 16 (1940) 455–474.–Revision; various new *spp.*; key.

Araucaria: BARSALI, Atti Soc. Toscana Sc. Nat. Pisa 25 (1909) 145–185, t. 1 (fig. 1–15).–Complete revision; syn.; keys.

WHITE, J. Arn. Arb. 28 (1947) 259–260.–New sect.; critical notes Pap. *spp.*

Cupressus: MASTERS, J. Linn. Soc. Lond. Bot. 31 (1896) 312–363.–Revision.

Libocedrus: FLORIN, Svensk Bot. Tidskr. 24 (1930) 117–131, t. 1–2.–E. Asiat. *spp.*

— & BOUTELJE, Acta Hort. Berg. 17: 2 (1954) 1–37, t. 1–10.–The genus segregated into 5 genera; key to the *spp.* by external morph. & epiderm. characters.

LI, J. Arn. Arb. 34 (1953) 17–34, t. 1–2.–Splitting *Libocedrus* into 4 segregate genera; the New Guinean species belong to *Papuacedrus.*

Pinus: ENGELMANN, Trans. St Louis Acad. Sc. 4 (1880) 161–190, t. 1–3.–Revision; key.

MASTERS, J. Linn. Soc. Lond. Bot. 35 (1904) 560–659.–Revision.

SHAW, Arn. Arb. Publ. 5 (1914) iv + 96 pp.–Revision.

Podocarpus: GRAY & BUCHHOLZ, J. Arn. Arb. 31 (1950) 82–92, t. 1–4, 93–97.–Taxon. revision; S. Pac. *spp.* of *§ Stachycarpus* and *§ Sundacarpus*; notes on *P. amara.*

WASSCHER, Blumea 4 (1941) 359–482.–Revision Indonesian *spp.*; keys.

CONNARACEAE

PLANCHON, J. E., Prodromus monographiae ordinis Connaracearum (Linnaea 23, 1850, 409–442).

RADLKOFER, L., Über die durchsichtigen Punkte und andere anatomische Charactere der Connaraceae (Sitz. Ber. Bayer. Akad. Wiss. 16, 1886, 345–378).

SCHELLENBERG, G., Beiträge zur vergleichenden Anatomie und zur Systematik der Connaraceen. Thesis, Zürich (1910) 1–158.

—, Bot. Jahrb. 60 (1925) 207–251.–Sections.

—, Pflanzenreich Heft 103 (1938) 1–326.

Local

Sumatra: MERRILL, Pap. Mich. Acad. Sc. Arts & Lett. 23 (1938) 178–179.–Records; a new *Rourea.*

Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 76 (1917) 84.–Record.

—, Philip. J. Sc. 13 (1918) Bot. 68–73.–5 new *Connarus spp.*

—, J. Str. Br. R. As. Soc. *no* 85 (1922) 198–201.–3 new *Agelaeas* and a *Connarus*; recomb. in *Cnestis.*

RIDLEY, Kew Bull. (1938) 275–276.–List records.

SCHELLENBERG, Bot. Jahrb. 59 (1924) Beibl. 131, p. 22–41.–Important survey of Born. *spp.*; several new *spp.* and comb.

Java: BAKHUIZEN VAN DEN BRINK, Blumea 6 (1950) 365.–New name in *Connarus.*

Philippines: ELMER, Leafl. Philip. Bot. 10 (1939) 3717–3719.–2 new *spp.*

MERRILL, Philip. J. Sc. 4 (1909) Bot. 117–128.–Revision; keys.

New Guinea: MERRILL & PERRY, J. Arn. Arb. 23 (1942) 391.–A new *Rourea*.
SCHELLENBERG, Bot. Jahrb. 58 (1923) 178–181.–Revision; no key; 2 new *spp.*

Genera

Cnestis: ANDREAS & PROP, Blumea 7 (1954) 602–616, fig. 1–7.–Revision, SE. Asiat. & Mal. *spp.*

Ellipanthus: PRAIN, J. As. Soc. Beng. 59, ii (1890) 208–210, t. 8.–Key to Ind. *spp.*

Pseudellipanthus: SCHELLENBERG, in MEZ, Bot. Arch. 1 (1922) 314–315.–Type descr.; Borneo; key.

Rourea: SCHELLENBERG, Bot. Jahrb. 56 (1920) 21–29.–Critical remarks on various neotrop. *spp.*

CONVOLVULACEAE

CHOISY, J. D., Convolvulaceae orientales, *etc.* (Mém. Soc. Phys. Hist. Nat. Genève 6, 1833, 383–502, t. 1–6).–Conspectus of genera and *spp.*; key only to genera; descr. Indo-Mal.-Austr. *spp.*–Also reprinted (1834) with independent pagination.

—, De Convolvulaceis dissertatio secunda, *etc.* (*ibid.* 8, 1838, 43–86, t. 1–4).–Continuation of the above; *ditto*.

—, De Convolvulaceis dissertatio tertia, *etc.* (*ibid.* 9, 1841, 261–288, t. 1–5).–Monogr. *Cuscuta*; no key.

HALLIER *f.*, H., Versuch einer natürlichen Gliederung der Convolvulaceen, *etc.* (Bot. Jahrb. 16, 1893, 453–594).–Evaluation morph. & anat. characters; keys to tribes and genera.

—, Bausteine zu einer Monographie der Convolvulaceen (Bull. Herb. Boiss. 5, 1897, 366–387, 736–754, 804–820, 996–1013, 1021–1052; *ibid.* 6, 1898, 714–724; *ibid.* 7, 1899, 408–418).–No keys.

OOSTSTROOM, S. J. VAN, The Convolvulaceae of Malaysia I–V (Blumea 3, 1938, 62–94; *ibid.* 1939, 267–371; *ibid.* 1940, 481–582; *ibid.* 5, 1943, 339–411; *ibid.* 1945, 689–691; *ibid.* 6, 1950, 337–348; *ibid.* 7, 1952, 171–178).–Revision, not complete for *Argyreia*; *Erycibe* not treated; keys!

— & R. D. HOOGLAND, Fl. Mal. I, 4 (1952) 388–512, fig. 1–62.

Local

Africa: HALLIER *f.*, Bot. Jahrb. 18 (1893) 81–160.–Enum.; no keys.

India: PRAIN, J. As. Soc. Beng. 63, ii (1894) 83–115.–Additions to Fl. Br. Ind.; many new *spp.*; no keys.
—, *ibid.* 65, ii (1896) 536–538.–*Ditto*.
SANTAPAU, J. Bombay Nat. Hist. Soc. 47 (1947) 337–354.–Revision *spp.* of Bombay Pres.; keys.

Siam: KERR, Kew Bull. (1941) 10–21.–Descr. new *spp.*

Sumatra: MERRILL, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 189–191.–2 new *Erycibes*.
VAN OOSTSTROOM, Blumea 5 (1945) 686–688, fig. 1.–New *Argyreia*.
—, *ibid.* 7 (1952) 171–178.–New *Argyreias*.
RIDLEY, J. Fed. Mal. St. Mus. 8, 4 (1917) 64–65.–List; new *Lettsomia*.

Malay Peninsula: HOOGLAND, Blumea 7 (1952) 179–192, fig. 1.–Revision *Argyreia*; key.

Borneo: VAN OOSTSTROOM, Kew Bull. (1938) 175–176.–Records RICHARDS coll.; one new *Merremia*.
—, Blumea 7 (1952) 175–177, fig. 1.–New *Argyreias*.

Philippines: ELMER, Leafl. Philip. Bot. 10 (1939) 3720–3722.–2 new *Riveas*.
MERRILL, Philip. J. Sc. 7 (1912) Bot. 244–245.–Note on *Ipomoea reptans*; new comb. in *Merremia*.
—, *ibid.* 26 (1925) 488–489.–New *Lettsomia*.
—, *ibid.* 29 (1926) 485.–*Ditto*.

New Guinea: VAN OOSTSTROOM, J. Arn. Arb. 29 (1948) 413–418, t. 1.–Misc. notes; new *Erycibe*; key to Pap. *Erycibe*.
—, Nova Guinea n.s. 6 (1955) (in the press).–Complete survey.
PILGER, Bot. Jahrb. 59 (1924) 84–86.–Descr. new *spp.*

Genera

Argyreia (*Rivea*, *Lettsomia*): HOOGLAND, Blumea 7 (1952) 179–192, fig. 1.–Rev. Mal. *spp.*; key.
VAN OOSTSTROOM, Blumea 6 (1950) 337–348.–Key & descr.
—, *ibid.* 7 (1952) 171–178, fig. 1–2.–Additions.

Cuscuta: ENGELMANN, Trans. Acad. Sc. St Louis 1, *no* 3 (1859) 453–523.–Syst. arrangement of *spp.*; key to groups, but no complete key to *spp.*
—, Generis Cuscutae species, *etc.* Berlin (1860) viii + 88 pp.–Latin ed. by ASCHERSON of the above.
YUNCKER, Illinois Biol. Monogr. 6 (1921) 91–241, t. 1–13.–Revision N. Amer. & W. Indian *spp.*; keys.
—, Mem. Torrey Bot. Club 18 (1932) 113–331, fig. 1–158.–Monogr.; keys.

Decalobanthus: VAN OOSTSTROOM, Blumea 2 (1936) 98–100.–Endemic in Sumatra.

Erycibe (*Fissipetalum*): HOOGLAND, Blumea 7 (1953) 310–319.–Descr. new *spp.*
—, *ibid.* 7 (1953) 342–361.–Critical review of all *spp.*; enum.

Evolvulus: VAN OOSTSTROOM, A monograph of the genus Evolvulus (1934) 1–267.–Keys.

Ipomoea: HOUSE, Ann. N.Y. Ac. Sc. 18 (1908) 181–263.–Rev. N. Amer. *spp.*

Hewittia (*Shutereia*): CHODAT & ROULET, Bull. Herb. Boiss. 1 (1893) 191–196, 5 fig.–Critical remarks.

Neuropeltis: VAN OOSTSTROOM, Blumea 5 (1942) 268–273, fig. 1–2.–Rev. Indo-Mal. *spp.*; key.

CORIARIACEAE

GOOD, R. D'O, New Phytologist 29 (1930) 170–198.–Geogr. distr.; groups; no key.

MAXIMOWICZ, K. J., De Coriaria, *etc.* (Mém. Acad. Imp. Sc. St Pétersb. VII, 29, *no* 3, 1881, 1–13).–Survey of *spp.* and morph. & anat. differences of *spp.* of N. and S. hemisphere; key (copied in Bot. Jahrb. 3, 1882, 186–187).

Local

Philippines: Merrill, En. Philip. Fl. Pl. 2 (1923) 465.–Record.

New Guinea: Warburg, Bot. Jahrb. 16 (1892) 22. –New *spp.*

New Zealand: Oliver, Rec. Dominion Mus. 1 (1942) 21–43, 6 pl.–Revision; key.

CORNACEAE

(*excl. Alangiaceae & Nyssaceae*)

Danser, B. H., The Cornaceae, sensu stricto, of the Netherlands Indies (Blumea 1, 1934, 46–74). –Full revision of Mal. *Mastixia.*

Hutchinson, J., Neglected generic characters in the family Cornaceae (Ann. Bot. n.s. 6, 1942, 83–93, fig. 1–5).–Splitting of the genus *Cornus.*

Wangerin, Pflanzenreich Heft 41^4 (1910) 1–110, fig. 1–24.

Local

Banka: Valeton, Ic. Bog. 2 (1906) 267–268, t. 179.–New *sp.*

Java: Miquel, Pl. Junghuhn. (1855) 426.–New *Mastixia.*

Philippines: Merrill, Philip. J. Sc. 26 (1925) 486–487.–New *Mastixia.*
Wangerin, in Fedde, Rep. 10 (1912) 273.–New *Mastixia.*

Solomons: Merrill & Perry, J. Arn. Arb. 21 (1940) 527.–Record.

Genera

Alangium. See *Alangiaceae.*

Mastixiodendron. See *Rubiaceae.*

Nyssa. See *Nyssaceae.*

CORSIACEAE

Local

New Guinea: Beccari, Malesia 1 (1878) 238–240, t. 9.–Type descr.
Gibbs, Contr. Fl. Phytogr. Arfak Mts (1917) 103–105, fig. 7.–Record & new *sp.*
Schlechter, Bot. Jahrb. 49 (1913) 109–112, fig. 1.–Descr. 2 new *spp.*
Smith, J. J., Nova Guinea 8 (1909) 197.
—, *ibid.* 8 (1912) 893.
—, *ibid.* 12 (1914) 171–172, t. 54.–New *sp.*
Williams, Bot. Mus. Leafl. Harv. Univ. 12 (1946) 179–182.–New *sp.*

CORYNOCARPACEAE

Hemsley, W. Botting & Fritsch, On the genus Corynocarpus Forst. (Ann. Bot. 17, 1903, 743–760, t. 36; *ibid.* 18, 1904, 179–180).–Anat.; descr. gen. and 2 *spp.*

Krause, K., Pflanzenfamilien ed. 2, 20b (1942) 22–35.

Steenis, C. G. G. J. van, Fl. Mal. I, 4 (1951) 262–264, fig. 1–2.

Tieghem, Ph. van, Sur le genre Corynocarpe, considéré comme type d'une famille distincte, les Corynocarpacées (in Morot, J. de Bot. 14, 1900, 193–197).–Anat.; morph.; taxon. position.

Local

New Guinea: Merrill & Perry, J. Arn. Arb. 22 (1941) 541–542.–Record.
Van Steenis, J. Arn. Arb. 28 (1947) 421.–Record.

Queensland: White, Contr. Arn. Arb. 4 (1933) 57, t. 5.–Descr. new *sp.*

Genera

Corynocarpus: van Steenis, Bull. Jard. Bot. Btzg III, 13 (1933) 99–101, fig. 1.–Rev. Mal. *sp.*

CRASSULACEAE

Backer, C. A., Fl. Mal. I, 4 (1951) 197–202, 2 fig.

Berger, A., Pflanzenfamilien ed. 2, 18a (1930) 352–483, fig. 183–212.

Candolle, A. P. de, Mémoire sur la famille des Crassulacées. Paris (1828) 1–47, t. 1–13.–Discussion of genera & descr. new *spp.*; no key; not dealing with Mal. *spp.*

Local

Java: Koorders, Bull. Jard. Bot. Btzg III, 1 (1919) 169–180, t. 14–15.–Descr. new *Kalanchoe* from E. Java.

Genera

Kalanchoe: Hamet, Bull. Herb. Boiss. II, 7 (1907) 869–900; *ibid.* 8 (1908) 17–48.–Monograph.

Sedum: Fröderström, Act. Hort. Gothob. 5 (1930) App. 1–75; *ibid.* 6 (1931) App. 1–111.
Praeger, J. R. Hort. Soc. Lond. 46 (1921) 1–314.–Only cult. *spp.*

CRUCIFERAE

Miquel, F. A. W., Ill. Fl. Arch. Ind. (1870) 14–19, t. 9–10.–Synopsis; no keys.

Schulz, O. E., Brassiceae, pars prima (Pflanzenreich Heft 70, 1919, 1–290, fig. 1–35).–*Brassica, Rapistrum, Sinapis.*

—, *ditto*, pars secunda (*ibid.* Heft 84, 1923, 1–100, fig. 1–26).

—, Sisymbrieae (*ibid.* Heft 86, 1924, 1–388, fig. 1–74).–*Sisymbrium.*

—, Draba et Erophila (*ibid.* Heft 89, 1927, 396, fig. 1–35).

—, Pflanzenfamilien ed. 2, 17b (1936) 227–658, fig. 121–426.

Local

Malay Peninsula: Burkill, Gard. Bull. Str. Settl. 5 (1930) 99–117.–Key to cultivated *Brassicas.*
Furtado & Holttum, M. A. H. A. Mag. 10 (1940) 47–51.–Cult. *Brassicas*; with key to Chin. vernac. names.

Java: Hochreutiner, Candollea 2 (1925) 367–372. –Records; *Nasturtium* under *Rorippa.*

New Guinea: Merrill & Perry, J. Arn. Arb. 24 (1943) 207.–Records, also of *Papuzilla.*

RIDLEY, Trans. Linn. Soc. Bot. II, 9 (1916) 16–17, t. 1, fig. 7–14.–Descr. *Papuzilla.*
SCHULZ, Bot. Jahrb. 55 (1918) 266–272, fig. 1.—Key.

Genera

Brassica: BAILEY, Gentes Herb. 1 (1922) 53–108, fig. 18–49; *ibid.* 2 (1930) 209–267, fig. 108–146; *ibid.* 4 (1940) 319–330, fig. 199–210.–Cult. *spp.*; keys.
LATHOUWERS, Bull. Inst. Agron. & Sta. Rech. Gembloux 2 (1933) 3–16.–Cult. *spp.*
PEARSON, Proc. Amer. Soc. Hort. Sc. 25 (1928) 105–110.–Classification of genus.
PRAIN, Dept Land Rec. & Agric. Bengal, Agric. ser. *no* 3, Bull. *no* 4 (1898); repr. in PRAIN, Bot. Not. & Pap. (1901) 145–222, t. 1–10.–Key, descr. & fig. cult. Bengal *spp.*
SABNIS, Ind. J. Agric. Sc. 5 (1935) 559–578.–Revision Indian *spp.*, var. & strains (types); key.
Cardamine: SCHULZ, Bot. Jahrb. 32 (1903) 280–623.–Monograph; keys.
Nasturtium: SPRAGUE, J. Bot. 62 (1924) 225–228.–Nomencl. of *N. officinale.*

CRYPTERONIACEAE

NIEDENZU, F., Zur Kenntnis der Gattung Crypteronia Bl. (Bot. Jahrb. 15, 1892, 161–179, 1 fig.).–Taxon. position; revision; key.

Local

New Guinea: MERRILL & PERRY, J. Arn. Arb. 22 (1941) 270.–Record.

CUCURBITACEAE

COGNIAUX, A., in DC. Mon. Phan. 3 (1881) 325–954.
—, Fevilleae et Melothrieae (Pflanzenreich Heft 66, 1916, 1–277, fig. 1–65).–*Alsomitra (= Neoalsomitra), Cerasiocarpum, Hemsleya, Macrozanonia (= Alsomitra), Melothria, Muellerargia, Thladiantha, Zanonia.*
— & H. HARMS, Cucurbiteae-Cucumerineae (Pflanzenreich Heft 88, 1924, 1–246, fig. 1–26).–*Citrullus, Cucumus, Gymnopetalum, Lagenaria, Luffa.*
ZIMMERMANN, A., Die Cucurbitaceae. Jena (1922). Pt I. Beiträge zur Anatomie und Physiologie, i–viii, 1–205, fig. 1–95; pt II. Beiträge zur Morphologie, Anatomie, Biologie, Pathologie und Systematik, i–iv, 1–86, fig. 1–99.–General chapters; taxon. consisting of descr. of some new *spp.* from Africa.

Local

India: CHAKRAVARTY, Ind. J. Agric. Sc. 16 (1946) 1–89.–Studies Ind. *spp.*; special remarks on distr. & uses of economic *spp.*
Sumatra: MERRILL, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 199–201.–New *Melothria*; *Siraitia n.g.*
—, Contr. Arn. Arb. 8 (1934) 165.–2 records.
RIDLEY, J. Mal. Br. R. As. Soc. *no* 87 (1923) 62.–Records.
Borneo: MERRILL, J. Mal. Br. R. As. Soc. 1 (1923) 44–45.–New *Melothria* and *Momordica.*
Lesser Sunda Islands: JACOBS, Blumea 7 (1954) 617.–Distr. *Gynostemma hederifolia.*
VAN WOERDEN, Trop. Natuur 29 (1940) 6, fig. 7.–Fig. of 2 podagric *spp.*
Philippines: ELMER, Leafl. Philip. Bot. 10 (1939) 3722–3723.–New *Alsomitra.*
MERRILL, Philip. J. Sc. 29 (1926) 495.–New *Melothria.*
—, *ibid.* 30 (1926) 429.–Record *Zanonia (Juppia).*
New Guinea: COGNIAUX, Bull. Acad. Roy. Belg. III, 14 (1887) 355, 363.–New *Melothria* and *Alsomitra.*
HARMS, Bot. Jahrb. 60 (1926) 150–161.–Synopsis; keys in *Alsomitra* and *Trichosanthes.*
JACOBS, Blumea 7 (1954) 617–621, fig. 1–2.–New *Melothria.*
MERRILL & PERRY, J. Arn. Arb. 29 (1948) 167–168.–3 new *Melothrias*; note on a *Gynostemma.*
—, *ibid.* 30 (1949) 56–59.–Notes on *Neoalsomitra*; 3 new *Melothrias*; 2 new *Trichosanthes.*
PULLE, Nova Guinea 8 (1910) 405–406.–List; new *Trichosanthes.*
—, *ibid.* (1912) 689.–Records.

Genera

Alsomitra (*Macrozanonia*); COGNIAUX, Bull. Soc. Bot. Belg. 43 (1906) 357–360.–Descr.; tax. position.
DE WIT, Bull. Bot. Gard. Btzg III, 18 (1949) 193–200.–Revision.
Citrullus: FOSBERG, Taxon 2 (1953) 99–101.–Prop. to conserve *Citrullus.*
Cucumis: KITAMURA, Act. Phytotax. & Geobot. 14 (1950) 41–44, 2 fig.–East Asiat. *spp.*; *C. melo* and *C. sativus* with varieties.
NAUDIN, Ann. Sc. Nat. IV, 11 (1859) 1–87.–Revision of *spp.* and var.; no key.
Cucurbita: BAILEY, Gent. Herb. 2 (1929) 63–115, fig. 29–64.–Domesticated *spp.*; key.
—, *ibid.* 6 (1943) 267–322.–American *spp.*
NAUDIN, Ann. Sc. Nat. IV, 6 (1856) 1–73.–Revision; no key.
RUSSELL, J. Wash. Acad. Sc. 14 (1924) 265.–Ident. of seeds.
WHITAKER, Ann. Missouri Bot. Gard. 34 (1947) 101–111, t. 11–12.–Amer. origin of cultiv. *spp.*
WHITAKER & BOHN, Econ. Bot. 4 (1950) 52–81.–Taxonomy, genetics, *etc.*; key to 5 *spp.* distinguished.
Hodgsonia: KUNDU, J. Bot. 76 (1938) 364–366.–Revision; key.
—, J. Bomb. Nat. Hist. Soc. 43 (1942) 362–388.–Indian *spp.*
Luffa: EXELL, J. Bot. 71 (1934) 352.–Synon. of *L. aegyptica.*
Neoalsomitra *(Alsomitra auct.)*: HUTCHINSON, Ann Bot. n.s. 6 (1942) 95–102.–Monogr.; key.
JACOBS, Blumea 7 (1954) 621–622, fig. 3.–Distr. *N. integrifoliola.*
Thladiantha: GAGNEPAIN, Bull. Mus. Hist. Nat.

Paris 24 (1918) 287–296.–Revision Asiat. *spp.* in Paris herb.

Trichosanthes: Kundu, J. Bot. 77 (1939) 9–14.–New *spp.* from India.

—, J. Bomb. Nat. Hist. Soc. 43 (1942) 362–388.–Revision Indian *spp.*

Zanonia *(Juppia)*: Harms, Notizbl. Berl.-Dahlem 8 (1924) 717–719.–Reduction.

Merrill, Philip. J. Sc. 30 (1926) 429.–Record from Philippines.

CUNONIACEAE

Engler, A., Pflanzenfamilien ed. 2, 18a (1930) 229–262.

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1934) 196.–List *spp.* of Mal. mountain genera.

Local

Borneo: Airy Shaw, Kew Bull. (1940) 259–261.–New *Weinmannia.*

Van Steenis, J. Bot. 70 (1934) 3–5.–New *Weinmannia.*

Moluccas: Valeton, Ic. Bog. 3 (1907) 69–70, t. 228.–New *Schizomeria* from Ambon.

New Guinea: Gibbs, Contr. Fl. Phytog. Arfak Mts (1917) 141–143.–New *spp.* of *Pullea* and *Spiraeanthemum.*

Kanehira & Hatusima, Bot. Mag. Tokyo 56 (1942) 105–109.–New *spp.* in *Aistopetalum, Betchea,* and *Opocunonia.*

Mattfeld, J. Arn. Arb. 20 (1939) 432–436.–New *spp.* in *Ceratopetalum* (1) and *Schizomeria* (4).

Perry, J. Arn. Arb. 30 (1949) 139–165.–Keys to *spp.* represented at the Arn. Arb., *Weinmannia* excepted; various new *spp.*

Pulle, Nova Guinea 8 (1911) 645–646.–New *Ackama* and *Spiraeanthemum.*

Ridley, Trans. Linn. Soc. Bot. II, 9 (1916) 56–63, t. 4, fig. 55.

Schlechter, Nova Guinea 12 (1914) 491–493.–New *spp.* in *Spiraeanthemum, Pullea,* and *Weinmannia.*

—, Bot. Jahrb. 52 (1915) 139–166, fig. 1–9.–Synopsis; keys to *spp.*; various new genera.

—, *ibid.* 55 (1918) 194.–Reduction *Cremnobates* to *Schizomeria.*

Schmidt, Nova Guinea 14 (1924) 150.–New *Schizomeria.*

Solomons: Burtt, Kew Bull. (1936) 462.–Record of *Spiraeopsis celebica.*

Fiji-Samoa: Smith, A. C., J. Arn. Arb. 33 (1952) 119–149.–Revision; keys. First record of *Pullea.*

Genera

Ackama: White & Francis, Proc. R. Soc. Queensl. 47 (1936) 59.–Discussions generic delimit. with *Betchea* in Australia.

CUPRESSACEAE

See Coniferae

CUPULIFERAE

See Fagaceae

CYANASTRACEAE

Clausen, R. T., A review of the Cyanastraceae (Gent. Herb. 4, 1940, 293–304).–Revision *Cyanastrum*; key.

Engler, A., Pflanzenfamilien ed. 2, 15a (1930) 188–190, fig. 72.

Local

Java: Backer, Handb. Fl. Java 3 (1924) 42–43.–Only cult. *spp.*

CYCADACEAE

Blume, C. L., Rumphia 4 (1848) 11–18, t. 176B–C.

Miquel, F. A. W., Monographia Cycadearum. Utrecht, folio (1842) 1–82, t. 1–8.–Monograph; keys.

—, Prodromus systematis Cycadearum (1861) 1–36.–Survey; partial keys.

—, Nouveaux matériaux pour servir à la connaissance des Cycadées (Adansonia 9, 1868, 29–73).–Revision.

Pilger, R., Pflanzenfamilien ed. 2, 13 (1926) 44–82, fig. 48–82.

Schuster, J., Pflanzenreich Heft 99 (1932) 1–168.

Local

Malay Peninsula: Ridley, J. Str. Br. R. As. Soc. *no* 60 (1911) 67–68.–Enum.

Java: Backer, Handb. Fl. Java 1 (1924) 25–27.–In Dutch; key.

Philippines: Brown & Kienholz, Philip. J. Sc. 26 (1925) 47–50, t. 1–2.–New *sp.* from Luzon hills.

Foxworthy, Philip. J. Sc. 6 (1911) Bot. 150–152, t. 26–27.–Revision; key.

Merrill, Philip. J. Sc. 60 (1936) 233–241, t. 1–4.–New *sp.* from Culion.

New Guinea: Beccari, Malesia 1 (1877) 183.–Record.

Kanehira & Hatusima, Bot. Mag. Tokyo 55 (1941) 385.–Record.

Pulle, Nova Guinea 8 (1910) 343.–*Ditto.*

Micronesia: Kanehira, J. Jap. Bot. 14 (1938) 579–588, fig. 1–7.–Rev.; no key.

Genera

Cycas: Stapf, Kew Bull. (1916) 1–8.–Distinction between *C. circinalis, thouarsii* and *rumphii* tabulated.

Tandy, J. Bot. 65 (1927) 281.–Interpr. of *Cycas inermis* Lour.

Warburg, O., Monsunia 1 (1900) 178–181.–Revision; key.

CYCLANTHACEAE

Gleason, H. A., New or noteworthy Monocotyledons from British Guiana (Bull. Torr. Bot. Club 56, 1929, 1–8).–Revision of *Carludovica.*

Harling, G., Studien über den Blütenbau und die Embryologie der Familie Cyclanthaceae (Svensk Bot. Tidskr. 40, 1946, 257–272, fig. 1–4).

—, Contribution to the knowlegde of the Cyclanthaceae in Ecuador (Acta Hort. Berg. 15, 9, 1950, 185–206).

Kuntze, O., Cyclanthaceae (Rev. Gen. Pl. 1891, 737–738).–Revision of *Carludovica*; key.

Surange, K. R., A contribution to the morphology & anatomy of the Cyclanthaceae (Trans. Nat. Inst. Sc. India III, 4, 1949, 159–209).

CYPERACEAE

Boeckeler, O., Die Cyperaceen des Königlichen Herbariums zu Berlin (Linnaea 35, 1868, 397–612; *ibid.* 36, 1870, 271–512, 691–768; *ibid.* 37, 1871, 1–144, 1873, 520–647; *ibid.* 38, 1874, 223–544; *ibid.* 39, 1875, 1–152; *ibid.* 40, 1876, 327–452; *ibid.* 41, 1877, 145–356).–Also as a reprint in 2 vols. Berlin (1879).

—, Bot. Jahrb. 5 (1884) 497–521.–New *Cyp.*, some Mal.

Clarke, C. B., Reductions of the Wallich Herbarium (Kew Bull. 1907, 264–281).–Modern names of the *Cyperaceae* in the Wallichian numerical list.

—, New genera and species of Cyperaceae (Kew Bull. add. ser. 8, 1908, 1–196).–Extract from MS. monogr.; new genera; many new *spp.*; partial keys.

—, Illustrations of Cyperaceae (1909) i-vi, 1–6, t. 1–144.

Holttum, R. E., The spikelet in Cyperaceae (Bot. Rev. 14, 1948, 525–541).–Discussion morph. value.

Kükenthal, G., Caricoideae (Pflanzenreich Heft 38, 1909, 1–824, fig. 1–128).–*Carex*, *Schoenoxiphium*, *Uncinia*.

—, Scirpoideae-Cypereae (Pflanzenreich Heft 101, 1935–1936, 1–671, fig. 1–65).–*Cyperus*.

—, Vorarbeiten zu einer Monographie der Rhynchosporoideae (in Fedde, Rep. 44, 1938, 1–32, 65–101, 161–195; *ibid.* 46, 1939, 13–32, 65–76; *ibid.* 47, 1939, 101–119, 209–216; *ibid.* 48, 1940, 49–72, 195–250; *ibid.* 50, 1941, 19–50, 112–128; *ibid.* 51, 1942, 1–17, 139–193; *ibid.* 52, 1943, 52–111; *ibid.* 53, 1944, 85–100, 187–219).–Monograph; keys; extracted for genera in Malaysia.

—, *ditto* (Bot. Jahrb. 74, 1949, 375–509; *ibid.* 75, 1950, 90–195; *ibid.* 75, 1951, 273–314; *ibid.* 75, 1952, 451–497).–*Ditto*.

—, Neue Cyperaceen aus dem Malayischen und Papuanischen Gebiet (Bull. Jard. Bot. Btzg III, 16, 1940, 300–323).–Also printed in Fedde, Rep. 53 (1944) 100–111.–Various important critical notes, records and new *spp.*

—, Neue oder nicht genügend bekannte Cyperaceen (Mitt. Thür. Bot. Ver., N. F., Heft 50, 1943, repr. 1–13).–Misc. notes on *Cyperus*, *Fimbristylis*, and *Scirpus*, mostly Papuan; some from the Philippines and Java; some new *spp.*

Kunth, C. S., Enumeratio plantarum II. Cyperaceae. Stuttgart (1837) 1–592.–Critical enumeration; partial keys.

Kurz, S., Über Pandanophyllum and verwandte Gattungen, insbesondere solche, welche im Indischen Archipel vorkommen (J. As. Soc. Beng. 38, ii, 1869, 70–85).–Prelim. revision of *Mapanieae*; partial key to genera.

Miquel, F. A. W., Sur quelques genres des Cypéracées de la tribu des Hypolytrées (Ill. Fl. Arch. Ind. 1870, 57–66, t. 20–28).–Descr.

Nelmes, E., Facts and speculations on phylogeny in the tribe Cariceae of the Cyperaceae (Kew Bull. 1951^3, 427–436, 1952).–Phylog. considerations.

Pfeiffer, H., Vorarbeiten zur systematischen Monographie der Cyperaceae-Mapanieae (in Mez, Bot. Arch. 12, 1925, 446–472).–Survey of genera & *spp.* and their synonymy; key to genera.

Steudel, E. G., Synopsis plantarum Glumacearum pars II. Cyperaceae. Stuttgart (1855) 1–246, 314–319.–Enum. descr. in Latin; contains also *spp.* based on specimens of Cuming, Zollinger, *etc.*

Uittien, H., Studies in Cyperaceae-Mapanieae I–VIII (Rec. Trav. Bot. Néerl. 33, 1936, 133–155, 277–291, fig. 1–3).–Precursory to revision of Mal. *spp.*

Local

India: Clarke, J. Linn. Soc. Lond. Bot. 34 (1898) 1–146.–Cyperaceae used for phytogeogr. subdivisions of India; list of material used in preparing the account in Fl. Br. Ind.
Nees von Esenbeck, in Wight, Contr. Bot. India (1834) 69–129.–Revision; partial keys.
Sedgwick, J. Bombay Nat. Hist. Soc. 25 (1918) 682–700; *ibid.* 26 (1918) 192–209.–Revision and keys to *Cyp.* of Bombay Presid.

Sumatra: Backer, Bull. Jard. Bot. Btzg III, 2 (1920) 328.–New *Mapania.*
Kükenthal, Bull. Jard. Bot. Btzg III, 16 (1940) 300–323.–Many new records.
Nelmes, Kew Bull. (1952) 83–84.–New *Carex*.
Ridley, J. Bot. 23 (1885) 35–36.–New *Carex*.
—, J. Mal. Br. R. As. Soc. *no* 87 (1923) 107–108. –List.

Malay Peninsula: Clarke, J. Linn. Soc. Lond. Bot. 37 (1904) 1–16.–*Carices* listed.
Holttum, Gard. Bull. Str. Settl. 11 (1947) 293–296, fig. 6.–New comb. and *spp.* in *Mapania*, *Scleria*, and *Diplacrum.*
Nelmes, Kew Bull. (1937) 353–355, 1 fig.–New *Carex*.
—, *ibid.* (1950) 209.–*Ditto.*
Ridley, J. Str. Br. R. As. Soc. *no* 23 (1891) 1–19. –Listed records; no new *spp.*; no key.
—, Mat. Fl. Mal. Pen. (Monocot.) 3 (1907) 55–118.–Keys.
Uittien, Gard. Bull. Str. Settl. 10 (1939) 182.–New *Mapania*.

Java: Kükenthal, Bull. Jard. Bot. Btzg III, 16 (1940) 300–323.–Various records.
Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 399.–Record of *Scleria oryzoides.*

Borneo: Kükenthal, Bull. Jard. Bot. Btzg III, 14 (1936) 47–49, fig. 1.–New *Oreobolus.*
—, *ibid.* 16 (1940) 300–323.–Various records.
Merrill, Philip. J. Sc. 11 (1916) Bot. 53–54.–2 new *Mapanias.*
—, J. Str. Br. R. As. Soc. *no* 76 (1917) 78–80.–New *Mapania*; further listed records.
—, *ibid. no* 85 (1922) 156–159.–4 new *Mapanias.*

Pfeiffer, Mitt. Inst. Allg. Bot. Hamburg 7 (1928) 166–176.–Listed records Winkler coll.; a new *Scirpus*.

Ridley, J. Str. Br. R. As. Soc. *no* 46 (1906) 221–228.–Enum.; new *spp.* in the *Mapanieae*.

Stapf, Trans. Linn. Soc. Bot. II, 4 (1894) 244–246.–Kinabalu records; new *spp.* in *Scirpus* and *Cladium*.

— & Turrill, J. Linn. Soc. Lond. Bot. 42 (1914) 173–185, fig. 7.–List of Kinabalu records; new *spp.* in *Scirpus*, *Schoenus*, *Vincentia*, and *Carex*; *Lophoschoenus n.g.*

Uittien, Rec. Trav. Bot. Néerl. 32 (1935) 193–202.–List Richards's coll.

Celebes: Kükenthal, Bull. Jard. Bot. Btzg III, 16 (1940) 300–323.–Various records.

Philippines: Clarke, Philip. J. Sc. 2 (1907) Bot. 77–110.–List of *spp.* represented at Kew.

Elmer, Leafl. Philip. Bot. 3 (1910) 853–855.–New *spp.* in *Carex*, *Cladium* and *Fimbristylis*.

—, *ibid.* 10 (1938) 3525–3542.–List of Irosin Valley *spp.*; new *spp.* in *Mapania*, *Carex*, and *Scleria*; no keys.

Gandoger, Bull. Soc. Bot. Fr. 66 (1919) 296.–New *Fuirena* and *Fimbristylis* from Philippines and Java.

Kükenthal, in Elmer, Leafl. Philip. Bot. 4 (1911) 1169–1170.–New *Carex*.

—, Philip. J. Sc. 6 (1911) Bot. 57–64.–Conspectus of *Caricoideae*; keys.

Merrill, Philip. J. Sc. 7 (1912) Bot. 231.–New *Fimbristylis*.

—, *ibid.* 35 (1928) 4–6.–Nomencl. notes.

—, *ibid.* 60 (1936) 27–28.–Identif. of an erroneously localized Amer. *Scleria*.

Palla, Allg. Bot. Zeitschr. 13 (1907) 49–50.–New *Scleria*.

Stapf, Philip. J. Sc. 19 (1921) 65–66.–Descr. new *Vincentia*.

Moluccas: Merrill, Philip. J. Sc. 11 (1916) Bot. 256–259.–Ambon records; new *Vincentia*.

New Guinea: Blake, J. Arn. Arb. 28 (1947) 99–116, fig. 1–4; 207–229, fig. 1, t. 1–2; *ibid.* 29 (1948) 90–102, fig. 1; *ibid.* 35 (1954) 203–238, fig. 1–2, t. 1.–Listed records coll. Brass; new *spp.* & comb. in *Carex*, *Mapania*, *Paramapania*, *Cyperus*, *Schoenus*, *Fimbristylis*; key to Papuan *Sclerias*!

Kükenthal, Bot. Jahrb. 59 (1924) 41–60.–Listed records; new *spp.* in *Fimbristylis*, *Mapania*, *Thoracostachyum*.

—, *ibid.* 69 (1938) 255–265.–List; new *spp.* in *Cyperus* and *Carex*.

—, *ibid.* 70 (1940) 463–468.–List Clemens coll., 3 new *Carices*.

—, Bull. Jard. Bot. Btzg III, 16 (1940) 300–323.–Various records and new *spp.*

—, Mitt. Thür. Bot. Ver., N. F., Heft 50 (1943) repr. 1–13.–Various critical notes on *Cyperus*, 2 new *Fimbristylis* and a new *Scirpus*.

Nelmes, Kew Bull. (1949) 378–386.–Brass coll.; no key.

—, *ibid.* (1949) 387–392.–Clemens coll.; no key.

Ohwi, Bot. Mag. Tokyo 56 (1942) 199–215.–Listed Kanehira-Hatusima records; new *spp.* in *Carex*, *Mapania*, *Thoracostachyum*, *Cladium*, *Schoenus*, *Scirpus*, and *Fimbristylis*.

Ridley, Trans. Linn. Soc. Lond. Bot. II, 9 (1916) 241–247.–Listed records; new *spp.* in *Cyperus*, *Lipocarpha*, *Cladium*, *Hypolytrum*, *Thoracostachyum*, *Mapania*, and *Carex*.

Uittien, J. Arn. Arb. 20 (1939) 213–215.–List Brass coll.; only *Mapanieae*.

Valckenier Suringar, Nova Guinea 8 (1912) 695–713, t. 113–118.–List; many new *spp.*

Micronesia: Kükenthal, Bot. Jahrb. 59 (1924) 2–10.–List of 48 *spp.*

Australia: Blake, Notes on Australian Cyperaceae I (Proc. R. Soc. Queensl. 48, 1937, 89–94, t. 2–3); *ditto* II (*ibid.* 49, 1938, 154–155); *ditto* III (*ibid.* 51, 1940, 32–50); *ditto* IV (*ibid.* 177–182); *ditto* V (*ibid.* 52, 1941, 55–61); *ditto* VI (*ibid.* 54, 1943, 69–74); *ditto* VII (*ibid.* 58, 1947, 35–50); *ditto* VIII (*ibid.* 60, 1949, 45–53).–Include occasionally Mal. *spp.*

—, Transact. R. Soc. South Australia 67 (1943) 52–61.–Critical notes on S. Austr. *spp.*; key to the *Cladium-Mariscus*-alliance.

Genera

Arthrostylis: Kükenthal, in Fedde, Rep. 53 (1944) 192–200.–Revision.

Capitularia: Ridley, Trans. Linn. Soc. Lond. Bot. II, 9 (1916) 244–245.–Reduces *Capitularia* to *Chorisandra*!

Uittien, Rec. Trav. Bot. Néerl. 33 (1936) 289–291.–New Solomon Isl. *sp.*

Valckenier Suringar, Nova Guinea 8 (1912) 711, t. 118.–Type descr.

Carex: Boott, Illustrations of the genus Carex. London 4 parts. I (1858) 1–74, t. 1–200; II (1860) 75–103, t. 201–310; III (1862) 105–126, t. 311–411; IV (1867) 127–233, t. 412–600.–Monogr. descr. and plates.

Kükenthal, Pflanzenreich Heft 38 (1909) 67–824, fig. 1–128.

Nelmes, Kew Bull. (1938) 106–110.–Critical notes on some *spp.* with key.

—, Proc. Linn. Soc. Lond. sess. 155 (1944) 277–285.–Rev. Austral. *spp.*; key.

—, Kew Bull. (1946) 5–29.–Key to Mal. & Polyn. *spp.*

—, *ibid* (1950) 198–208.–Descr. new or noteworthy *spp.*

—, *ibid.* (1951) 121.–Descr. 3 new sect.

—, Reinwardtia 1 (1951) 221–450.–Complete revision; keys.

—, *ibid.* 2 (1954) 373–383.–Addit. notes listed.

Carpha: Kükenthal, in Fedde, Rep. 47 (1939) 101–119, 209–211.–Revision.

Cladium: Kükenthal, in Fedde, Rep. 51 (1942) 1–17, 139–193.–Revision; key.

Van Steenis, Arch. Hydrobiol. Suppl. 3 (1932) 281–282, fig. 3.–Records of 2 *spp.*

Costularia (*Lophoschoenus*): Kükenthal, in Fedde, Rep. 46 (1939) 13–32, 65–76.–Revision; key.

Cyperus (*Kyllinga*, *Juncellus*, *Pycreus*, *Mariscus*): Blake, Univ. Queensl. Pap. Dep. Biol. 2, *no* 2 (1942) 1–14, t. 1–8.–*C. rotundus* & allied *spp.* in Australia; synon.; key.

CLARKE, J. Linn. Soc. Lond. Bot. 21 (1884) i–xi, 1–202, t. 1–4.–Revision Indian *spp.*; partial keys.
KERN, Reinwardtia 1 (1952) 463–466, fig. 1.–*C. alulatus n. sp.*, hitherto often confused with *C. iria*; India.
—, *ibid.* 2 (1952) 97–130, fig. 1–14.–Critical notes; some new *spp.*; precursory to revision.
—, *ibid.* 3 (1954) 27–66, fig. 1–12.–*Ditto*, 2nd part.
KÜKENTHAL, Pflanzenreich Heft 101 (1936) 1–671.–Monograph; keys.
—, Mitt. Thür. Bot. Ver., N. F., Heft 50 (1943) repr. 1–8.–Critical addit. notes; new key for *§ Graciles.*
VALCKENIER SURINGAR, Het geslacht Cyperus (sensu amplo) in den Maleischen Archipel benevens een overzicht van de geschiedenis der systematiek van de familie der Cyperaceën. Thesis, Leeuwarden (1898) i–xv, 1–192, t. 1–6.–Revision Indon. *spp.*; no keys; in Dutch; descr. in Latin.

Eleocharis: BLAKE, Proc. R. Soc. Queensl. 50 (1939) 88–132, t. 7–10.–Monograph of Austr. & N. Zeal. *spp.*; key.
NELMES, Kew Bull. (1952) 289–290.–Submerged Afr. 1-flowered *spp.*
SVENSON, Rhodora 31 (1929) 121–135, 152–163, 167–191, 199–219, 224–242; *ibid.* 34 (1932) 193–203, 215–227; *ibid.* 36 (1934) 377–389; *ibid.* 39 (1937) 210–231, 236–272; *ibid.* 41 (1939) 1–19, 43–77, 90–110.–Monographic studies, with plates and text maps.

Fimbristylis (*Abildgaardia*): BLAKE, Univ. Queensl. Pap. Dept of Biol. 1, *no* 13 (1940) 1–14.–New Queensl. *spp.*
BOECKELER, Linnaea 37 (1871) 2–56.–Revision Berlin specim.; partial keys.

Fuirena: BUSH, Rep. Missouri Bot. Gard. 16 (1905) 87–99.–North Amer. *spp.*; key.

Gahnia: BENL, Flora 131 (1937) 369–386, fig. 1–11. –Dispersal mechanisms.
—, in FEDDE, Rep. 44 (1938) 196–199.–New *spp.*
—, *ibid.* 49 (1940) 30–34.–Nomenclator.
—, Bot. Arch. 40 (1940) 151–257, fig. 1–30.–Compl. monogr.; keys.
—, Bot. Jahrb. 75 (1950) 82–89.–Critical remarks on following paper.
KÜKENTHAL, in FEDDE, Rep. 52 (1943) 52–111.–Revision; key.

Hypolytrum *p.p.*; UITTIEN, Rec. Trav. Bot. Néerl. 33 (1936) 153–155.–Key.

Isolepis: BEETLE, Amer. Midl. Nat. 34 (1945) 723–734.–Evaluation of 470 combinations published under *Isolepis* with their correct name (belonging to 18 genera of *Cyp.* presently accepted).

Lepidosperma: KÜKENTHAL, in FEDDE, Rep. 50 (1941) 19–50, 112–128.–Revision; key.

Lipocarpha: DANDY, J. Bot. 70 (1932) 331–332.–Synon. *L. senegalensis.*

Mapania § Halostemma: UITTIEN, Rec. Trav. Bot. Néerl. 33 (1936) 151–153, fig. 3, 284–289.–Revision; key.

Mapania § Pandanophyllum: UITTIEN, Rec. Trav. Bot. Néerl. 33 (1936) 145–151.–Key.

Mapania § Pandanoscirpus: UITTIEN, Rec. Trav Bot. Néerl. 33 (1936) 277–284.–Revision; key.

Oreobolus: KÜKENTHAL, in FEDDE, Rep. 48 (1940) 60–72.–Revision; key.
PFEIFFER, in FEDDE, Rep. 23 (1927) 350–352.–Key.

Paramapania: UITTIEN, Rec. Trav. Bot. Néerl. 32 (1935) 184–192; *ibid.* 33 (1936) 141–145.–Revision; key.

Remirea: KÜKENTHAL, in FEDDE, Rep. 53 (1944) 200–209.–Revision.

Rhynchospora: BLAKE, Proc. R. Soc. Queensl. 51 (1940) 47.–New *sp.* from Philippines, Madura & Queensl.
KÜKENTHAL, Bot. Jahrb. 74 (1949) 375–509; *ibid.* 75 (1950) 90–195; *ibid.* 75 (1951) 273–314.–Revision; keys.

Schoenoxiphium: KÜKENTHAL, Pflanzenreich Heft 38 (1909) 28–33.
—, Bull. Jard. Bot. Btzg III, 16 (1940) 312–313. –New Sumatran *sp.*

Schoenus: KÜKENTHAL, in FEDDE, Rep. 44 (1938) 5–32, 65–101, 161–195; corrections *ibid.* 48 (1940) 195–250.

Scirpodendron: KURZ, J. As. Soc. Beng. 38, ii (1869) 70–85; *cf.* Flora 52 (1869) 441.

Scirpus: BACKER, Onkruid. Jav. Suiker. (1928) 147–151.–In Dutch; key to Jav. *spp.*
BEETLE, Amer. J. Bot. 27 (1940) 63–64.–Delimitation of subgenera.
—, *ibid.* 29 (1942) 82–88.–Key for *§ Bolboschoenus.*
—, *ibid.* 30 (1943) 395–401.–Key for *§ Schoenoplectus.*
BLAKE, Proc. R. Soc. Queensl. 58 (1947) 38–42. –Some critical notes; key for *Sc. merrillii* and allies in Australia.
—, *ibid.* 62 (1952) 83–88.–Critical notes and key to *Sc. supinus*, *lateriflorus*, and *juncoides.*
PALLA, Bot. Jahrb. 10 (1889) 293–301, t. 11.–Key to allied genera, partly segregates.

Scleria: BLAKE, Proc. R. Soc. Queensl. 62 (1952) 88–89.–Critical notes; *S. oryzoides* reduced.
CORE, Brittonia 2 (1936) 1–105, t. 1–3.–Revision Amer. *spp.*; key.
PIÉRART, Lejeunea 13 (1951) 1–70.–Rev. *spp.* Congo Belge.

Thoracostachyum: UITTIEN, Rec. Trav. Bot. Néerl. 33 (1936) 133–140.

Uncinia: KÜKENTHAL, Pflanzenreich Heft 38 (1909) 50–67.
NELMES, Kew Bull. (1949) 140–145.–Three new *spp.*, 2 from New Guinea.

CYRTANDRACEAE

See Gesneriaceae

DAPHNIPHYLLACEAE

ROSENTHAL, K., Pflanzenreich Heft 68^5 (1919) 1–16, fig. 1.
—, Pflanzenfamilien ed. 2, 19c (1931) 233–235, fig. 124.

Local

Philippines: QUISUMBING & MERRILL, Philip. J. Sc. 37 (1928) 161–162.–New *sp.*

Genera

Daphniphyllum: CROIZAT, Lingn. Sc. J. 20 (1941) 79–103.–Taxon. position.
— & METCALFF, Lingn. Sc. J. 20 (1941) 105–127. –Chin. & Jap. *spp.*
HARRISON, Kew Bull. (1951) 369–370, fig. 1–2 (1952).–Note on pseudohermaphrodism in *D. macropodum* MIQ. cult. at Kew.
P'EI, Contr. Biol. Lab. Sc. Soc. China (bot. ser.) 8 (1933) 233–243.–Chin. *spp.*

DATISCACEAE

GILG, E., Pflanzenfamilien ed. 2, 21 (1925) 543–547, fig. 249–250.
STEENIS, C. G. G. J. VAN, Fl. Mal. I, 4 (1953) 382–387, fig. 1–6.

Genera

Octomeles: MIQUEL, Fl. Ind. Bat. Suppl. (1861) 336.–Type descr.
WARBURG, Bot. Jahrb. 13 (1891) 385–386.–Record New Guinea; new *sp.*
Tetrameles: KOORDERS & VALETON, Bijdr. Booms. Java 9 (1903) 36–40.
MERRILL & PERRY, J. Arn. Arb. 23 (1942) 407. –New Guinea.

DICHAPETALACEAE

(*Chailletiaceae*)

BECCARI, O., Malesia 1 (1877) 175–177.–Affinity genus; list 3 *spp.* of which one Papuan new.
ENGLER, A., Pflanzenfamilien ed. 2, 19c (1931) 1–11, fig. 1–5.

Local

Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 86 (1922) 319.–Record of a Philip. *sp.*
RIDLEY, Kew Bull. (1930) 372–373.–Descr. new *spp.*; records.
—, *ibid.* (1938) 234.–Descr. of new *sp.* with 4-merous flowers and entire petals.
Philippines: MERRILL, Philip. J. Sc. 17 (1920) 271–272.–Descr. 3 new *spp.*, one with entire petals.
—, *ibid.* 30 (1926) 401–402.–New *sp.* from Sulu.
New Guinea: KRAUSE, Bot. Jahrb. 49 (1912) 168–169.–Descr. 2 new *spp.*
—, *ibid.* 62 (1929) 341–346.–Survey; key.
Queensland: WHITE, Proc. R. Soc. Queensl. 53 (1942) 211–212.–First (new) *sp.* from Australia.

DILLENIACEAE

(*for Saurauia see Actinidiaceae*)

GILG, E. & E. WERDERMANN, Pflanzenfamilien ed. 2, 21 (1925) 7–36, fig. 1–25.
HOOGLAND, R. D., Fl. Mal. I, 4 (1951) 141–174, fig. 1–13.
MARTELLI, U., Le Dilleniaceae Malesi e Papuane delle collezioni Beccari (in BECCARI, Malesia 3, 1886, 150–167).–Census & descr. BECCARI coll.; no keys; compl. en. of *Dillenia* and *Wormia*.
MIQUEL, F. A. W., Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 73–80, t. 1.–Revision; no keys.
VRIESE, W. H. DE, Pl. Ind. Bat. Orient. (1856) 79–81, t. 6–7.–Descr.

Local

India: PARKINSON, Ind. For. 61 (1935) 447–453, t. 28–29.–Key to 3 allied *spp.* of *Dillenia*, one new (Andamans).
Sumatra: MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 315, t. 9.–New *Wormia* from Banka.
Malay Peninsula: CORNER, Gard. Bull. Str. Settl. 10 (1939) 3–11.–Critical remarks on some *spp.*
Borneo: MERRILL, Plant. Elm. Born. (1929) 194–196.–List; new *sp.* in *Tetracera* and *Dillenia.*
RIDLEY, Sarawak Mus. J. 1 (1913) 68–71.–List; 2 new *Tetraceras.*
Java: DE WIT, Bull. Bot. Gard. Btzg III, 18 (1949) 208–209.–Disc. whether *Dillenia suffruticosa* is native.
Philippines: MERRILL, Philip. J. Sc. 9 (1914) Bot. 517–521.–4 new *Dillenias.*
New Guinea: DIELS, Bot. Jahrb. 57 (1922) 436–441. –Revision; keys.
—, Nova Guinea 14 (1923) 81.–Records.
GIBBS, Contr. Fl. Phytog. Arfak Mts (1917) 148–149.–New *Hibbertia.*
KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 57 (1943) 63.–Records.
LAUTERBACH, Nova Guinea 8 (1910) 305.–Some records.
RIDLEY, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 13–14.–New *Wormia.*
SMITH, A. C., J. Arn. Arb. 22 (1941) 497–502.–List; 3 new *Wormias.*
WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 242–243, fig. 9.–New *Wormia.*

Genera

Dillenia (*Wormia*): CORNER, Gard. Bull. Str. Settl. 10 (1939) 3–11.–Critical remarks.
HOOGLAND, Blumea 7 (1952) 1–145, fig. 1–11.–Complete revision of the genus; key.
Tetracera: HOOGLAND, Reinwardtia 2 (1953) 185–224, pl. 1.–Revision Indo-Austr. *spp.*; key.
Trematanthera = Saurauia (*Actinidiaceae*).

DIOSCOREACEAE

BURKILL, I. H., Fl. Mal. I, 4 (1951) 293–335, fig. 1–14.
KNUTH, R., Pflanzenreich Heft 87 (1924) 1–387, fig. 1–69.
—, Pflanzenfamilien ed. 2, 15a (1930) 438–462, fig. 192–206.
PRAIN, D. & I. H. BURKILL, Kew Bull. (1926) 118–120.–Corrections on KNUTH's monograph.
ULINE, E. B., Eine Monographie der Dioscoreaceen (Bot. Jahrb. 25, 1881, 126–165).–Key to genera and sections.

Local

Malay Peninsula: BURKILL, Gard. Bull. Str. Settl. 3 (1925) 289–290.–Observations on *Stenomeris.*
PRAIN & BURKILL, *ibid.* 4 (1927) 86–88, 2 fig.–Observ. on *Diosc. tamarisciflora.*
Java: BACKER, Handb. Fl. Java 3 (1924) 108–116. –In Dutch; key.
Borneo: KNUTH, in FEDDE, Rep. 36 (1934) 127.–New *sp.*

Lesser Sunda Islands: KNUTH, in FEDDE, Rep. 38 (1935) 119–120.–New *Dioscorea* from Sumba.

Philippines: PRAIN & BURKILL, in ELMER, Leafl. Philip. Bot. 5 (1913) 1589–1599.–List; descr. new *spp.*

Celebes: BURKILL, Kew Bull. (1950) 259–260. fig. –New *sp.*

KNUTH, in FEDDE, Rep. 36 (1934) 127–128.–3 new *spp.* coll. KJELLBERG.

New Guinea: KNUTH, in FEDDE, Rep. 42 (1937) 163–164.–Descr. 3 new *spp.*

Genera

Dioscorea (*Peripetasma*): BURKILL, Gard. Bull. Str. Settl. 3 (1924) 258–259, t.–Varieties of *D. pentaphylla* in Mal.; key to var.

—, J. S. Afr. Bot. (1952) 177–191.–Reduction of *Testudinaria* as an Afr. sect.; key.

— & HOLTTUM, Gard. Bull. Str. Settl. 3 (1924) 260.–*D. piscatorum* as a fish poison.

— & PRAIN, Ann. R. Bot. Gard. Calcutta 14, part 1 (1936) x + 210 pp.; part 2 (1938) ii + 211–528 + xx, t. 1–150.–Complete revision of Indo-Austr. *spp.*

PRAIN & BURKILL, J. As. Soc. Beng. II, 4 (1908) 447–457.–Misc. descr. new *spp.*

—, *ibid.* II, 10 (1914) 5–41.–Revision Indo-Austr. *spp.*; key.

—, Kew Bull. (1919) 339–375.–Key to Linnean *spp.* of *Dioscorea*; nomencl. *D. sativa.*

—, *ibid.* (1925) 58–66.–List misc. new *spp.*; reduction *Peripetasma* p. 66.

—, *ibid.* (1926) 118–120.–Reduction of KNUTH's and ULINE's *spp.*

—, *ibid.* (1931) 88–91, map.–Key to *spp.* of § *Stenocorea.*

—, Gard. Bull. Str. Settl. 5 (1932) 51–57, fig. 1–13.–Observ. on *D. gibbiflora*; new key to *Dioscorea* series of *D. alata.*

—, Kew Bull. (1933) 240–246.–Descr. new *spp.* from SE. Asia, incl. one from Sumatra & Malaya.

Stenomeris: BECCARI, Nuovo Giorn. Bot. Ital. 2. (1870) 8–12, t. 2.–New *sp.* from the Philippines.

TAUBERT, Bot. Jahrb. 15 (1893) Beibl. 38, p. 1–2. –Revision; key.

Trichopus: BECCARI, Nuovo Giorn. Bot. Ital. 2 (1870) 13–19, t. 3.

DIPSACACEAE

ALVARADO, S., Die morphologische Aufbau des Hüllkelches der Dipsacaceen (Bot. Jahrb. 61, 1927, Beibl. 138, p. 10–21, t. 9).–Morph. of epicalyx.

STEENIS, C. G. G. J. VAN, Fl. Mal. I, 4 (1951) 290–292, fig. 1.

Genera

Triplostegia (*Hoeckia*): VAN STEENIS, Fl. Mal. I, 4 (1951) 290–292, fig. 1.–Complete revision.

DIPTEROCARPACEAE

BERGER, L. G. DEN, Unterscheidungsmerkmale von rezenten und fossilen Dipterocarpaceengattungen (Bull. Jard. Bot. Btzg III, 8, 1927, 495–498). –Anat.

BRANDIS, D., An enumeration of the Dipterocarpaceae, *etc.* (J. Linn. Soc. Bot. 31, 1895, 1–148, t. 1–3).–Monograph chiefly based on specimens at Kew and London; partial geogr. keys.

BURCK, W., Sur les Diptérocarpacées des Indes néerlandaises (Ann. Jard. Bot. Btzg 6, 1887, 145–249).–Anat.; key to genera; crit. enum. of *spp.*; descr. of *spp.*

FOXWORTHY, F. W., Distribution of the Dipterocarpaceae (J. Arn. Arb. 27, 1946, 347–354).–General figures.

GILG, E., Pflanzenfamilien ed. 2, 21 (1925) 237–269, fig. 108–118.

HEIM, F., Recherches sur les Diptérocarpacées. Introduction à la monographie générale de la famille (1892) i–v, 1–186, t. 1–11.–Anat.; no exact key to the genera, but several keys on basis of different organs; no *spp.* treated.

MERRILL, E. D., Distribution of the Dipterocarpaceae (Philip. J. Sc. 23, 1923, 1–33, 2 maps, t. 3–8).–Distr. in the light of geol. hist. of Malaysia.

MIQUEL, F. A. W., Dipterocarpaceae novae vel minus cognitae (Ann. Mus. Bot. Lugd.-Bat. 1, 1864, 213–215).–Descr. new *spp.*

—, Annotationes de Dipterocarpeis (Ann. Mus. Bot. Lugd.-Bat. 3, 1867, 83–85).–Complete list of Mal. *spp.*; records.

PARIJS, J. P., Bijdrage tot de kennis van de Oost-Indische damarhars. Thesis, Leiden (1933) 1–135, fig. 1–15, t.–Descr. some resinous *Dipteroc.*; anat.; phytochem.; some new *spp.*; in Dutch.

SCHEFFER, R. H. C. C., Nat. Tijd. Ned. Ind. 31 (1870) 346–351.–Misc. descr. many new *spp.*

—, *ibid.* 32 (1873) 407–409.–Misc. descr. from Banka and Borneo.

SLOOTEN, D. F. VAN, Sertulum Dipterocarpacearum malayensium I (Bull. Jard. Bot. Btzg III, 16, 1940, 430–454, fig. 1–10).–New or noteworthy *spp.* in *Anisoptera*, *Dipterocarpus*, *Vatica*, and *Dryobalanops.*

—, *ditto* II (*ibid.* 17, 1941, 96–138, fig. 11–20).–*Ditto*, *Dipterocarpus*, *Shorea* (key to § *Isoptera*), *Hopea*, and *Vatica.*

—, *ditto* III (*ibid.* 17, 1942, 220–255, fig. 21–36). –*Ditto*, one *Shorea*; new *spp. of Vatica subg. Isauxis*; key to *spp.* of *subg. Synaptea.*

—, *ditto* IV (*ibid.* 18, 1949, 229–269, fig. 1–14). –*Ditto*, *Shorea.*

—, *ditto* V (Reinwardtia 2, 1952, 1–68, fig. 1–22). –The Dipterocarpaceae of Eastern Malaysia (Celebes, Moluccas, and New Guinea); *Anisoptera*, *Hopea*, *Shorea.*

Local

Siam: RYAN & KERR, J. Siam Soc. 8¹ (1911) 1–24, t. 1–5.–Revision *spp.* of N. Siam; key; econ. & sylvic. possibilities; S. Siam. *spp.* listed.

Sumatra: PARIJS, in FEDDE, Rep. 33 (1933) 243–244. –Descr. some new *spp.*

Malay Peninsula: FOXWORTHY, Mal. For. Rec. 10 (1932) 1–289, t. 1–23, 1 map.–Descr.; distr.; uses; keys.

HEIM, Bull. Mens. Soc. Linn. Paris *no* 127 (1892)

1009–1011.–Descr. *Duvalliella problematica n. g. n. sp.* from Penang (= *Dipterocarpus*). *Cf.* Symington (1937) below.

Symington, Notes on Malayan Dipterocarpaceae (Gard. Bull. Str. Settl. 7, 1933, 129–159, t. 33–47).–Notes on *Shoreas*.

—, *ditto* II (*ibid.* 8, 1934, 1–40, t. 1–10).–*Anisoptera, Balanocarpus, Hopea, Vatica, Cotylelobium.*

—, *ditto* III (*ibid.* 8, 1935, 265–292, t. 16–28).–Notes on *Shoreas* and *Hopeas*.

—, *ditto* IV (*ibid.* 9, 1938, 319–354, t. 17–27).–Various notes on *Dipterocarpus, Hopea, Shorea,* and *Parashorea*.

—, *ditto* V (*ibid.* 10, 1939, 336–386, t. 11–27).–Cont. *Hopea, Shorea, Parashorea, Dryobalanops.*

—, *ditto* VI (J. Mal. Br. R. As. Soc. 19, 1941, 139–168, t. 1–7).–Descr. new *spp.* in *Hopea* (6), *Vatica* (1), *Shorea* (1); discussion of special groups of *Shorea* and *Vatica*.

—, Kew Bull. (1937) 318–319.–Reduction *Duvalliella* to *Dipterocarpus*.

—, Mal. For. Rec. *no* 16 (1943) i–xliii, 1–244, fig. 1–114.—Complete revision of Mal. Pen. *spp.*

Thiselton-Dyer, J. Bot. 12 (1874) 154.–New *Vatica*.

Borneo: Heim, Bull. Mens. Soc. Linn. Paris *no* 120 (1891) 954–958; *ibid.* 122 (1891) 970–976.–Descr. new *spp.* coll. Beccari; *Richetia n.g.*

—, *ibid. no* 120 (1891) 958–960.–Descr. *Pierrea* (coll. Beccari).

Merrill, Philip. J. Sc. 29 (1926) 398–400.–2 new *Dipterocarpus*.

Parijs, in Fedde, Rep. 33 (1933) 243–244.–Misc. new *spp.*

Van Slooten, in Merrill, Pl. Elm. Born. (1929) 200–206.–List; one new comb.

Vesque, C. R. Ac. Sc. Paris 70 (1874) 625–627.–Descr. of new *spp.* of *Dipterocarpus* from the Beccari collection.

Philippines: Elmer, Leafl. Philip. Bot. 4 (1912) 1469–1474.–4 new *spp.*

Foxworthy, Philippine Dipterocarpaceae (Philip. J. Sc. 6, 1911, Bot. 231–285, t. 34–44; *ibid.* 13, 1919, 163–199, t. 1–2).–Revision; keys.

—, *ditto* III (*ibid.* 67, 1938, 241–331, t. 1–9).–Complete revision; keys!

—, in Elmer, Leafl. Philip. Bot. 6 (1913) 1949–1958.–Records & new *spp.* from Agusan region (Mindanao).

Gilg, Bot. Jahrb. 18 (1894) Beibl. 45, p. 38–39.–New Philip. *Shorea*.

Merrill, Philip. J. Sc. 26 (1925) 475–477.–New *Shorea*.

—, *ibid.* 30 (1926) 411.–Record of *Vatica papuana*.

Thiselton-Dyer, J. Bot. 16 (1878) 100.–New *sp.*

Celebes: van Slooten, Reinwardtia 2 (1952) 1–68, fig. 1–21.–Survey of *spp.*

Moluccas: van Slooten, Reinwardtia 2 (1952) 1–68, fig. 1–21.–Survey of *spp.*

New Guinea: Diels, Bot. Jahrb. 57 (1922) 460–463.–Revision; keys.

Gilg, Bot. Jahrb. 18 (1894) Beibl. 45, p. 38–39.–New *Vatica*.

Van Slooten, Nova Guinea 14 (1927) 222–227.

—, Reinwardtia 2 (1952) 1–68, fig. 1–21.–Survey; no keys.

Thiselton-Dyer, J. Bot. 16 (1878) 98–103.–2 new *spp.*

White, Proc. R. Soc. Queensl. 43 (1932) 49.–New *Hopea*.

Genera

Anisoptera: van Slooten, Bull. Jard. Bot. Btzg III, 8 (1926) 1–17, fig. 1–2.–Revision; key.

Cotylelobium: van Slooten, Bull. Jard. Bot. Btzg III, 10 (1929) 393–406, fig. 1–3; *ibid.* 12 (1932) 43–44.–Revision; keys in both papers.

Dipterocarpus: van Slooten, Bull. Jard. Bot. Btzg III, 8 (1927) 263–352, fig. 1–15; *ibid.* 16 (1940) 443–448; *ibid.* 17 (1941) 97–110.–Revision with additions; key in the first paper.

Thiselton-Dyer, J. Bot. 12 (1874) 101–108, t. 143–145.–Revision; partial key.

—, *ibid.* 12 (1874) 152–154.–Critical notes on Vesque's *spp.* (see below).

Dryobalanops: van Slooten, Bull. Jard. Bot. Btzg III, 12 (1932) 1–45, fig. 1–5; *ibid.* 16 (1940) 448–451.–Revision; key.

Thiselton–Dyer, J. Bot. 12 (1874) 98–101, t. 142.–Revision; no key.

Parashorea: van Slooten, Bull. Jard. Bot. Btzg III, 8 (1927) 370–380, fig. 1–3.–Revision; key.

Shorea § Isoptera: van Slooten, Bull. Bot. Gard. Btzg III, 17 (1941) 115–130.

Shorea: van Slooten, Bull. Bot. Gard. Btzg III, 18 (1949) 230–269.–New *spp.*

Upuna: Symington, Bull. Jard. Bot. Btzg III, 17 (1941) 88–95, t. 1–2, fig. I–II.–New Bornean genus.

Vatica: van Slooten, Bull. Jard. Bot. Btzg III, 9 (1927) 67–137, fig. 1–13.–Revision; key.

—, *ibid.* 17 (1941) 133–137.–Additions.

Vatica § Isauxis: van Slooten, Bull. Jard. Bot. Btzg III, 17 (1942) 223–242.

Vatica § Synaptea: van Slooten, Bull. Jard. Bot. Btzg III, 17 (1942) 243–254.–Key.

DROSERACEAE

Diels, L., Pflanzenreich Heft 26 (1906) 1–136, fig. 1–40.

—, Pflanzenfamilien ed. 2, 17b (1936) 766–784, fig. 473–486.

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1933) 106–109, 202.

—, Fl. Mal. I, 4 (1953) 377–381, fig. 1–7.

Local

Timor: von Malm, in Fedde, Rep. 41 (1937) 295.–Record *Aldrovanda*.

New Guinea: van Steenis, J. Arn. Arb. 28 (1947) 420–421.–List Brass coll.

EBENACEAE

Bakhuizen van den Brink, R. C., Revisio Ebenacearum Malayensium (Bull. Jard. Bot. Btzg III, 15, 1936, 1–49; *ibid.* 1937, 59–178; *ibid.* 1938, 179–368; *ibid.* 1941, 369–515).–Plates and final part in the press.–Complete revision; keys.

HIERN, W. P., A monograph of Ebenaceae (Trans. Cambr. Philos. Soc. 12, 1873, 27–300, 1 fig., t. 1–11.–Complete monograph; keys to genera and *spp.*

Local

Siam: BAKHUIZEN VAN DEN BRINK, Kew Bull. (1937) 382–392.
—, *ibid.* (1938) 24–26, t.–New *sp.*

Ceylon: WRIGHT, Ann. R. Bot. Gard. Perad. 2 (1904) 1–106, 133–210, t. 1–20.–Revision; key.

Malay Peninsula: BAKHUIZEN VAN DEN BRINK, Gard. Bull. Str. Setl. 7 (1933) 161–190, t. 48–50.

Borneo: DIELS & HACKENBERG, Bot. Jahrb. 60 (1926) 313–314.–2 new *Diospyros.*
MERRILL, J. Str. Br. R. As. Soc. *no* 87 (1923) 25–26.–New *Diospyros.*
RIDLEY, J. Bot. 63 (1925) 51–52.–New *sp.*

Philippines: MERRILL, Philip. J. Sc. 26 (1925) 487–488.–New *sp.*
—, *ibid.* 29 (1926) 483.–New *sp.*
—, *ibid.* 30 (1926) 421–423.–2 new *spp.*

Moluccas: MERRILL, Philip. J. Sc. 11 (1916) Bot. 303–304.–New *Maba* from Ambon.

New Guinea: HIERN, Nova Guinea 8 (1909) 199–200.–List; 2 new *spp.*

Solomon Islands: BAKHUIZEN VAN DEN BRINK, J. Arn. Arb. 16 (1935) 68–69, t. 120–122.–Records.

ELAEAGNACEAE

NELSON, AVEN, The Elaeagnaceae. A mono-generic family (Am. J. Bot. 22, 1935, 681–683).–*Shepherdia* and *Hippophae* are reduced to *Elaeagnus.* Key to Rocky Mt *spp.*

SCHLECHTENDAL, D. F. L. VON, Elaeagnacearum in Candollei prodromo (Vol. XIV) expositarum adumbratis (Linnaea 30, 1859–60, 304–386).–Comments; descr.; no keys; in Latin.

SERVETTAZ, C., Note préliminaire sur la systématique des Elaeagnacées (Bull. Herb. Boiss. II, 8, 1908, 381–394).–Prelim. revision; keys.

—, Monographie des Eléagnacées (Beih. Bot. Centralbl. 25, ii, 1909, 1–420, fig. 1–145).–Monogr.; keys.

Local

Formosa: LI, Lloydia 15 (1952) 156–160.–Key to 8 *spp.* of *Elaeagnus*; 2 new.

Java: MIQUEL, Pl. Jungh. (1852) 173.–List.

New Guinea: MERRILL & PERRY, J. Arn. Arb. 22 (1941) 267–268.–Record.

ELAEOCARPACEAE

Local

Sumatra: MERRILL, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 168.–New *Elaeocarpus.*

Malay Peninsula: BURKILL, J. Str. Br. R. As. Soc. *no* 75 (1917) 41.–New *Elaeocarpus.*
CORNER, Gard. Bull. Str. Settl. 10 (1939) 308–329.–Revision; 2 new *spp.*; key.
HENDERSON, Gard. Bull. Str. Settl. 5 (1930) 74–76, 2 fig.–New *Elaeocarpus.*

Java: ADELBERT, Blumea 6 (1948) 310–313.–Critical notes.
KOORDERS, Bull. Jard. Bot. Btzg III, 1 (1919) 140–144, t. 7–8.–Record of *Elaeocarpus littoralis.*

Borneo: DE CANDOLLE, Bull. Herb. Boiss. II, 3 (1902) 367–368.–2 new *Elaeocarpus.*
KNUTH, in FEDDE, Rep. 44 (1938) 124–132.–20 new *spp.* of *Elaeocarpus.*
MERRILL, J. Str. Br. R. As. Soc. *no* 76 (1917) 96–97.–New *Elaeocarpus.*
—, *ibid. no* 77 (1917) 191–203.–Critical notes, a dozen new *spp.* of *Elaeocarpus.*
—, *ibid. no* 86 (1922) 327.–New *Elaeocarpus.*
—, Sarawak Mus. J. 3 (1928) 527–528.–New *Elaeocarpus.*
RIDLEY, Kew Bull. (1938) 229–234.–List records; 9 new *Elaeocarpus.*
AIRY SHAW, Kew Bull. (1949) 163–165.–Records; new *Elaeocarpus.*
WARBURG, in FEDDE, Rep. 18 (1922) 327–329. 5 new *Elaeocarpus.*

Philippines: DE CANDOLLE, in ELMER, Leafl. Philip. Bot. 2 (1909) 633–638.–Revision & key to *Elaeocarpus.*
ELMER, Leafl. Philip. Bot. 4 (1911) 1171–1190. –New *spp.*
—, *ibid.* 9 (1934) 3185–3186.–New *sp.*
MERRILL, Philip. J. Sc. 26 (1925) 470.–New *Elaeocarpus.*
— & QUISUMBING, *ibid.* 82 (1953) 328.–Record *Sloanea sigun.*
VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 409.–Syn. *Elaeocarpus sphaericus.*

Celebes: KOORDERS, Bull. Jard. Bot. Btzg III, 2 (1920) 258–260, t. 7A–B.–Descr. new *Elaeocarpus.*
DE WIT, Bull. Bot. Gard. Btzg III, 18 (1949) 210.–Reduction of an *Elaeocarpus.*

New Guinea: GIBBS, Contr. Fl. Phytog. Arfak Mts (1917) 148.–One *Elaeocarpus* and 2 *Sericoleas.*
KANEHIRA-HATUSIMA, Bot. Mag. Tokyo 56 (1942) 308–322, fig. 4–14.–New *spp.* in *Aceratium, Echinocarpus, Elaeocarpus,* and *Sericolea.*
KOORDERS, Nova Guinea 8 (1909) 173–174.–Record and new *Elaeocarpus.*
PULLE, Nova Guinea 8 (1912) 661–662.–2 new *Elaeocarpus.*
RIDLEY, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 21–22.–New *Elaeocarpus spp.* and a *Sloanea.*
SCHLECHTER, Bot. Jahrb. 54 (1916) 92–155.–Extensive revision; keys.
SCHMIDT, Nova Guinea 14 (1924) 151–157.–New *spp.* and records.
—, J. Arn. Arb. 10 (1929) 79–80.
SMITH, A. C., J. Arn. Arb. 25 (1944) 104–121, 222–270, 271–298.–Many novelties.
VAN STEENIS, Nova Guinea 14 (1927) 304–305.–*Sericolea* records.

Genera

Aceratium: SCHLECHTER, Bot. Jahrb. 54 (1916) 100–107.–Key.
SMITH, A. C., J. Arn. Arb. 25 (1944) 110–121.–Records and 11 new Pap. *spp.*

White, Kew Bull. (1932) 42–43.–*Aceratium* in Queensland.

Dubouzetia: Brongniart & Gris, Bull. Soc. Bot. Fr. 8 (1881) 199–200.–Type descr.

Smith, A. C., J. Arn. Arb. 25 (1944) 272–273.–2 new *spp.*

Sprague, Kew Bull. (1907) 11, 125–128.–Revision; key to New Caled. *spp.*

Elaeocarpus: Knuth, in Fedde, Rep. 48 (1940) 72–79.–20 new *spp.* from New Guinea, Celebes, Bismarcks & Timor.

—, *ibid.* 49 (1940) 66–73.–New *spp.* from various regions.

—, *ibid.* 50 (1941) 81–88.–New *spp.* from New Guinea, Philippines, Celebes & Java.

Merrill, J. Arn. Arb. 32 (1951) 157–200.–New *spp.* and critical notes, specially on Knuth's *spp.*; many reductions; no keys.

—, Proc. R. Soc. Queensl. 62 (1952) 49–56.–Further critical notes and reductions; no keys.

Smith, A. C., J. Arn. Arb. 25 (1944) 222–270.–Key to sect. in Papua; records and *c.* 30 new *spp.*

Turczaninow, Bull. Soc. Nat. Moscou 19^2 (1846) 489–496.–Key to 3 sect.; no keys to *spp.*; 11 *spp.* treated from Cuming's and Zollinger's Mal. coll.

Sericolea (*Hormopetalum*, *Mischopleura*, *Pyrsonota*): Schlechter, Bot. Jahrb. 55 (1918) 194.–Reduction of *Pyrsonota.*

—, in Fedde, Rep. 16 (1919) 29–32.–Census *spp.*; nomencl.

Schmidt, Nova Guinea 14 (1919) 151–153.–2 new *spp.*

Smith, A. C., J. Arn. Arb. 25 (1944) 104–110.–Records and 5 new *spp.*

Wernham, in Hook. Ic. Pl. 31 (1916) t. 3059, pp. 1–2.–2 *spp.* under *Mischopleura.*

Sloanea (*Antholoma*, *Anoniodes*, *Echinocarpus*, *Phoenicosperma*): Miquel, Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 68.–Descr. Jav. *sp.*

Von Mueller, Vict. Nat. 8 (1892) 164; *ibid.* 9 (1892) 111.–2 new *spp.* from New Guinea.

Smith, A. C., J. Arn. Arb. 25 (1944) 273–297.–Rev. Pap. *spp.*; sect. in Papua; records and 11 new *spp.*

Smith, C. E., Contr. Gray Herb. 175 (1954) 1–114.–Revision New World *spp.*; key.

ELATINACEAE

Backer, C. A., Fl. Mal. I, 4 (1951) 203–206, 1 fig.

Niedenzu, F., Pflanzenfamilien ed. 2, 21 (1925) 270–276.

Genera

Bergia: Milne-Redhead, Kew Bull. (1948) 450.–Synon. *B. capensis.*

EPACRIDACEAE

Copeland, H. F., Observations on certain Epacridaceae (Am. J. Bot. 41, 1954, 215–222, fig. 1–44). –General discussion; main subdiv.

Lam, H. J., Blumea 5 (1945) 571–574.–Distinction of *Styphelia* and *Trochocarpa* by means of venation, referring a number of Mal. *spp.* to the latter genus.

Smith, J. J., Nova Guinea 12 (1912) 797–798.–List of Mal. *spp.*

Local

Java: De Vriese, in Miquel, Plant. Jungh. (1851) 84–86.–Redescr. Jav. *spp.* and remarks on occurrence of *Styphelia* in Mal.

Lesser Sunda Islands: Fawcett, in Forbes, Wand. Nat. (1885) 509.–New *sp.* from Timor.

Smith, J. J., Ic. Bog. 4 (1913) 171–173, t. 352.–New *sp.*

Borneo: Gibbs, J. Linn. Soc. Lond. Bot. 42 (1914) 105–107, fig. 7.–List & new *sp.* from Mt Kinabalu.

Celebes: Lam, Blumea 5 (1945) 571–574.–Records; referring a number of Mal. *spp* to *Trochocarpa.*

Smith, J. J., Ic. Bog. 4 (1910) 81–82, t. 325.

Philippines: Merrill, Philip. J. Sc. 20 (1922) 419. –New *sp.*

Moluccas: Scheffer, Nat. Tijd. Ned. Ind. 32 (1871) 419.–New *sp.* from Gebeh Isl.

New Guinea: Diels, Bot. Jahrb. 62 (1929) 488.–2 records.

Kanehira & Hatusima, Tokyo Bot. Mag. 56 (1942) 483–485.–Records; 1 new *sp.*

Ridley, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 100–102.–4 new *spp.*

Smith, J. J., Nova Guinea 8 (1912) 797–803, t. 143–146.–List Mal. *spp.*; 5 new *spp.*

—, *ibid.* 12 (1917) 539–541, t. 224–225.–Records; 2 new *spp.*

—, in Gibbs, Contr. Fl. Phytog. Arfak Mts (1917) 167–168.–Some records.

ERICACEAE

(*incl. Monotropaceae*, *Pirolaceae*, *Vacciniaceae*)

Copeland, H. F., A study, anatomical, and taxonomic, of the genera of Rhododendroideae (Am. Midl. Natural. 30, 1943, 533–625, fig. 1–229).–Morph.

Cox, H. T., Studies in the comparative anatomy of the Ericales, Ericaceae subfamily Rhododendroideae (Amer. Midl. Nat. 39, 1948, 220–245). –Morphology and phylogeny.

Miquel, F. A. W., Ericaceae Archipelagi Indici (Ann. Mus. Bot. Lugd.-Bat. 1, 1864, 36–45; 1866, 220–221, t. 2).–Descr.; records.

Sleumer, H., Vaccinioideen-Studien (Bot. Jahrb. 71, 1941, 375–510).–Subdiv. of the subfamily; keys to tribes and genera and subdivision of genera (*e. g. Vaccinium*); many new comb.

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1934) 203–207.–List of a number of mountain *spp.*

Local

Sumatra: Merrill, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 181–184.–New *spp.*

—, Not. Nat. Acad. Nat. Sc. Philadelphia *no* 47 (1940) 3–6.–3 new *Rhododendrons* from Atjeh.

Moore, J. Bot. (1925) Suppl. 55–57, 147.–List; 3 new *Vacciniums.*

Ridley, J. Fed. Mal. Stat. Mus. 8, 4 (1917) 56–58.–List; 2 new *Vacciniums.*

Airy Shaw, Kew Bull. (1948) 158–161.–Pictures of 2 *spp.*

Smith, J. J., Med. Rijksherb. Leiden *no* 30 (1916) 1–10.–Some *Vacciniums.*

—, Contr. Arn. Arb. 8 (1934) 122–129.–Records and new *spp.* from N. Sumatra.

—, in Fedde, Rep. 35 (1934) 292–297.–New *spp.*

—, Bull. Jard. Bot. Btzg III, 13 (1935) 443–464.–Some new *spp.* & var.

Malay Peninsula: Airy Shaw, Kew Bull. (1940) 304–305.–New *Gaultheria.*

Smith, J. J., Gard. Bull. Str. Settl. 8 (1935) 262–263.–New *Rhododendron.*

Java: Smith, J. J., Ic. Bog. 4 (1910) 73–74, t. 322.–New *Rhododendron.*

—, *ibid.* (1912) 99–101, t. 331.–New *Vaccinium.*

—, in Koord. & Val., Bijdr. Booms. Java 13 (1914) 88–169.

Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 387–389.–Critical notes on *Rhododendron* and *Vaccinium.*

—, Act. Hort. Berg. 15 (2) (1949) 41, fig. 1.–Distr. *Vaccinium bracteatum* in Mal.

Lesser Sunda Islands: Sleumer, Bot. Jahrb. 71 (1940) 146–147.–New *Rhododendron* from Flores.

Borneo: Beccari, Malesia 1 (1878) 199–213.–Descr. new *spp.*

Fischer, Kew Bull. (1932) 293.–New *Vaccinium.*

Gibbs, J. Linn. Soc. Lond. Bot. 42 (1914) 101–105.–List Kinabalu; a new *Rhododendron.*

Merrill, J. Str. Br. R. As. Soc. *no* 76 (1917) 102–110.–New *spp.*

—, J. Mal. Br. R. As. Soc. 1 (1923) 22–23.–New *Vaccinium.*

—, Sarawak Mus. J. 3 (1928) 541–543.–List; 2 new *Rhododendrons.*

Ridley, Kew Bull. (1914) 209–210.–New *Rhododendron.*

—, *ibid.* (1922) 106–108.–Descr. new *Vacciniums,* partly under *Rigiolepis.*

Sleumer, Bot. Jahrb. 71 (1940) 138–168.–Descr. new *spp.* mainly from Mt Kinabalu.

Smith, J. J., Ic. Bog. 4 (1910) 67–72, 75–79, t. 320–321, 323–324.–2 new *Vacciniums,* a *Rhododendron* and *Costera n.g.*

—, Bull. Jard. Bot. Btzg III, 1 (1920) 399–410.–Few new *spp.*

—, *ibid.* III, 13 (1935) 443–464.–Various new *spp.* & var.

Stapf, Trans. Linn. Soc. Lond. II, Bot. 4 (1894) 189–198, t. 14–15.–Kinabalu coll.; new *spp.* in all genera.

Philippines: Copeland, Philip. J. Sc. 40 (1929) 133–179, t. 1–16.–*Rhododendron*; key.

—, *ibid.* 42 (1930) 537–607, t. 1–7.–*Vaccinium*; key.

—, *ibid.* 47 (1932) 57–118, t. 1–8.–Other ericaceous genera; keys.

Elmer, Leafl. Philip. Bot. 3 (1911) 1089–1107.–Account *Eric.* Mt Apo, Mindanao; many new *spp.*

—, *ibid.* 10 (1939) 3730–3731.–New *Vaccinium.*

Merrill, Philip. J. Sc. 3 (1908) Bot. 369–382.–Revision; keys.

—, *ibid.* 27 (1925) 43–45.–2 new *spp.*

—, *ibid.* 30 (1926) 419.–New *Rhododendron.*

— & Quisumbing, *ibid.* 82 (1953) 333–334.–2 new *spp.* of *Rhododendron* from Palawan.

Rendle, J. Bot. 34 (1896) 355–357.–Some new *spp.*

Warburg, in Perkins, Fragm. Fl. Philip. (1905) 172–175.–4 new *spp.*

Celebes: Sleumer, Bot. Jahrb. 71 (1940) 138–168.–Descr. new *spp.* from coll. Warburg, Heinrich, and Sarasin.

Smith, J. J., Bull. Jard. Bot. Btzg II, *no* 8 (1912) 48–49.–New var. of a *Vaccinium.*

—, Med. Rijksherb. Leiden *no* 30 (1916) 7–9.–New *Vaccinium* var.

—, Bull. Jard. Bot. Btzg III, 1 (1920) 399–410.–Descr. new *spp.*

—, *ibid.* 4 (1922) 240.–New *Rhododendron.*

—, in Fedde, Rep. 30 (1932) 162–178.–Descr. new *spp.* Mt Bonthain.

—, Bull. Jard. Bot. Btzg III, 13 (1935) 443–464.–Some new *spp.* and var.

—, Bot. Jahrb. 68 (1937) 199–215.–Novelties coll. Kjellberg.

Moluccas: Smith, J. J., in Fedde, Rep. 30 (1932) 162–178.–Descr. new *spp.*

New Guinea: Beccari, Malesia 1 (1878) 199–213.–Descr. new *spp.*

Diels, Bot. Jahrb. 62 (1929) 486–488.–List; 3 new *spp.*

Förster, in Fedde, Rep. 13 (1914) 221–225.–6 new *Rhododendrons,* leg. Keysser.

Kanehira & Hatusima, Bot. Mag. Tokyo 56 (1942) 476–483.–List; 2 new *spp.*

Koorders, Nova Guinea 8 (1909) 183–191, t. 48.–New *spp.*

—, *ibid.* 8 (1912) 875–887, t. 150–157.–New *spp.*

Von Mueller, Vict. Nat. 1 (1884) 101–102.–New *Rhododendron.*

—, J. Bot. 24 (1886) 289–291.–*Agapetes n. sp., Catanthera n. g.* (= *Medinilla!*)

—, in Wing's South. Sc. Record new ser. 2 (1886) 2 pp.–Type descr. *Dimorphanthera* under *Agapetes.*

—, Vict. Nat. 4 (1887) 110–112.–New *Rhododendron.*

Schlechter, Bot. Jahrb. 55 (1918) 137–194.–Keys.

Sleumer, Bot. Jahrb. 70 (1939) 95–124.–Revision *Agapetes* & *Dimorphanthera*; keys.

—, *ibid.* 72 (1942) 207–269.–Revision of *Diplycosia, Gaultheria, Vaccinium*; many new *spp.*; keys.

Smith, J. J., Bull. Jard. Bot. Btzg II, *no* 8 (1912) 50–55.–List prelim. descr. new *spp.*

—, in Fedde, Rep. 12 (1913) 209.–New *Rhododendron.*

—, Ic. Bog. 4 (1913) 175–178, t. 353.–New *Dimorphanthera.*

—, Nova Guinea 12 (1914) 129–168, t. 29–52.–Records; new *spp.*

—, Meded. Rijksherb. Leiden *no* 25 (1915) 1–14.–Descr. new *spp.*

— , Nova Guinea 12 (1917) 495–537, t. 193–223;

correct. vol. 18, p. 89.–Key to *Rhododendron* & *Vaccinium*; records and new *spp.*

—, in Gibbs, Contr. Fl. Phytog. Arfak Mts (1917) 168–174.–List; records & new *spp.*

Wernham, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 89–99.–Many new *spp.* also *Mischopleura n.g.* (= *Elaeoc.*).

Solomon Isl.: Sleumer, Notizbl. Berl.-Dahlem 12 (1935) 485–486.–3 *Rhododendrons* from Bougainville.

Genera

Agapetes (*Pentapterygium, Paphia, Corallobotrys, Desmogyne*): Airy Shaw, Kew Bull. (1935) 24–53.–Critical notes; keys.

—, *ibid.* (1948) 77–104.

Sleumer, Bot. Jahrb. 70 (1939) 97–106.–Revision; key.

Catanthera = Medinilla (*Melastomataceae*).

Cheilotheca: Ridley, Fl. Mal. Pen. 2 (1923) 222–223, fig. 93.–Descr. *sp.* from Mal. Pen.

Costera (*Cymothoë, Iaera*): Airy Shaw, in Hook. Ic. Pl. 33 (1935) t. 3281, pp. 1–3.–New *sp.*

—, Kew Bull. (1935) 150–156.–*Cymothoë.*

Smith, J. J., Bull. Jard. Bot. Btzg III, 13 (1935) 418–424, fig. 1.–Revision; key.

Dimorphanthera: Sleumer, Bot. Jahrb. 70 (1939) 106–124.–Revision; key.

Gaultheria: Airy Shaw, Kew Bull. (1940) 306–330.–Classif. Asiat. *spp.*; keys; some Sumatran *spp.* included.

—, *ibid.* (1952) 171–174.–Key to Sino-Himalayan *spp.* of § *Leucothoides.*

Mischopleura = Sericolea (*Elaeocarpaceae*).

Pirola: Andres, Bull. Jard. Bot. Btzg III, 14 (1936) 4–7, fig. 1.–Descr. new *sp.* from N. Sumatra.

Rhododendron: Cowan, J. M., The Rhododendron leaf. A study of the epidermal appendages. Edinburgh & London (1950) 1–120, t. 1–15, fig. 1–8.–Structure of indument as a taxonomic character.

Hayes, Keenan & Cowan, Not. R. Bot. Gard. Edinb. 21 (1951) 1–33, t. 1–11.–Anat. of leaf in relation to taxon.

Von Hoff, Ber. Deut. Bot. Ges. 63 (1950) 31–35.–Significance of hair structures for allianceships and their interrelation.

—, Jahrbuch Rhododendron Gesellschaft Bremen (1953) 58–71, 81 fig.–Ontogeny of indumentum and importance of taxonomy.

—, *ibid.* (1954) 42–55, 11 fig.–Considerations on phylogeny on the basis of geogr. and morph.

Hutchinson, Rhododendron Yearbook (1946) 42–47.–Evolution and classification of the genus.

Kingdon Ward, J. Bot. 73 (1935) 241–247, fig. 1–3.–Seed types in *Rhododendron.*

—, Rhododendron Yearbook (1947) 99–114.–Observ. on classification.

Sinclair, Not. R. Bot. Gard. Edinb. 19 (1937) 267–271.–Structure of bud as a taxonomic character.

Sleumer, Bot. Jahrb. 74 (1949) 511–553.–Attempt of a subdivision of the genus.

Vaccinium (*Disiphon, Neojunghuhnia, Rigiolepis*): Sleumer, Bot. Jahrb. 71 (1941) 408–493.–Many new comb.; subdivision of the genus; keys to Indian & SE.-E. Asiat. *spp.*; occasionally a Mal. *sp.* included.

Smith, J. J., Blumea 1 (1935) 323–342, fig. 1.–Revision Mal. *spp.* of § *Rigiolepis*; no key.

ERIOCAULACEAE

Koernicke, F., Monographia scripta de Eriocaulaceis. Berlin (1856) i–ii, 1–36.–*Non vidi.*

—, Eriocaulacearum monographiae supplementum (Linnaea 27, 1856, 561–692).–List; descr.; partial keys.

—, in Miquel, Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 238–241.–Some records and one new *sp.*

Moldenke, H. N., The known geographic distribution of the members of the . . . and Eriocaulaceae. New York (1949) mimeogr. 1–215.–Checklist of names, geogr. arranged.

Ruhland, W., Pflanzenreich Heft 13 (1903) 1–294, fig. 1–40.

—, Zur geographischen Verbreitung der Eriocaulaceen (Bot. Jahrb. 50, Suppl. 1914, 363–374).–Geogr. distr.

—, Pflanzenfamilien ed. 2, 15a (1930) 39–57, fig. 16–25.

Steudel, E. G., Enumeratio plantarum Glumacearum pars II. Stuttgart (1855) 267–283.–Enum. descr. in Latin.

Local

India: Fyson, J. Ind. Bot. 1 (1919) 49–53; *ibid.* 2 (1921) 133–150, 192–207, 259–266, 307–320; *ibid.* 3 (1922) 12–18, 91–115, 51 t. & fig.–*Non vidi.*

—, The Indian species of Eriocaulon (1923) 1–88, t. 1–55.–Reprint of the above. *Non vidi.*

Raizada, Sc. & Cult. 14 (1949) 387–388.–Floral proliferation.

Indo-China: Lecomte, in Morot, J. de Bot. 21 (1908) 86–94, 101–109, fig. 1–3, 129–136, fig. 1–3.–Key to I.-C. *spp.*; morphol.; ecol.; dispersal.

Malay Peninsula: Ridley, Mat. Fl. Mal. Pen. (Monocot.) 3 (1907) 53–55.–Key.

Java: Backer, Handb. Fl. Java 3 (1924) 5–8.–Key; in Dutch.

Borneo: Gibbs, J. Linn. Soc. Bot. 42 (1914) 172.–List records.

Stapf, Trans. Linn. Soc. Lond. II, Bot. 4 (1894) 243–244.–New *sp.*

Suessenguth & Heine, Mitt. Bot. Staatssamml. München Heft 2 (1950) 57–58.–New *sp.*

Philippines: Ruhland, in Perkins, Fragm. Fl. Philip. (1904) 136.–New *sp.*

New Guinea: Ridley, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 240–241.–New *sp.*

Genera

Eriocaulon: van Steenis, Bull. Bot. Gard. Btzg III, 18 (1950) 460–461.–Reduction of the forgotten genus *Busseuillia* Less. from Australia to *Eriocaulon.*

ERYTHROPALACEAE

See Olacaceae

ERYTHROXYLACEAE

BURCK, W., Les Erythroxyleae des Indes Néerlandaises (Ann. Jard. Bot. Btzg 11, 1893, 190–194, t. 15–16).–Survey; no key; 4 new *spp.*

SCHULZ, O. E., Pflanzenreich Heft 29 (1907) 1–176.

—, Pflanzenfamilien ed. 2, 19a (1931) 130–143, fig. 60–67.

Local

New Guinea: SCHULZ, Bot. Jahrb. 58 (1924) 249.–Records; new var.

Solomon Islands: WHITE, J. Arn. Arb. 31 (1950) 89–90.–New *sp.*

EUPHORBIACEAE

(*excl. Daphniphyllaceae*)

BAILLON, H., Étude générale du groupe des Euphorbiacées. Paris (1858) 1–684, Atlas 1–52, t. 1–27.–Classification of genera.

—, Nouvelles observations sur les Euphorbiacées (Adansonia 11, 1873–74, 72–138).–Mostly relating to New Caled. *spp.*; some of Africa & Malaysia; *Cephalomappa n.g.*

CROIZAT, L. C. M., The tribe Plukenetiinae of the Euphorbiaceae in eastern tropical Asia (J. Arn. Arb. 22, 1941, 417–431).–*Plukenetia*, *Tragia*, *Megistostigma* (*Clavistylus*), *Cnesmone;* no keys to *spp.*

GRÜNING, G., Porantheroideae, Ricinocarpoideae (Pflanzenreich Heft 58, 1913, 1–97, fig. 1–16).–Contains only some Australian genera, some of which might occur in New Guinea.

JABLONSZKY, E., Euphorbiaceae-Bridelieae (Pflanzenreich Heft 65, 1915, 1–98, fig. 1–15).–*Bridelia*, *Cleistanthus.*

MUELLER(-ARG.), J., Euphorbiaceae. Vorläufige Mittheilungen aus dem für De Candolle's Prodromus bestimmten Manuscript über diese Familie (Linnaea 32, 1863, 1–126; *ibid.* 34, 1865, 1–224).–Descr.; partial keys.

— & E. BOISSIER, in DC. Prodr. 15² (1866) 1–1286.

PAX, F., Euphorbiaceae-Jatropheae (Pflanzenreich Heft 42, 1910, 1–148, fig. 1–45).–*Aleurites*, *Elateriospermum*, *Hevea*, *Jatropha*, *Tritaxis.*

—, Euphorbiaceae-Adrianeae (*ibid.* Heft 44, 1910, 1–111, fig. 1–35).–*Cephalomappa*, *Manihot.*

— & K. HOFFMANN, Euphorbiaceae-Cluytieae (*ibid.* Heft 47, 1911, 1–124, fig. 1–35).–*Codiaeum*, *Dimorphocalyx*, *Erismanthus*, *Galearia*, *Microdesmis*, *Paracroton*, *Strophioblachia*, *Syndyophyllum*, *Trigonopleura*, *Trigonostemon.*

—, Euphorbiaceae-Gelonieae (*ibid.* Heft 52¹, 1912, 1–41, fig. 1–11).–*Baliospermum*, *Chaetocarpus*, *Cheilosa*, *Endospermum*, and *Gelonium.*

—, Euphorbiaceae-Hippomaneae (*ibid.* Heft 52², 1912, 1–319, fig. 1–58).–*Excoecaria*, *Homalanthus*, *Hura*, *Omphalea*, *Pimeleodendron*, *Sapium*, *Sebastiania.*

—, Euphorbiaceae - Acalypheae - Chrozophorinae (*ibid.* Heft 57, 1912, 1–142, fig. 1–45).–*Agrostistachys*, *Chrozophora*, *Sumbavia*, *Sumbaviopsis.*

—, Euphorbiaceae - Acalypheae - Mercurialinae (*ibid.* Heft 63, 1914, 1–473, fig. 1–67).–*Alchornea*, *Alcinaeanthus*, *Blumeodendron*, *Calpigyne*, *Cladogynos*, *Claoxylon*, *Clarorivinia*, *Cleidion*, *Coccoceras*, *Coelodepas*, *Macaranga*, *Melanolepis*, *Micrococca*, *Neotrewia*, *Podadenia*, *Trewia*, *Wetria.*

—, Additamentum V (*ibid.* Heft 63, 1914, 397–427).

—, Acalypheae - Plukenetiinae, A.-Epiprininae, A.-Ricininae, Pereae (*ibid.* 68¹, 1919, 1–134, fig. 1–29).–*Clavistylus*, *Cnesmone*, *Epiprinus*, *Homonoia*, *Pachystylidium*, *Plukenetia*, *Pterococcus*, *Ricinus*, *Sphaerostylis*, *Tragia.*

—, *ibid.* Heft 68² (1919) 1–59, fig. 1–9.–*Dalechampia.*

—, Additamentum VI (*ibid.* Heft 68⁴, 1919, 1–81).–System of the *Crotonoideae*; *Annesijoa n. g.* (Papua); *Blumeodendron n. spp.*; *Claoxylon n. spp.* (Papua), *Mallotus n. spp.* (Malaysia), *Coelodepas n. sp.* (Borneo), *Cleidion n. spp.* (Malaysia), *Macaranga* (*ditto*; many of Papua), *Neomphalea n.g.* (Papua), *Homalanthus n. sp.* (Papua).

—, Euphorbiaceae - Phyllanthoideae - Phyllantheae (*ibid.* Heft 81, 1922, 1–349, fig. 1–26).—*Actephila*, *Agyneia*, *Andrachne*, *Antidesma*, *Aporosa*, *Baccaurea*, *Bischofia*, *Dicoelia*, *Drypetes*, *Hymenocardia*, *Longetia*, *Richeriella*, *Sauropus.*

—, Euphorbiaceae - Crotonoideae - Acalyphinae (*ibid.* Heft. 85, 1924, 1–178, fig. 1–3).–*Acalypha*, *Acalyphopsis n. g.* (Celebes).

—, Additamentum VII (*ibid.* Heft 85, 1924, 179–204).–New Mal. *spp.* in *Claoxylon*, *Macaranga*, and *Pimeleodendron.*

—, Pflanzenfamilien ed. 2, 19c (1931) 1–233, fig. 6–123.

SCHEFFER, R. H. C. C., Observationes de quibusdam Euphorbiaceis Archipelagi indici (in MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 4, 1869, 119–127).–List; based on MÜLLER's monogr.; few new *spp.*

SMITH, J. J., Ic. Bog. 4 (1910) 16–47, t. 306–316.–New *spp.* of *Antidesma*, *Baccaurea*, *Croton*, *Cyclostemon* and *Glochidion.*

—, Bull. Jard. Bot. Btzg III, 1 (1920) 390–396, t. 38–44.–Misc. new *spp.*

—, *ibid.* 4 (1922) 235–237, t. 9.–*Ditto.*

—, *ibid.* 6 (1924) 82–107.–*Ditto.*

WHEELER, L. C., The genera of the living Euphorbiaceae (Amer. Midl. Nat. 30, 1943, 456–503).–List of genera and their types.

ZOLLINGER, H., Over de soorten van Rottlera . . ., alsmede over eenige verwante geslachten uit de familie der Euphorbiaceae (Acta Soc. Sc. Indo-Neerl. 1, 1856, 1–32).–Redefinition of *Rottlera* (= Mallotus); enum. *spp.* based on coll. in Herb. Hort. Bog.; descr. some new genera under joint authorship with REICHENBACH.

—, Nachtrag zu dem Aufsatze über Rottlera und verwandte Euphorbiaceen (Linnaea 29, 1857, 462–469).–List of *spp.* of *Mappa*; *Doryxylon n.g.*

Local

Asia: Croizat, J. Arn. Arb. 21 (1940) 490–510.–Various misc. notes and descr. also incl. Mal. *spp.*

—, *ibid.* 23 (1942) 29–54.–*Ditto.*

Sumatra: Croizat, J. Arn. Arb. 23 (1942) 54.–New *Trigonostemon.*

Merrill, Contr. Arn. Arb. 8 (1934) 85–91.–List; new *Endospermum.*

—, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 161–162.–New *Macaranga.*

Moore, J. Bot. (1925) Suppl. p. 92–105.–List Forbes coll.; new *spp.* in *Cleistanthus, Glochidion, Drypetes, Neoscortechinia, Gelonium, Blumeodendron; Clonostylis n. g.*

Ridley, J. Fed. Mal. Stat. Mus. 8, 4 (1917) 82–84.–List; new *Homalanthus.*

—, Kew Bull. (1925) 88–90.–New *spp.* in *Glochidion, Macaranga & Trigonostemon.*

—, *ibid.* 1 (1926) 80–81.–List; new *Gelonium* and *Trigonostemon.*

Malay Peninsula: Corner, Gard. Bull. Str. Settl. 10 (1939) 288–299.–Critical notes on species of various genera.

Croizat, Gard. Bull. Str. Settl. 9 (1937) 145–151.–New name for a *Euphorbia.*

Gage, Kew Bull. (1914) 239–241.–New *spp.* of *Cleistanthus & Phyllanthus.*

—, Rec. Bot. Surv. Ind. 9 (1920) 219–249.–New *spp.* and records.

—, J. & Proc. As. Soc. Bengal 75 (1936) 469–527.–Good general keys to genera; revisions of *Bridelia, Cleistanthus, Actephila, Andrachne, Agyneia, Flueggea.*–Continuation of King & Gamble's 'Materials', but not complete.

Henderson, Gard. Bull. Str. Settl. 7 (1933) 121–125, t. 32.–List; new *Sauropus & Richeriella.*

Ridley, Kew Bull. (1923) 360–369.–New *spp.*, *Actephiliopsis n. g.*

Java: Koorders, Bull. Jard. Bot. Btzg III, 1 (1919) 145–147, t. 9.–Descr. new *Glochidion.*

Meeuse & Adelbert, in Backer, Bekn. Fl. Java (em. ed.) 4C (1943) fam. 112, p. 1–134.–Revision, in Dutch; keys.

Pax & Hoffmann, Blumea 3 (1938) 60–61.–New *sp.* from E. Java.

Smith, J. J., in Koord. & Val. Bijdr. Booms. Java 12 (1910) 1–782.–Very important contribution.

Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 399.–Record of *Chrozophora.*

Borneo: Diels & Hackenberg, Bot. Jahrb. 60 (1926) 309.–New *Macaranga.*

Gagnepain, Bull. Soc. Bot. Fr. 71 (1924) 621.–New *Dimorphocalyx.*

Hutchinson, J. Linn. Soc. Lond. Bot. 42 (1914) 133–186.–List coll. Gibbs; new *Antidesma.*

Merrill, Philip. J. Sc. 11 (1916) Bot. 54–77.–Many new *spp.* in various genera; *Moultonianthus n. g.*

—, J. Str. Br. R. As. Soc. *no* 76 (1917) 89–93.–3 *Antidesmas*, 1 *Ostodes.*

—, Philip. J. Sc. 13 (1918) Bot. 80–84.–3 new *Mallotus*, 1 new *Cleistanthus.*

—, J. Str. Br. R. As. Soc. *no* 86 (1922) 319–322.–List; new *spp.* in *Galeria, Glochidion.*

—, Philip. J. Sc. 21 (1922) 521–523.–List; new *Aporosa & Cyclostemon.*

—, *ibid.* 30 (1926) 80–81.–New *Coelodepas.*

—, Sarawak Mus. J. 3 (1928) 525–526.–List; new *Mallotus* and *Trigonostemon.*

—, Pl. Elm. Born. (1929) 139–166.–List; new *spp.* in many genera.

Pax & Hoffmann, Pflanzenreich Heft 63 (1914) 418, 422–423.–New *spp.* of *Endospermum & Excoecaria.*

—, Mitt. Allg. Inst. Bot. Hamburg 7 (1931) 222–230.–List; new *sp.* in *Antidesma, Glochidion, Alchornea, Macaranga* and *Gelonium.*

Stapf, Trans. Linn. Soc. Lond. II, 4 Bot. (1894) 223–226.–New *sp.* in *Claoxylon, Glochidion.*

Philippines: Elmer, Leafl. Philip. Bot. 2 (1908) 427–434.–6 *Macarangas.*

—, *ibid.* 3 (1910) 903–931.–List & new *spp.* from Sibuyan.

—, *ibid.* 4 (1911) 1271–1306.–List; new *spp.* from Palawan.

—, *ibid.* 9 (1934) 3186–3187.–New *Gelonium.*

—, *ibid.* 10 (1939) 3731–3736.–4 new *spp.*

Merrill, Philip. J. Sc. 7 (1912) Bot. 379–410; *ibid.* 9 (1914) 461–493; *ibid.* 11 (1916) Bot. 189–191; *ibid.* 16 (1920) 539–597.–Misc. new *spp.*; no keys.

—, *ibid.* 26 (1925) 462–466.–New *spp.* in *Glochidion* and *Phyllanthus.*

—, *ibid.* 27 (1925) 30–31.–*New Gelonium* and *Dimorphocalyx.*

—, *ibid.* 30 (1926) 402–407.–New *sp.* in *Cleidion, Croton,* and 2 in *Phyllanthus.*

Quisumbing, Philip. J. Sc. 41 (1930) 328–332, fig. 7–8.–2 new *Trigonostemons.*

—, *ibid.* 76 (1944) 42–43.–New *Claoxylon.*

— & Merrill, *ibid.* 37 (1928) 158–161.–New *sp.* in *Actephila, Antidesma* and *Phyllanthus.*

Robinson, Philip. J. Sc. 4 (1909) Bot. 71–105.–Philippine *Phyllanthinae*; keys.

Stapf, in Elmer, Leafl. Philip. Bot. 1 (1907) 206–207.–New *Trigonostemon.*

Moluccas: Merrill, Philip. J. Sc. 11 (1916) Bot. 281–285.–Records; new *spp.* in *Breynia* and *Macaranga.*

New Guinea: Bailey, Proc. R. Soc. Queensl. 18 (1903) repr. p. 3–4.–New *Baccaureas.*

Croizat, Bull. Bot. Gard. Btzg III, 16 (1940) 351–357.–New *Euphorbia.*

—, J. Arn. Arb. 23 (1942) 369–376.–New *Crotons.*

Gage, Nova Guinea 12 (1914) 479–486, t. 182–187.–List; new *spp.* in *Phyllanthus, Macaranga, Homalanthus,* and *Omphalea.*

Hutchinson, in Gibbs, Contr. Fl. Phytog. Arfak Mts (1917) 145, 213–214.–New *Homalanthus* and some records.

Mansfeld, J. Arn. Arb. 10 (1929) 77–79.–New *sp.* of *Macaranga & Aporosa.*

Moore, J. Bot. (1923) Suppl. 44–49.–List; new *Glochidion,* 2 *Phyllanthus, Antidesmas, Acalyphas, Macarangas.*

Pax, in Fedde, Rep. 8 (1910) 325.–New *Phyllanthus.*

— & Hoffmann, Pflanzenreich Heft 63 (1914) 419.–New *Omphalea.*

Perry, J. Arn. Arb. 34 (1953) 191–257.–Revision *Macaranga*; keys.

Ridley, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 147–148.–List; 2 new *Macarangas.*

Smith, J. J., Nova Guinea 8 (1910) 221–245, t. 52–60.–Several new *spp.*

—, *ibid.* 8 (1912) 779–795, t. 130–142.–*Ditto.*

—, *ibid.* 12 (1917) 543–548, t. 226–229.–*Ditto.*

Smith, L. S., Proc. R. Soc. Queensl. 58 (1946) 51–60, t. 1–2.–Revision *Endospermum*; key.

—, North Queensl. Natur. 15 (*no* 84) (1947) 1–2. –Notes on *Phyllanthus § Nymania*; one new name.

Warburg, Bot. Jahrb. 13 (1891) 347–361.–List; new *spp.* in many genera.

—, *ibid.* 18 (1893) 196–199.–Descr. of a new genus and of new *spp.* in several genera.

Fiji: Smith, A. C., J. Arn. Arb. 33 (1952) 367–402. –Revision of *Antidesma*, *Acalypha* & *Macaranga.*

Genera

Acalypha: Nitschke, in Mez, Bot. Arch. 4 (1923) 277–317, map.–Geogr. distr. & system. of the genus.

Agyneia: van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 410–411.–Distr. *A. bacciformis* in Malaysia.

Aleurites: Hemsley, Kew Bull. (1906) 119–121; *ibid.* (1908) 93; *ibid.* (1914) 1–4.–Revisions; new *spp.*; synon.; no key.

—, in Hook. Ic. Pl. 29 (1906) t. 2801–2802.–*A. cordata* & *trisperma.*

Langeron, M., Le genre Aleurites Forst. Systématique–Anatomie–Pharmacologie. Paris (1902) 1–160, fig. 1–52.–Key to 3 *spp.*

Antidesma: Miquel, Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 218.–3 new *spp.*

Botryophora: Beumée, Hoe het groeide. Wageningen (1947) 10–12.–Reduction of a Sumatran *Sterculia* to *B.;* ♂ floral morphol.; in Dutch; no new comb.

Airy Shaw, Kew Bull. (1948) 484.–Syn. & distr. of the genus and *sp.*

Breynia: Croizat, Bull. Bot. Gard. Btzg III, 17 (1942) 211–212.–Nomencl. generic name.

Bridelia: Gehrmann, Bot. Jahrb. 41 (1908) Beibl. 95, 1–42, fig. 1–3.–Precursor to monogr.; special attention to African *spp.*; general remarks; key to *spp.*

Haines, J. Bot. 59 (1921) 188–193.–Critical notes on some Indian *spp.*

Chondrostylis: Boerlage, Ic. Bog. 1 (1897) 71–72, t. 23.

Koorders, Ann. Jard. Bot. Btzg 19 (1904) 45–56, t. 4–5.–Descr.; morph.; anat.; taxon. position.

Chrozophora: Prain, Kew Bull. (1918) 49–120.–Monogr.; key.

Claoxylon (*Erythrococca, Micrococca*): Prain, Ann. Bot. 25^2 (1911) 575–638.–*Erythrococca* & *Micrococca* segregated as separate genera; keys.

Cleistanthus (*Paracleisthus*): Croizat, J. Arn. Arb. 23 (1942) 38–41.–Reduction; new *spp.* and recomb. from SE. Asia.

Gagnepain, Bull. Soc. Bot. Fr. 70 (1923) 497–502.—Disc. of *Paracleisthus*; delimit.; 3 new *sp.*

Coelodepas: Croizat, J. Arn. Arb. 23 (1942) 29.–*Calpigyne auct.* = *Coelodepas* Hassk. (*Nephrostylus* Gagn.)

Coelodiscus: Pax, in Fedde, Rep. 8 (1910) 481–482.–Two new Pap. *spp.*

Daphniphyllum. See *Daphniphyllaceae.*

Dicoelia: Croizat, J. Arn. Arb. 23 (1942) 38.–Some critical notes.

Dimorphocalyx: White, Proc. R. Soc. Queensl. 47 (1935) 80 (1936).–Descr. 1st Austr. *sp.*

Elaeogene = Vatica (*Dipterocarpaceae*), *cf.* Hallier *f.*, Med. Rijksherb. Leiden *no* 36 (1918) 4.

Endospermum (*Capellenia* T. & B.): Kurz, J. Bot. 5 (1867) 23.–Reduction *Capellenia*; enum. *spp.*

Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 457–458; Fl. Mal. Bull. 3 (1948) 74.–Prop. conserv.

Epiprinus (*Symphyllia*): Croizat, J. Arn. Arb. 23 (1942) 52–54.–Critical notes; some new comb.; new *sp.* from SE. Asia.

Euphorbia: Keng, Quart. J. Taiw. Mus. 4 (1951) 253–260, fig. 1–2.–Revision; key.

Sedgwick, J. Bombay Nat. Hist. Soc. 26 (1919) 599–600.–*E. rothiana* reduced to *E. laeta*; *E. oreophila* restored for the mountain *sp.*

Sherff, Ann. Missouri Bot. Gard. 25 (1937) 1–94, t. 2–11.–Revision Hawaiian *spp.*; keys.

White, A., R. A. Dyer & B. L. Sloane, The succulent Euphorbieae (Southern Africa). Pasadena, Cal. (1941) 2 vol., xiv + 990 + 11 pp., 1102 fig., 26 col. pl.–Descr.; key to the *spp.*

White, C. T., Proc. R. Soc. Queensl. 53 (1942) 227.–Record of *Euph. plumerioides* from Thursday Isl.

Glochidion: Alston, Ann. R. Bot. Gard. Peradeniya 11 (1928) 1–10, t. 1.–Revision & key to Ceylon *spp.*

Mueller-Arg., Flora 48 (1865) 369–380, 385–391.–Brief revision; partial keys.

Hevea: Ducke, Arch. Jard. Bot. Rio de Janeiro 5 (1930) 147–157.–Key; synopsis.

—, *ibid.* 6 (1933) 49–57.–List.

—, Arq. Inst. Biol. Veget. (Rio de Janeiro) 2 (1935) 217–246, t. 1–3.–Revision of mainly Brazilian *spp.*; key.

—, Arq. Serv. Florestal, Rio de Jan. 2^1 (1943) 25–49.–Discussion of some *spp.;* hybridization; no key.

Huber, Bol. Mus. Goeld. 4 (1905) 620–651.–Synopsis; partial key; in Portuguese.

—, *ibid.* 7 (1913?) 199–281, map.–New contrib.; new *spp.*; partly in German, partly in Portug.; descr. in Latin.

Jatropha: McVaugh, Bull. Torr. Bot. Club 72 (1945) 271–294, fig. 1–24.–Rev. Amer. *sp.*; keys.

Wilbur, J. Elisha Mitchell Sc. Soc. 70 (1954) 92–101.–Synopsis *§ Eucurcas*; key to *spp.*

Lophopyxis: Holthuis & Lam, Blumea 5 (1942) 205–208, fig. 7.–Synon. & distr.

Macaranga: Baker, Gard. Bull. Str. Settl. 8 (1934) 63–68, t. 11–15.–Biol. of *Macaranga spp.* in relation to ants.

Perry, J. Arn. Arb. 34 (1953) 191–257.–Full rev. of 60 Pap. *spp.* incl. some of adjacent islands; keys!

Mallotus (*Aconceveibum*): Merrill & van Steenis, Webbia 8 (1952) 405–406.–Reduction.

Megistostigma (*Clavistylus*): van Steenis, Bull. Jard. Bot. Btzg III, 12 (1932) 174, 201–204, fig. 6, 10.–Full descr. of *C. peltatus*.

Melanolepis: Gagnepain, Bull. Soc. Bot. Fr. 71 (1924) 1026–1027.–2nd *sp.* of the genus.

Moultonianthus: Merrill, Philip. J. Sc. 11 (1916) Bot. 70–71.–Type descr.

van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 405.–New comb.

Neoscortechinia (*Alcinaeanthus*, *Scortechinia* Hook. *f. non* Sacc.): Merrill, Philip. J. Sc. 11 (1916) Bot. 75–76.–Census of the genus.

—, Pl. Elm. Born. (1929) 164–165.–Critical note on identity of *Alcinaeanthus*.

Phyllanthodendron (*Phyllanthus § , etc.*): Croizat, J. Arn. Arb. 23 (1942) 32–38.–Revision; key to subdivision; no key to *spp.*; recomb.

Phyllanthus § Nymania (*Leichhardtia*, *Nymania*, *Phyllanthus § Leichhardtia*): Diels, Notizbl. Berl.-Dahlem 11 (1931) 308–311.–Revision; key.

Smith, L. B., North Queensl. Natur. 15 (1947) 1–2.–Nomencl.; addit. descr.

van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 460.–Nomencl.

Pimeleodendron: Smith, J. J., Bull. Jard. Bot. Btzg III, 6 (1924) 100–107.–Census; descr. new *spp.*; no key.

Ptychopyxis (*Calpigyne*, *Podadenia*): Croizat, J. Arn. Arb. 23 (1942) 47–50.–Critical notes; *Calpigyne* is regarded as a *nomen confusum*; new subdiv.; no key.

Sauropus (*Breyniopsis*): Croizat, J. Arn. Arb. 21 (1940) 494–496.–*Breyniopsis* is reduced.

—, Bull. Bot. Gard. Btzg III, 17 (1941) 209–211.–Proposed conserv. against *Arachne*.

Sebastiana: van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 409–410.–Key to some W. Mal. *spp.*

Suregada (*Gelonium* Roxb. *non* Gaertn.): Croizat, Bull. Jard. Bot. Btzg III, 17 (1942) 212–217.–Reduction; all recombinations.

Merrill, J. Arn. Arb. 32 (1951) 79–81.–Addit. critical remarks on the above; some *spp.* removed to other families.

Trigonopleura (*Peniculifera*): Symington, Kew Bull. (1937) 319.–Reduction.

Trigonostemon: van Steenis, Fl. Mal. Bull. 3 (1948) 74–75.–Proposed conserv. against *Enchidium*.

Trisyngyne = Nothofagus (*Fagaceae*)

EUPOMATIACEAE

Diels, L., Die verwandtschaftlichen Beziehungen von Eupomatia (Bot. Jahrb. 48, Beibl. 107, 1912, 11–13).

Local

New Guinea: Diels, Bot. Jahrb. 49 (1912) 165.–Under *Annonaceae*.

White, J. Arn. Arb. 10 (1929) 213.

FAGACEAE

(*Castaneaceae, Cupuliferae*)

Barnett, E. C., Keys to the groups of Quercus, Lithocarpus, and Castanopsis of Eastern Asia with notes to their distribution (Trans. & Proc. Bot. Soc. Edinb. 34, 1944, 159–204).–List; keys to genera, sections, and species groups.

Hjelmqvist, H., Studies on the floral morphology and phylogeny of the Amentiferae (Bot. Notiser 1948, Suppl. vol. 2, *no* 1, p. 1–171, fig. 1–58).

Koidzumi, G., On the classification of Castaneaceae (Bot. Mag. Tokyo 30, 1916, 92–103, 185–215).–Complete enum.; for *Lithocarpus* the name *Synaedrys* is introduced; otherwise no new comb.

Lendner, A., Sur la cupule des Fagacées (Bull. Soc. Bot. Genève II, 8, 1916, 161–166, 2 fig.).

Miquel, F. A. W., Plant. Jungh. (1851) 8–14.–List *Quercus*; descr. *Callaeocarpus* (= *Castanopsis*).

—, Adnotationes de Cupuliferis (Ann. Mus. Bot. Lugd.-Bat. 1, 1863, 102–121, 221).–Enum.; descr.

Prantl, K., Beiträge zur Kenntnis der Cupuliferen (Bot. Jahrb. 8, 1887, 321–336).–General discussion morph.

Schwarz, O., Entwurf zu einem natürlichen System der Cupuliferen und der Gattung Quercus L. (Notizbl. Berl.-Dahlem 13, 1936, 1–22).–System of the family; subdiv. Quercus; keys to these subdivisions and segregates!

Seemen, A. von, Cupuliferen in dem Herbar zu Buitenzorg (Bull. Dép. Agric. Ind. Néerl. *no* 1, 1906, 1–14).–List *spp.* in Herb. Bog., some new.

Local

Formosa: Li, Bull. Torr. Bot. Club 80 (1953) 317–324.–Taxon. notes.

Siam: Barnett, Kew Bull. (1938) 98–106.–Descr. new *spp. Quercus* and *Castanopsis*.

—, Trans. & Proc. Bot. Soc. Edinb. 33 (1942) 327–343.–Revision; no descr.; keys to genera & *spp.*!

Sumatra: Merrill, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 152–153.–New *Castanopsis*.

—, Contr. Arn. Arb. 8 (1934) 42–44.–List *Quercus*.

—, J. Arn. Arb. 33 (1952) 241–242.–Interpr. 2 *spp.* of Jack.

Scheffer, Nat. Tijd. Ned. Ind. 31 (1870) 359–363; *ibid.* 32 (1873) 415–417.–New records and *spp.* of *Quercus* and *Castanopsis* from Banka.

Malay Peninsula: Camus, Bull. Mus. Hist. Nat. Paris II, 4 (1932) 912–914.–New *Quercus spp.* from the Mal. Pen.

—, Bull. Soc. Bot. Fr. 80 (1933) 353–355.–New *Quercus*; also from SE. Asia.

—, Bull. Mus. Hist. Nat. Paris II, 5 (1933) 88–89.–New *Quercus*.

—, *ibid.* II, 6 (1934) 92–94.–New *Quercus* & *Castanopsis.*

—, Bull. Soc. Bot. Fr. 94 (1947) 4–5.–New *spp.* of *Castanopsis* and *Quercus.*

CORNER, Gard. Bull. Str. Settl. 10 (1939) 279–280.–Synon. *Quercus lappacea*; critics on subdivision of *Quercus.*

GAMBLE, Kew Bull. (1914) 177–181.–Descr. new *spp. Quercus* & *Castanopsis.*

HENDERSON, Gard. Bull. Str. Settl. 5 (1930) 76–78, 1 fig.–New *Pasania.*

Borneo: CAMUS, Bull. Soc. Bot. Fr. 75 (1928) 698. –New *Castanopsis.*

SCHOTTKY, Bot. Jahrb. 49 (1913) 356–359.–Records coll. WINKLER; 2 new *Pasanias* and 2 new *Castanopsis.*

WARBURG, Kew Bull. (1936) 19–21.–3 new *Castanopsis* from Sarawak.

Java: BLUME, Verh. Bat. Gen. K. & W. 9 (1823) 205–221, 6 pl.–Descr. *Quercus.*

JUNGHUHN, Nat. Tijd. Ned. Ind. 15 (1858) 119–123.–Descr. *Quercus.*

KOORDERS, Teysmannia 11 (1900) 133–138.–In Dutch; key to *Castanopsis.*

— & VALETON, Bijdr. Booms. Java 10 (1904) 1–65.

MIQUEL, Plant. Jungh. (1851) 8–13.–List; some new *spp.*

OUDEMANS, in MIQUEL, J. de Bot. (1861) 244–249.–Prelim. note *Quercus* coll. JUNGHUHN.

Celebes: KOORDERS, Suppl. Flora N. O. Celebes 2 (1922) t. 2; *ibid.* 3 (1922) 1.–New *Quercus.*

Philippines: CAMUS, Bull. Soc. Bot. Fr. 81 (1934) 816.–New *Quercus.*

ELMER, Leafl. Philip. Bot. 3 (1910) 933–946.–Account of *Quercus* & *Castanopsis* on Mt Apo; some new *spp.*

—, *ibid.* 6 (1913) 1981–1986.–*Quercus* from Mt Urdaneta; some new *spp.*

—, *ibid.* 9 (1934) 3188–3189.–New *Quercus* from Mt Pinatubo.

—, *ibid.* 10 (1939) 3736–3738.–New *Quercus* from Mt Bulusan.

MERRILL, Philip. J. Sc. 3 (1908) Bot. 317–330.–Revision of *Fagac.*; keys!

—, *ibid.* 21 (1922) 516–517.–A *Quercus § Pasania.*

—, *ibid.* 29 (1926) 362–363.–New *Castanopsis.*

—, *ibid.* 29 (1926) 476–477.–New *Quercus § Pasania.*

—, *ibid.* 30 (1926) 79–80.–New *Castanopsis.*

—, *ibid.* 35 (1928) 6.–New name in *Quercus.*

VON SEEMEN, in FEDDE, Rep. 5 (1908) 21.–New *Quercus.*

New Guinea: BAILEY, Queensl. Agric J. 22 (1908) 149.–New *Castanopsis.*

MARKGRAF, Bot. Jahrb. 59 (1924) 61–79, 4 fig.; *ibid.* (1925) 538–539.–Revision.

VAN STEENIS, Blumea 7 (1952) 146–147, 306.–Diagn. new *Nothofagus.*

—, J. Arn. Arb. 34 (1953) 301–374, fig. 1–23.–Revision *Nothofagus*; keys!

—, *ibid.* 35 (1954) 266–267, 1 fig.–Add. note *Nothofagus.*

WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 227.–List of records coll. LANE-POOLE.

Genera

Castanopsis: DEN BERGER, Hand. 4e Ned. Ind. Natuurw. Congr. (Weltevreden) (1926) 402.–*Quercus acuminatissima* is a *Castanopsis* as to wood-anat.

BLUME, Mus. Bot. Lugd.-Bat. 1 (1850) 282–286. –List.

CAMUS, A., Les châtaigniers. Monographie des genres Castanea et Castanopsis (Encycl. Écon. Sylv. 3, 1929, 1–604, t. 1–24, maps 1–4; Atlas (folio) (1929) t. 1–76, I–XXXIV).–Monogr.; keys.

KING, Ann. R. Bot. Gard. Calc. 2 (1889) 17–18, 93–107, t. 83–103.–Revision Indo-Mal. *spp.*; key.

LITTLE, Phytologia 3 (1949) 81–82.–Prop. conserv. *Castanopsis.*

MIQUEL, Pl. Jungh. (1851) 13–14.

REHDER, J. Arn. Arb. 1 (1919) 121–122.–New comb. Malaysian *spp.*

Nothofagus: CAMUS, Rev. Int. Bot. Appl. & Agric. Col. 31 (1951) 71–84, pl. 4 (1952).–Survey; (incomplete and wrong) key!

LANGDON, Bot. Gazette 108 (1947) 350–371, 37 fig.–Compar. morphol.

DU RIETZ, Svensk Bot. Tidskr. 24 (1930) 504–510.–Domatia in New Zeal. *spp.*

VAN STEENIS, Taxon 2 (1953) 177.–Proposal for conservation.

—, J. Arn. Arb. 34 (1953) 301–374, fig. 1–23.–Revision of the genus; keys!

—, *ibid.* 35 (1954) 266–267, fig. 1.–Reduction of *Trisyngyne* BAILL. (New Caledonia); notes on some S. Amer. & Papuan *spp.*

Quercus *s. l.* (*Lithocarpus, Pasania, etc.*): BLUME, Mus. Bot. Lugd.-Bat. 1 (1850) 287–288.–List of some *spp.*

CAMUS, A., Les chênes. Monographie du genre Quercus sous-genre Cyclobalanopsis et Euquercus (sect. Cerris & Mesobalanus) (Encycl. Écon. Sylv. 7, 1936–1938, 1–686, fig. 1–35; Atlas (1934) 1–93, t. 1–178, 1–XXX).–Monograph; keys.

—, *ditto*, sous-genre Euquercus sect. Lepidobalanus et Macrobalanus (*ibid.* 7, 1938–1939, 1–830, fig. 1–59; Atlas (folio) 1935–1936, 1–177, t. 79–236, XXXI–LVIII).–*Ditto.* Not more seen.

DE CANDOLLE, Ann. Sc. Nat. Bot. IV, 18 (1862) 49–58.–New subdiv. *Quercus. Cf.* also J. Bot. 1 (1863) 134–142.

HANCE, J. Bot. 1 (1863) 173–183.–On generic delimitation in *Quercus* and other *Fagaceae.*

—, *ibid.* 12 (1874) 240–243.–Some new Mal. *spp.* of *Quercus.*

KING, Ann. R. Bot. Gard. Calc. 2 (1889) 17–92, t. 15–82, 104.–Revision Indo-Mal. *spp.*; keys!

KORTHALS, in TEMMINCK, Verh. Nat. Gesch., Botanie (1842–44) 195–217, t. 43–47.–Descr.

MULLER, U. S. Dep. Agric. Misc. Publ. 477 (1942) 1–216, t. 1–124.–Revision Central Amer. *spp.*; key!

—, Chron. Bot. 7 (1942) 12–14.–Discussion infrageneric subdiv.

OUDEMANS, Annotationes criticae in Cupuliferas nonnullas javanicas (Nat. Verh. Kon. Akad. 11,

1865, repr. 1–24).–Descr. some new *spp.*; revision; key to Mal. *spp.*

REHDER, J. Arn. Arb. 1 (1919) 122–136.–New comb. in *Lithocarpus* and *Quercus*, several from Malaysia.

—, *ibid.* 10 (1929) 132–134.–A number of transfers of Mal. *Quercus* to *Lithocarpus*.

SCHWARZ, Notizbl. Berl.-Dahlem 13 (1936) 1–22.–Segregates of *Quercus s. l.* and other subdivisions; keys to these.

VON SEEMEN, Bot. Jahrb. 27 (1900) Beibl. 64, p. 11–18.–Various descr. of *spp.* from Java, Borneo, Celebes, *etc.* herb. KOORDERS and cult. in Hort. Bog.

TROLL, Ber. Deut. Bot. Ges. 44 (1926) 290–295. –Morph. ♀ inflor. in *Quercus*.

TRELEASE, Mem. Nat. Acad. Sc. 20 (1924) 1–255, t. 1–420.–Revision American *Quercus*; keys!

WENZIG, Jahrb. Bot. Gart. Berlin 3 (1884) 175–219.–List American *spp.*; no key.

—, *ibid.* 4 (1886) 179–213.–*Quercus* in Europe, N. Africa & Orient.

—, *ibid.* 4 (1886) 214–240.–Enum. Asiat. & Mal. *spp.*; no keys!

FICOIDACEAE

See Aizoaceae

FLACOURTIACEAE

(*Samydaceae, Bixaceae pro parte*)

BENTHAM, G., Notes on Bixaceae and Samydaceae (J. & Proc. Linn. Soc. Lond. 5, 1861, 2nd Suppl., 75–94).–Struct. of fam.; delimitation of genera and descr. new *spp.*; no keys.

CLOS, D., Révision des genres et des espèces appartenant à la famille des Flacourtiacées (Ann. Sc. Nat. IV, 8, 1857, 209–274).–Revision; keys to *spp.*; contains also several genera now assigned to different families.

GILG, E., Pflanzenfamilien ed. 2, 21 (1925) 377–457, fig. 163–212.

SLEUMER, H., New Malaysian Flacourtiaceae (Blumea 7, 1954, 484–497).–Descr. new *spp.* and a new gen.; precursor to next revision.

—, Fl. Mal. I, 5 (1954) 1–106, fig. 1–37.

SLOOTEN, D. F. VAN, Bijdrage tot de kennis der Combretaceeën en Flacourtiaceeën van Nederlandsch-Indië. Thesis, Utrecht (1919) 57–175.–Keys.

—, Bull. Jard. Bot. Btzg III, 7 (1925) 291–421.–New revision; keys.

Local

Sumatra: BAKER *f.*, J. Bot. (1924–25) Suppl. 6, 42–43, 142–143.–List FORBES coll.; new var. in *Hydnocarpus*; *n. sp.* in *Casearia*.

MERRILL, Philip. J. Sc. 14 (1919) 246–247.–New *Osmelia*.

—, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 174–175.–New *Casearia*; redescr. of a *Hydnocarpus*.

Malay Peninsula: BUNTING & MILSUM, Kew Bull. (1927) 49–56, 3 fig., t. 8.–Cultivation data on *Hydnocarpus* & *Taraktogenos* in the F.M.S.

Borneo: MERRILL, Philip. J. Sc. 11 (1916) Bot. 92–100.–New records and new *spp.*

—, J. Str. Br. R. As. Soc. *no* 86 (1922) 332–333. –New *Taraktogenos* and *Casearia*.

—, Plant. Elm. Born. (1929) 207–210.–List ELMER coll.; 2 new *Hydnocarpus*.

RIDLEY, in HOOK. Ic. Pl. V, 2 (1932) t. 3167.–New *Taraktogenos*.

—, J. Bot. 74 (1936) 221–225.–Descr. new *spp.* of *Flacourtia*, *Ryparosa*, and *Xylosma*.

—, Kew Bull. (1938) 110–112.–Descr. new *spp.*

AIRY SHAW, Kew Bull. (1949) 157–158.–2 records and a new *Hydnocarpus*.

Philippines: DE CANDOLLE, Philip. J. Sc. 11 (1916) Bot. 37–38.–New *Hydnocarpus*.

ELMER, Leafl. Philip. Bot. 9 (1934) 3189–3190. –New *Casearia*.

—, *ibid.* 10 (1939) 3738–3739.–New *Casearia*.

MERRILL, Philip. J. Sc. 27 (1925) 37–39.–2 new *Homaliums*.

—, *ibid.* 30 (1926) 411–413.–New *Casearia*.

— & QUISUMBING, *ibid.* 82 (1953) 330.–New *Hydnocarpus* and *Casearia*; syn. *Flacourtia jangomas*.

QUISUMBING, Philip. J. Sc. 76 (1944) 54–55.–New *Casearia*.

— & MERRILL, *ibid.* 37 (1928) 171–172.–*Ditto*.

New Guinea: BAKER *f.*, J. Bot. (1923) 22.–New *Casearia*.

GILG, Bot. Jahrb. 55 (1918) 273–294.–Revision; keys.

MILDBRAED, see *sub Ryparosa*.

PULLE, Nova Guinea 8 (1912) 671–672.–List; new *Flacourtia* & *Hydnocarpus*.

VAN SLOOTEN, Nova Guinea 14 (1927) 190–194. –List.

Genera

Erythrospermum: VON TIEGHEM, in MOROT, J. de Bot. 14 (1900) 125–129.–Proposed as type of a new family.

Flacourtia: GAGNEPAIN, in MOROT, J. de Bot. 21 (1908) 168–173.–Revision & key.

RIDLEY, J. Bot. 74 (1936) 221–224.–Critical notes on Mal. *spp.*; new *sp.* from Borneo and Assam.

Homalium: BENTHAM, J. Linn. Soc. Lond. Bot. 4 (1860) 31–38.–Revision; no key.

Hydnocarpus (*Taraktogenos*): SLEUMER, Bot. Jahrb. 69 (1938) 1–93.–Monograph; key.

Itoa (*Mesaulosperma*): SLEUMER, Notizbl. Berl.-Dahlem 11 (1934) 1024–1026.

Ryparosa (*Gertrudia*): MILDBRAED, Notizbl. Berl.-Dahlem 10 (1928) 338–340.–New Guinea; reduction.

Scolopia: GAGNEPAIN, in MOROT, J. de Bot. 21 (1908)164–168.–Revision; key.

Xylosma: SLEUMER, Notizbl. Berl.-Dahlem 14 (1938) 288–297.–Mal.-Pac. *spp.*

FLAGELLARIACEAE

BACKER, C. A., Fl. Mal. I, 4 (1951) 245–250, fig. 1–2.

ENGLER, A., Pflanzenfamilien ed. 2, 15a (1930) 6–8, fig. 1.

Local

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 18.–Record of *Joinvillea.*

Malay Peninsula: RIDLEY, J. Str. Br. R. As. Soc. *no* 44 (1905) 199–200.–New *Joinvillea.*

Java: BACKER, Handb. Fl. Java 3 (1924) 2–3.–Key; in Dutch.
BAKHUIZEN VAN DEN BRINK Jr, Blumea 6 (1950) 399.–Comb. nov. of a var.

New Guinea: KRAUSE, Bot. Jahrb. 59 (1925) 544–546.–List.
—, Nova Guinea 14 (1927) 180.–Records.
LAUTERBACH, Bot. Jahrb. 50 (1913) 288–289.–Key.

Genera

Hanguana (*Susum, Veratronia*): ERDTMANN, Rapp. & Commun. 8e Congr. Int. Bot. Sect. 2–6 (1954) 33.–Pollen & epidermal structure are in favour of removing this genus to *Liliaceae.*
KURZ, Flora 56 (1873) 224.–Revision; reduction of genera.
—, J. As. Soc. Bengal 44, ii (1875) 199.–Addit. note.

Joinvillea: BRONGNIART & GRIS, Bull. Soc. Bot. Fr. 8 (1861) 268–269.–Survey; no key.

FUMARIACEAE

FEDDE, F., Pflanzenfamilien ed. 2, 17b (1936) 140–145, fig. 75–76.

HUTCHINSON, J., The genera of Fumariaceae and their distribution (Kew Bull. 1921, 97–115).–Key.

Local

Java: BACKER, Bekn. Fl. Java (em. ed.) 4 A (1942) fam. 42.–Keys; in Dutch.

Genera

Fumaria: PUGSLEY, J. Linn. Soc. Lond. Bot. 44 (1919) 233–355, t. 9–13.–Revision; partial keys.

GENTIANACEAE

GRISEBACH, A. H. R., Genera & species Gentianearum, *etc.* (1839) 1–364.–Monograph; keys.

KNOBLAUCH, E., Beiträge zur Kenntnis der Gentianaceae (Bot. Centralbl. 60, 1894, 321–334, 353–363, 385–401).–Notes on genera & *spp.*

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 208–209.–List Mal. *Crawfurdia, Gentiana, Swertia.*

Local

China: FRANCHET, Bull. Soc. Bot. Fr. 46 (1899) 302–324.–List, with new *spp.*; no key.

India: CLARKE, J. Linn. Soc. Lond. Bot. 14 (1875) 423–457.–Revision; concise descr.; partial keys.

Sumatra: BACKER, Bull. Jard. Bot. Btzg III, 2 (1920) 326–328.–New *Gentiana.*
MERRILL, Contr. Arn. Arb. 8 (1934) 138–139.–Record of *Crawfurdia.*
—, Not. Nat. Acad. Nat. Sc. Philad. *no* 47 (1940) 7.–2 new *Gentianas.*
MOORE, J. Bot. (1925) Suppl. 70–71.–List; new *Gentiana & Limnanthemum.*
RIDLEY, J. Fed. Mal. Stat. Mus. 8, 4 (1917) 58.–New *Gentiana.*
—, Kew Bull. (1939) 29–31.–New *Gentiana.*

Malay Peninsula: HENDERSON, J. Mal. Br. R. As. Soc. *no* 17 (1939) 58.–List limestone *spp.*

Java: RIDLEY, Kew Bull. (1939) 29–31.–Record of 2nd *Gentiana* from Java.

Borneo: MERRILL, Philip. J. Sc. 13 (1918) Bot. 120.–New *Gentiana.*
STAPF, Trans. Linn. Soc. Lond. II, 4 Bot. (1894) 208–209.–New *Gentiana.*

Philippines: ELMER, Leafl. Philip. Bot. 10 (1939) 3739–3740.–New *Microphium.*
ROBINSON, Philip. J. Sc. 3 (1908) Bot. 214.–New *Swertia.*
VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 409.–New record of a *Gentiana.*

New Guinea: DIELS, Bot. Jahrb. 62 (1929) 488–489.–New *Swertia.*
HEMSLEY, Kew Bull. (1899) 106–107.–Record and 2 new *Gentianas.*
KOORDERS, Nova Guinea 8 (1909) 175–176.–List; new *Gentiana.*
—, *ibid.* 8 (1912) 889–890.–Records.
MANSFELD, Bot. Jahrb. 61 (1927) 28–29.–List.
MERRILL & PERRY, J. Arn. Arb. 30 (1949) 45.–Records of 2 *spp.* of *Nymphoides.*
WERNHAM, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 117–118.–4 new *Gentianas.*

Genera

Cotylanthera: FIGDOR, Ann. Jard. Bot. Btzg 14 (1897) 213–240, t. 16–17.–Morph.

Exacum: HALLIER *f.*, Beih. Bot. Centralbl. 34, ii (1916) 42–43.–Mal. *E. 'tetragonum'* is a separate *sp.*
NAUEN, M. A. H. A. Mag. 10 (1940) 152.–Cult. *spp.*
VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 462.–Syn. *Paracelsea* Z. & M. 1844.

Gentiana (*Crawfurdia*): KUSNEZOW, Act. Hort. Petrop. 15 (1904) i–iv, 1–507, 4 maps, 1 tab.–Monograph of *subgen. Eugentiana*; key to sect. and *spp.*; ± verbatim German translation of a Russian edition dated 1894.
MARQUAND, Kew Bull. (1931) 68–70.–*Crawfurdia p. maj. p.* is reduced to *Gentiana.*
—, J. R. Hort. Soc. 57 (1932) 188–211.–Rev. Chin. & Himal. sect.; descr.; keys to *spp.*
—, Kew Bull. (1937) 134–180.–Revision of Chin. *spp.*; keys.

Nymphoides (*Limnanthemum*): GOEBEL, Ann. Jard. Bot. Btzg 9 (1891) 120–126, t. 16.–Morph.
MIKI, Tokyo Bot. Mag. 49 (1935) 779–780, fig. 10.–Rev. Japan. *spp.*; key.
VAN STEENIS, Arch. Hydrobiol. Suppl. 3 (1932) 320–322, fig. 6.–Records of Sumatra; details on 3 *spp.*

GERANIACEAE

KNUTH, R., Pflanzenreich Heft 53 (1912) 1–640, fig. 1–80.

—, Pflanzenfamilien ed. 2, 19a (1931) 43–66, fig. 20–34.

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 209–210.–List Mal. mountain *spp.*

Local

New Guinea: Knuth, in Fedde, Rep. 45 (1938) 61–62.–Two new *Geraniums*.

GESNERIACEAE

(*Cyrtandraceae*)

Beddome, R. H., Gesneraceae, with annotated list of the genera and species which have been introduced to cultivation (J. R. Hort. Soc. 33, 1908, 74–100).–List with short descr. of *spp.*

Burtt, B. L., Studies in the Gesneraceae of the Old World (Not. R. Bot. Gard. Edinb. 21, 1954, 185–218, t. 1–2).–Introd.; types of certain genera and other groups; status of *Ceratoscyphus*; new Burmese *Didymocarpus*; notes on *Ancylostemon*.

Clarke, C. B., in DC. Mon. Phan. 5 (1883) 1–303, t. 1–32.

Craib, W. G., Didissandra and allied genera in China and North India (Not. R. Bot. Gard. Edinb. 11, 1919, 255–268).–Keys.

Local

SE. Asia: Clarke, Commelinaceae et Cyrtandraceae Bengalenses. Calcutta (1874) 63–133, t. 43–93.–Descr. & pl.

Indo-China: Pellegrin, Bull. Soc. Bot. Fr. 73 (1926) 412–429.–Subfam. *Cyrtandreae*; keys.

Sumatra: Forbes, J. Linn. Soc. Lond. Bot. 19 (1882) 297.–New *Boea*.

Merrill, Contr. Arn. Arb. 8 (1934) 151–154, t. 14.–List; 2 new *Trichosporums*.

Moore, J. Bot. (1925) Suppl. 72–76.–List Forbes coll.; new *spp.* in *Agalmyla* (1), *Stauranthera* (1), *Cyrtandra* (5).

Ridley, J. Mal. Br. R. As. Soc. *no* 87 (1923) 79–81).–List; new *spp.* in *Aeschynanthus* (1), *Didymocarpus* (1), *Rhynchothecum* (1), *Cyrtandra* (2).

—, Kew Bull. (1925) 86–87.–List; new *Didymocarpus*.

—, *ibid.* (1926) 75–76.–List; new *spp.* in *Didissandra* (1), *Cyrtandra* (2), *Didymocarpus* (1).

—, Arch. Hydrobiol. Suppl. 11 (1932) 326–330, fig. 7.–List; new *Didissandra*.

Malay Peninsula: Henderson, Gard. Bull. Str. Settl. 4 (1929) 412–413.–New *Loxocarpus*.

—, *ibid.* 7 (1933) 115–118.–3 new *Paraboeas*.

—, J. Mal. Br. R. As. Soc. 17 (1939) 60–62.–List limestone *spp.*

Kränzlin, Notizbl. Berl.-Dahlem 4 (1907) 293–294.–Two new *Didymocarpus*.

Ridley, J. Linn. Soc. Bot. 32 (1896) 497–528.–Rev.; Malayan *Cyrtandreae* listed.

—, Kew Bull. (1929) 258–260.–3 new *spp.*

Spare, M. A. H. A. Mag. 10 (1940) 131–133.–Key to some ornamental *spp.* of *Aeschynanhus*.

Java: Backer, Trop. Natuur 1 (1912) 173–175, 179–183, fig. 1–3.–Key to Jav. *Trichosporum*; in Dutch.

Bakhuizen van den Brink Jr, Blumea 6 (1950) 394–398.–Critical list.

Borneo: Bayley Balfour & W. W. Smith, Not. R. Bot. Gard. Edinb. 8 (1915) 349–356, t. 146.–*Moultonia n. g.*; full discussion.

—, Sarawak Mus. J. 6 (1915) 277–286, t. 2.–Copy of the above.

Kränzlin, J. Linn. Soc. Lond. Bot. 37 (1906) 275–285.–3 new *spp.* in each *Cyrtandra* and *Aeschynanthus*.

—, Notizbl. Berl.-Dahlem 4 (1907) 292–293.–2 *Cyrtandras*.

—, Mitt. Inst. Allg. Bot. Hamburg 7 (1927) 80–113, fig. 1–2.–List Hans Winkler coll.; new *spp.* in *Aeschynanthus* (3), *Didissandra* (1), *Didymocarpus* (9), *Monophyllaea* (1), *Stauranthera* (1), *Hexatheca* (2), *Cyrtandra* (16).

Merrill, J. Mal. Br. R. As. Soc. *no* 87 (1923) 32–36.–New *spp.* in *Didymocarpus* (1) and *Cyrtandra* (3).

—, Sarawak Mus. J. 3 (1928) 549–552.–Records & new *spp.* of *Didymocarpus* (1), *Trichosporum* (1), *Dichrotrichum* (1).

Moore, J. Linn. Soc. Lond. Bot. 42 (1914) 116–118.–List Gibbs; new *Cyrtandra* and *Aeschynanthus*.

Stapf, Trans. Linn. Soc. Lond. II, 4 Bot. (1894) 212–214.–List; 4 new *spp*

Winkler, Bot. Jahrb. 44 (1910) 537–541.–List Hub. Winkler; 5 new *Cyrtandras*.

Celebes: Kränzlin, J. Linn. Soc. Lond. Bot. 37 (1906) 275–285.–New *Cyrtandra*.

Philippines: Elmer, Leafl. Philip. Bot. 2 (1908) 553–567.–List *spp.* Cuernos Mts; several new; no key.

—, *ibid.* 3 (1910) 947–970.–Descr. new & interesting *spp.*

—, *ibid.* 9 (1934) 3191–3194.–2 new *Cyrtandras*.

—, *ibid.* 10 (1939) 3741–3744.–3 *spp. ditto.*

Kränzlin, J. Linn. Soc. Bot. 37 (1906) 275–285.–5 new *Cyrtandras*.

—, Philip. J. Sc. 8 (1913) Bot. 163–179, 311–333. –List new *spp.*; no key.

Merrill, Philip. J. Sc. 10 (1915) Bot. 75–84, 340–341.–Descr. new *spp.*

—, *ibid.* 26 (1925) 489–490.–New *Didymocarpus* from Palawan.

Moluccas: Merrill, Philip. J. Sc. 11 (1916) Bot. 313.–Ambon records; new *Trichosporum*.

New Guinea: Diels, Bot. Jahrb. 62 (1929) 492–493.–A *Cyrtandra* and 2 *Dichrotrichums*.

Forbes, J. Bot. 25 (1887) 347–348.–New *Boea*.

Kanehira, Hatusima & Ohwi, Bot. Mag. Tokyo 57 (1943) 111–128.–Many new *spp.*

Lauterbach, Nova Guinea 8 (1910) 325–331, t. 66.–List; new *spp.* in *Dichrotrichum* (1), *Monophyllaea* (1), *Cyrtandra* (7); *Cyrtandropsis n. g.*

—, *ibid.* 8 (1912) 859–862.–List; 3 new *Cyrtandras*.

Moore, J. Bot. 37 (1899) 172–175.–Notes on Forbes coll.; listed records; new *spp.* in *Trichosporum* and *Chirita* from Papua.

—, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 122–132.–List Wollaston Exp.; new *spp.* in *Aeschynanthus* (3), *Dichrotrichum* (5), *Monophyllaea* (1), *Cyrtandra* (8).

—, J. Bot. 67 (1929) 50–51.–New *Cyrtandra*.

Von Mueller, in Wing's South. Sc. Rec. 2 (1882) 229.–New *Didymocarpus*.

—, Melbourne Chem. & Drugg. (June 1884) 14. –New *Dichrotrichum*.

Schlechter, Bot. Jahrb. 58 (1923) 255–379, fig 1–11.–Revision; keys.
—, Nova Guinea 14 (1927) 308–322.–New *spp.* in *Aeschynanthus* (4), *Dichrotrichum* (2), *Cyrtandra* (16); *Oxychlamys n. g.*

Genera

Aeschynanthus (*Trichosporum*): Hallier *f.*, Nat. Tijd. Ned. Ind. 56 (1896) 333–346.–Rev. *spp.* in Herb. Bog.; no key.
Pellegrin, Bull. Soc. Bot. Fr. 72 (1926) 821–824.–Key to Indo-Chin. *spp.*

Anna: Pellegrin, Bull. Soc. Bot. Fr. 77 (1930) 45–46.–Indo-Chin. *spp.*

Corallodiscus: Burtt, Gard. Chron. III, 121 (1947) 204, 212.–Segregate of *Didissandra.*

Cyrtandra: Hosokawa, Trans. Nat. Hist. Soc. Formosa 25 (1935) 410–473.–Distr.
Smith, A. C., J. Arn. Arb. 34 (1953) 37–51.–Revision; descr. many new *spp.*

Cyrtandropsis: van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 459–460.–Nomencl. generic name.

Dichrotrichum: Schlechter, in Fedde, Rep. 16 (1919) 212–213.–*D. borneense*; definition new infrageneric group.

Didissandra: Bakhuizen van den Brink Jr, Fl. Mal. Bull. *no* 3 (1948) 72–73.–Conservation against *Ellobum.*
Craib, Not. R. Bot. Gard. Edinb. 11 (1919) 255–268.–Segregation of the genus.

Moultonia: Bayley Balfour & W. W. Smith, Sarawak Mus. J. 2 (1916) 277–286, t. 2.

Paraboea § Paraboea: Burtt, Kew Bull. (1948) 55–56.–Survey; no key.

Tetradema: Schlechter, Notizbl. Berl.-Dahlem 7 (1920) 359–362.–Key.

GNETACEAE

Beccari, O., Malesia 1 (1877) 181–183.–His coll. listed; 2 new *spp.*

Blume, C. L., De Gnetaceis (Rumphia 4, 1848, 1–10, t. 174–176).–List.

Markgraf, F., Monographie der Gattung Gnetum (Bull. Jard. Bot. Btzg III, 10, 1930, 407–511, t. 1–14).–Revision; keys.
—, Fl. Mal. I, 4 (1951) 336–347, fig. 1–5.

Warburg, O., Monsunia 1 (1900) 195–197.–Survey; no key.

Local

Malay Peninsula: Ridley, J. Str. Br. R. As. Soc. *no* 60 (1911) 59–66.–Key.

Borneo: Markgraf, Reinwardtia 1 (1952) 462.–New variety.

Philippines: Foxworthy, Philip. J. Sc. 6 (1911) Bot. 172–176, t. 32–33.–Revision; key.

New Guinea: Markgraf, Bot. Jahrb. 60 (1925) 144–149.–Key.
—, Nova Guinea 14 (1927) 221.–Record.
Pulle, Nova Guinea 8 (1910) 345.–Record.

GONYSTYLACEAE

See Thymelaeaceae

GOODENIACEAE

Krause, K., Pflanzenreich 54 (1912) 1–207, fig. 1–34.

Vriese, W. H. de, Goodenovieae (Natuurk. Verh. Holl. Mij. Wet. Haarlem, 2e verzam., 10, 1854, i–viii, 1–194, t. 1–38).–Monograph.

Local

Java: Backer, Bekn. Fl. Java (em. ed.) 8 (1949) fam. 185.

Philippines: Merrill, Publ. Govt Lab. (Manila) *no* 35 (1906) 66–68.–Disc. *Calogyne* record.
—, Philip. J. Sc. 5 (1910) Bot. 249–252.–List; descr. 3 new *spp.*
Miquel, Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 210.–2 new *spp.*

New Guinea: Merrill & Perry, J. Arn. Arb. 22 (1941) 387–388.–*Velleia, Calogyne.*
—, *ibid.* 30 (1949) 60.–*Leschenaultia.*
Von Mueller, Vict. Nat. 1 (1884) 122–123.
Pulle, Nova Guinea 8 (1912) 693.

GRAMINEAE[1]

Amshoff, A. & J. Th. Henrard, Gramineae, in Pulle, Flora of Surinam 1, part 1 (1948) 273–442.

Blake, S. T., Monographic studies in the Australian Andropogoneae I (Queensl. Univ. Pap. Dept Biol. 2, 1944, 1–62).–Revisions of the genera *Botriochloa, Capillipedium, Chrysopogon, Vetiveria* and *Spathia.*

Gardner, C. A., Flora of Western Australia vol. 1, pt 1 (1952) 1–400, t. 1–103, 6 diagr., map.–Revision; keys.

Hackel, E., Die auf der Expedition S. M. S. 'Gazelle' von Dr Naumann gesammelten Gramineen (Bot. Jahrb. 6, 1885, 233–248).
—, Andropogoneae in DC. Mon. Phan. 8 (1889) 1–716, t. 1–2.

Henrard, J. Th., A contribution to the knowledge of the Indian Maydeae (Meded. Rijksherb. Leiden *no* 67, 1931, 17 pp.).–Keys.
—, Identification of some Malaysian grasses (Blumea 1, 1935, 305–311).–Notes on *Paspalum, Schizachyrium, Deschampsia,* and *Cenchrus.*
—, Notes on the nomenclature of some grasses (Blumea 3, 1940, 411–480.)
—, *Ditto* II (*ibid.* 4, 1941, 496–542).

Hitchcock, A. S., The grasses of Hawaii (Mem. Bern. P. Bish. Mus. 8, *no* 3, 1922, 132 pp.).
—, Grasses of British Guyana (Contr. U. S. Nat. Herb. 22, 1922, 439–514).
—, Manual of the grasses of the United States (U. S. Dept Agric. Misc. Publ. *no* 200, 1935, 1040 pp.).
— & A. Chase, Revisions of North American grasses (Contr. U. S. Nat. Herb. 22, 1920, 1–77, 115–234).–*Ichnanthus, Brachiaria, Cenchrus, Isachne, Oplismenus, Echinochloa, Setaria, Pennisetum.*

Hubbard, C. E., The genera of the tribe Arundinelleae (Kew Bull. 1936, 317–322).–Key to the genera.
—, Apochiton burtti C. E. Hubbard (in Hook.

---

(1) *Bambusaceae* have been treated here, for convenience, separately at the end of the *Gramineae.*

Ic. Pl. V, 4, 1936, t. 3319, 9 pp.).–Key to genera of *Eragrosteae.*

—, Key to the genera of the Rottboelliastrae in Australia (in HOOK. Ic. Pl. V, 4, 1936, t. 3313–3314, p. 5–6).

—, Limnopoa meeboldii (C. E. C. FISCHER) C. E. HUBBARD (in HOOK. Ic. Pl. V, 5, 1943, t. 3432, 4 pp.).–Contains a key to the genera of *Isachneae.*

— & O. STAPF, Sclerandrium truncatiglume (F. MUELL.) STAPF & C. E. HUBBARD (in HOOK. Ic. Pl. V, 3, 1935, t. 3262, 7 pp.).–Key to genera of *Polliniastrae.*

JANOWSKI, M., Arundinellearum, Graminum tribus conspectus (Bot. Arch. 1, 1922 21–28).–Keys to *spp.* of *Arundinella* & *Thepanolaena.*

JANSEN, P., Notes on Malaysian grasses I (Reinwardtia 2, 1953, 225–350, fig. 1–18).–Misc. notes; one new genus, many new *spp.* and var. and new comb.

—, *ditto* II (Acta Bot. Neerl. 1, 1953, 468–483, fig. 1–4).–*Ditto.*

—, *ditto* III (*ibid.* 2, 1953, 363–386, fig. 1–10). –*Ditto.*

KUNTH, K. S., Révision des Graminées, *etc.* (in HUMBOLDT & BONPLAND, Nova genera et species plantarum). 2 vols (issued in 44 parts, *cf.* Fl. Mal. I, 4, cxciv-cxcv, in 1829–1834). The same work issued by KUNTH, under the title: 'Distribution méthodique de la famille des Graminées', Paris (1835), plates and letterpress identical but paging different; I, i–xlv, 1–175, II, 177–579, *errata*, 220 tab.

—, Enumeratio plantarum, *etc.* I. Gramineae (Agrostographia synoptica sive enumeratio Graminearum). Stuttgart (1833) 1–606.–Monograph; descr. of genera and *spp.*; no keys.

—, *ditto* II (Suppl. to vol. I). Stuttgart (1835) 1–436, t. 1–40.–*Ditto.*

MEZ, C. (& M. JANOWSKI), Graminea novae vel minus cognitae (in FEDDE, Rep. 17, 1921, 83–86, 145–153, 291–303).–Mixed descr.

MUNRO, W., On the identification of the grasses of Linnaeus's Herbarium, *etc.* (J. Linn. Soc. Lond. 6, 1861, 35–55).

OHWI, J., New or noteworthy grasses from Asia (Bull. Tokyo Sc. Mus. *no* 18, 1947, 1–15).–Almost entirely dealing with Mal. grasses.

PILGER, R., Pflanzenfamilien ed. 2, 14e (1940) 1–208, fig. 1–106.–Subfam. *Panicoideae;* tribes *Paniceae*, *Arthropogoneae*, *Andropogoneae*, and *Maydeae.*

—, Additamenta agrostologica 1–III (Bot. Jahrb. 74, 1945, 1–27, 199–265, 554–567).–*Sclerodeyeuxia n. g.* (Malaysia).

—, Das System der Gramineae (Bot. Jahrb. 76, 1954, 281–384).–New key to all genera.

—, Pflanzenfamilien ed. 2, 14d. *In preparation.*–Subfam. *Festucoideae, Micrairoideae, Eragrostoideae, Oryzoideae, Olyroideae.*

STAPF, O., The oilgrasses of India and Ceylon (Kew Bull. 1906, 297–363).–*Cymbopogon, Vetiveria* & *Andropogon spp.* with key.

— & C. E. HUBBARD, Gramineae. Maydeae-Paniceae in Fl. Trop. Afr. 9 (1917–1934) 1–1132; 10 (1937–?) unfinished.

STEUDEL, E. G., Synopsis plantarum Glumacearum pars I. Gramineae. Stuttgart (1854) i–viii, 1–475.–Enum. descr. in Latin; contains also *spp.* based on specimens of CUMING, ZOLLINGER, *etc.*

Local

Assam: BOR, N. L., in KANJILAL, *c.s.*, Fl. Assam 5, 1940, 1–480.

Malay Peninsula: HACKEL, Oesterr. Bot. Z. 41 (1891) 5–9, 47–50.–Records and descr.
HOLTTUM, Gard. Bull. Sing. 11 (1947) 297–298. –New *Spodiopogon* and *Rottboellia.*
HUBBARD, Kew Bull. (1941) 24–25.–New *Cymbopogon* and new comb. in *Eustachys.*
—, J. Str. Br. R. As. Soc. *no* 23 (1891) 19–32.–Listed records; no new *spp.*; no keys.
RIDLEY, Mat. Fl. Mal. Pen. (Monocot.) 3 (1907) 118–182.–Keys.

Sumatra: HENRARD, in FEDDE, Rep. 22 (1926) 349–350.–New *Erianthus.*

Java: BACKER, Bull. Jard. Bot. Btzg III, 2 (1920) 325–326.–New *Diplachne.*
—, Handb. Fl. Java 2 (1927) 1–300.–Important revision; keys; in Dutch.
HENRARD, Blumea 3 (1939) 238–242.–New *Polytoca.*

Borneo: PILGER, Mitt. Inst. Allg. Bot. Hamburg 7 (1928) 177–178.–List WINKLER coll.
RIDLEY, J. Str. Br. R. As. Soc. *no* 46 (1906) 215–221.–Listed records; no new *spp.*
STAPF, J. Linn. Soc. Lond. Bot. 42 (1914) 185–189.–Listed Kinabalu records.

Philippines: HACKEL, Govt Lab. Publ. Philip. 35 (1905) 79–82.
—, Philip. J. Sc. 1 (1906) Suppl. 263–269.
—, *ibid.* 2 (1907) Suppl. 419–420.
—, *ibid.* 3 (1908) 167–169.
MERRILL, Philip. J. Sc. 1 (1906) Suppl. 307–392. –Important enumeration; keys.
—, Philip. J. Sc. 30 (1926) 390.–*Koordersiochloa.*
—, Philip. J. Sc. 35 (1928) 1–4.
QUISUMBING & MERRILL, Philip. J. Sc. 37 (1928) 135–136.–New *Panicum.*
SANTOS, J. Wash. Acad. Sc. 33 (1943) 135–140.–Two new species.

Moluccas: HENRARD, in FEDDE, Rep. 22 (1925) 106–107.–New *Andropogon.*
MERRILL, Philip. J. Sc. 11 (1916) Bot. 253–255. –List of Ambon *Gram.*

Lesser Sunda Islands: HENRARD, in FEDDE, Rep. 18 (1922) 240–241.–New *Eragrostis.*

New Guinea: BLAKE, Blumea Suppl. 3 (1946) 56–62.–*Ancistagrostis* & *Buergersiochloa n. g.*
CHASE, J. Arn. Arb. 20 (1939) 304–316.–BRASS coll.
—, *ibid.* 24 (1943) 77–89.–BRASS coll.
HENRARD, Blumea 4 (1941) 525–526.–New *Arthraxon.*
HITCHCOCK, Proc. Linn. Soc. N. S. W. 54 (1929) 145–146.–See also J. Arn. Arb. 10 (1929) 272–273.–List BRASS coll.
—, Brittonia 2 (1936) 107–130.–BRASS coll.
HUBBARD, Kew Bull. (1949) 474.–New *Poa.*
PILGER, Bot. Jahrb. 52 (1914) 167–176.–List.

—, *ibid.* 62 (1929) 457–461.–New *spp.*

—, *ibid.* 69 (1938) 253–255.–New *spp.* of *Digitaria, Deschampsia, Dichelachne.*

Reeder, J. Arn. Arb. 29 (1948) 257–318, 321–392.–Full account of *Panicoideae*; keys.

—, J. Arn. Arb. 31 (1950) 320–328.–New & noteworthy *spp.*

Stapf, in Hook. Ic. Pl. IV, 7 (1901) t. 2605–2608.–*Deyeuxia, Poa*, and *Danthonia spp.*

Micronesia: Hosokawa, Contr. Herb. Taihoku Imp. Univ. *no* 42, 7 (1935) 305–325.–Enumeration.

Genera

Acrachne: Henrard, Blumea 3 (1938) 164–167.

Acroceras: Henrard, Blumea 3 (1940) 444–452.–Critical notes.

Aegilops: Eig in Fedde, Rep. Beih. 55 (1929) 1–228.–Monograph.

Agrostis: Henrard, Blumea 3 (1940) 436–439.–Critical notes.

Ancistagrostis: Blake, Blumea Suppl. 3 (1946) 56–59.–From New Guinea.

Ancistrachne: Blake, Univ. Queensl. Pap. Dept Biol. 1, *no* 19 (1941) 4–7.

Aristida: Blake, Proc. R. Soc. Queensl. 51 (1940) 169–176.–New *spp.* of *Aristida* from Queensland.

—, *ibid.* 56 (1944) 11–20.–*A. utilis.*

Henrard, Meded. Rijksherb. Leiden *no* 54, 54A, 54B, I (1926) 1–220; II (1927) 221–464; III (1928) 465–701.

—, *ibid. no* 58 (1929) 1–153; 58A (1932) 157–325.–Monograph.

Arundinella: Hubbard, Kew Bull. (1936) 317–322.

Janowski, in Mez, Bot. Arch. 1 (1922) 21–28. –Key.

Asthenochloa: Henrard, Ned. Kruidk. Arch. (1929) 579–582.

Avena § Avenastrum: Saint-Yves, Candollea 4 (1930) 353–503.–Key.

Aulacolepis: Hackel, in Fedde, Rep. 3 (1907) 241–245.

Hitchcock, J. Wash. Acad. Sc. 24 (1934) 290–292.

Bothriochloa: Camus, Ann. Soc. Linn. Lyon 76 (1930) Mém. 162–165.–Revision Old World *spp.*; no key.

Henrard, Blumea 3 (1940) 456–457.–New comb.

—, Gedenkb. J. Valckenier Suringar (1942) 181–187.–Notes; new comb.

Brachyachne (*Cynodon § Brachyachne*): Hubbard, Kew Bull. (1934) 448.–List.

Brachypodium: Saint-Yves, Candollea 5 (1934) 427–493.–Key.

Bromus: Stapf, Kew Bull. (1928) 209–211.–Survey of generic concept.

Buergersiochloa: Blake, Blumea Suppl. 3 (1946) 59–62.–New Guinea.

Lauterbach, Bot. Jahrb. 52 (1914) 167–169.

Calamagrostis: Matuszkiewicz, Ann. Univ. Curie-Sklodowska sect. C. Biol. 3 (1948) 223–256.

Capillipedium: Henrard, Blumea 3 (1940) 457–463.–Critical notes; new *spp.* from the Philippines and Java.

Jansen, Reinwardtia 2 (1953) 246–252.–Critical notes; key.

Chionachne: Henrard, Meded. Rijksherb. Leiden *no* 67 (1931) 13–17.

Chloris: Merrill, Bull. Soc. Bot. Fr. 73 (1926) 27–30.–Syn. of *C. tenera.*

Chrysopogon: Henrard, Blumea 4 (1941) 531–535.–Nomencl., some new Mal. *spp.*

Coelachne (*pulchella*): Hubbard, in Hook. Ic. Pl. V, 5 (1943) t. 3440.–List of *spp.*

Coelorhachis: Jansen, Reinwardtia 2 (1953) 254–256.–Rev. Mal. *spp.*; key.

Coix: Koorders, Bull. Jard. Bot. Btzg III, 1 (1919) 153–158, 190–191.–*C. palustris* from Java.

Vallaeys, Bull. Agric. Congo Belg. 39 (1948) *no* 2; repr. 1–70.–Monogr.

Cyrtococcum: Camus, Bull. Mus. Hist. Nat. Paris 27 (1921) 118.–List.

Jansen, Reinwardtia 2 (1953) 256–258.–Rev. Mal. *spp.*; key.

Danthonia: Jansen, Reinwardtia 2 (1953) 258–265, fig. 4–6.–Rev. Mal. *ssp.*; key.

Deyeuxia: Jansen, Act. Bot. Neerl. 1 (1952) 468–472, fig. 1.–Crit. enum.

—, *ibid.* 2 (1953) 363–365, fig. 1.–New Sum. *sp.*

Vickery, Contr. N. S. W. Nat. Herb. 1 (1940) 43–82.–Delimit. of the genus; rev. Austral. *spp.*

Dichanthium: Jansen, Act. Bot. Neerl. 1 (1952) 473–474.–Descr. 2 *spp.*

Digitaria: Henrard, Meded. Rijksherb. Leiden *no* 61 (1930) 1–21.–New & noteworthy *spp.*; key to *§ Solitaria.*

—, Blumea 1 (1934) 90–114.–Notes and new *spp.*

—, Monograph of the genus Digitaria. Leiden (1950) xxi + 999 pp.

Echinochloa: Blake, Proc. R. Soc. Queensl. 62 (1952) 91–92.–Key to Austral. *spp.*

Echinopogon (*intermedius*): Hubbard, in Hook. Ic. Pl. V, 3 (1935) t. 3261.–Monograph; key.

Ectrosia: Hubbard, in Hook. Ic. Pl. V, 4 (1936) t. 3312, 16 pp.–Revision; key.

Ectrosiopsis: Jansen, Act. Bot. Neerl. 1 (1952) 474–475, fig. 2.–New *sp.*

—, Reinwardtia 2 (1953) 267–269.–Rev. Mal. *spp.*; key.

Enneapogon: Burbidge, Proc. Linn. Soc. Lond. 60 (sess. 153) (1941) 52–91, 5 fig.–Revision Austral. *spp.*; key.

Eragrostis: Blake, Proc. R. Soc. Queensl. 59 (1948) 153–156.–Queensl. *spp.*

Camus, Not. Syst. 2 (1911–13) 226–229.–List E. Asiat. *spp.*

Jansen, Reinwardtia 2 (1953) 269–275.–Critical notes.

Jedwabnick, in Mez, Bot. Arch. 5 (1924) 177–216. List; no key; incl. new *spp.*

Eremochloa: Camus, Not. Syst. 3 (1914) 85–88.–Asiat. *spp.*; key.

Erianthus: Jansen, Reinwardtia 2 (1953) 275–276. –2 new comb. Mal. *spp.*

Eulalia: Jansen, Reinwardtia 2 (1953) 277–278.–Rev. Mal. *spp.*; key.

Festuca subg. Eufestuca: Jansen, Act. Bot. Neerl. 2 (1953) 365–376.–Rev. Mal. *spp.*; key.

Saint-Yves, Candollea 4 (1929) 65–129, 147–165, (1930) 293–397.–African, Malaysian, and N. Zealand *spp.*; key.

Garnotia: Jansen, Acta Bot. Neerl. 2 (1953) 376–382, fig. 9.–Critical notes; key to Mal. *spp.*

Santos, J. Arn. Arb. 25 (1944) 85–95.–Philip., Chin., and Indo-Chinese *spp.*

—, Nat. & Appl. Sc. Bull. (Philip.) 10 (1950) 3–179.–Compl. revision; key.

Garnotiella: Stapf, Kew Bull. (1910) 301–302.–Morph.; syst. position.

Helictotrichon (*Avenastrum*): Henrard, Blumea 3 (1940) 425–431.–Nomencl.

Imperata: Hubbard, in Joint Publ. *no* 7 Imp. Agric. Bur. (1944) 5–13.

Isachne: Henrard, Blumea 3 (1940) 463–473.–Critical notes.

Jansen, Reinwardtia 2 (1953) 279–292.–Critical notes; key Mal. *spp.*

—, Act. Bot. Neerl. 2 (1953) 382–384, fig. 10.–New *sp.* from Sumba.

Ischaemum: Jansen, Reinwardtia 2 (1953) 292–301.–Critical notes.

Iseilema: Blake, Proc. R. Soc. Queensl. 49 (1938) 82–94.–Queensl. *spp.*; key.

Camus, Bull. Mus. Hist. Nat. Paris 24 (1918) 539–541.–Key.

Hubbard, in Hook. Ic. Pl. V, 3 (1935) t. 3286, 1–16.–Revision Austral. *spp.*; key.

Jansen, Reinwardtia 2 (1953) 302–303, fig. 11.–New *sp.* from Wetar.

Leptaspis: Jansen, Reinwardtia 2 (1953) 302–305.–Rev. Mal. *spp.*; key.

Lophatherum: Camus, Bull. Mus. Hist. Nat. Paris 25 (1919) 494–496.–Key.

Microstegium: Henrard, Blumea 3 (1940) 453–455.–Critical notes.

Jansen, Reinwardtia 2 (1953) 305–307.–*Ditto.*

Mnesithea: Jansen, Reinwardtia 2 (1953) 307–309.–Rev. & key to Mal. *spp.*

Monostachya: Merrill, Philip. J. Sc. 5 (1910) Bot. 330–332.–Orig. descr.

Oryza: Backer, Blumea Suppl. 3 (1946) 45–55.–Revision wild Mal. *spp.*; key.

Chatterjee, Ind. J. Agric. Sc. 18 (1948) 185–192 (1949).–Enum. *spp.*; key.

Jansen, Reinwardtia 2 (1953) 312–313, fig. 13.–New Pap. *sp.*

Prodoehl, in Mez, Bot. Arch. 1 (1922) 211–224, 231–255.–Monograph.

Roschevicz, Bull. Appl. Bot. Gen. & Pl. Breed. 27^2 (1931) 3–134.–Monogr.; summary, bibliogr. & key in Engl. p. 119–134.

Ottochloa: Dandy, J. Bot. 69 (1931) 55.–Nomencl.

Henrard, Blumea 4 (1941) 530–531.–Key.

Jansen, Reinwardtia 2 (1953) 313–314, fig. 14.–New Pap. *sp.*

Panicum: Camus, Not. Syst. 2 (1911–13) 246–253.–List E. Asiat. *spp.*

Hughes, Kew Bull. (1923) 305–332.–Nomencl. Austr. *spp.*.

Jansen, Reinwardtia 2 (1953) 314–319.–Critical notes.

Paspalidium: Blake, Proc. R. Soc. Queensl. 62 (1952) 92–99.–List Austral. *spp.*; key to some *spp.*

Paspalum: Camus, Not. Syst. 2 (1911–13) 216–226.–Key to E. Asiat. *spp.*

Vasey, Bull. Torrey Bot. Club (1886) 162–168.–Synopsis.

Pennisetum: Leeke, Zeitschr. f. Naturw. 79 (1907) 1–108. Also Thesis, Halle, 1907. New *spp.* copied in Fedde, Rep. 5 (1908) 66–76.

Poa: Bor, J. Bombay Nat. Hist. Soc. 50 (1952) 787–838; *ibid.* 51 (1952) 61–103, 7 pl., 38 fig.–Extensive revision Indian *spp.* (49); descr.; key.

Jansen, Reinwardtia 2 (1953) 322–333, fig. 15–17.–Rev. Mal. *spp.*; key.

Pogonatherum: Chase, J. Arn. Arb. 31 (1950) 130–132.

Jansen, Reinwardtia 2 (1953) 333–334.–Rev. Mal. *spp.*; key.

Polytoca: Henrard, Meded. Rijksherb. Leiden *no* 67 (1931) 7–13.–Key.

—, Blumea 3 (1939) 238–242.–New Jav. *sp.*

Pseudoraphis: Pilger, Notizbl. Berl.-Dahlem 10 (1928) 207–210.–No key.

Ramosia: Merrill, Philip. J. Sc. 11 (1916) Bot. 2–4.

Schizachyrium: Jansen, Reinwardtia 2 (1953) 336–339.–Rev. Mal. *spp.*; key.

Sclerachne: Henrard, Meded. Rijksherb. Leiden *no* 67 (1931) 7.

Sehima: Camus, Bull. Mus. Hist. Nat. Paris 27 (1921) 372–373.–Key to Asiat. *spp.*

Setaria (*Chaetochloa*): Hubbard, Amer. J. Bot. 2 (1915) 169–198.–*S. italica* & allied *spp.*

Jansen, Reinwardtia 2 (1953) 339–343.–Rev. Mal. *spp.*; key.

Stapf, Kew Bull. (1920) 124–127.–Discussion generic concept in relation to *Chaetochloa.*

—, *ibid.* (1928) 147–149.–*S. glauca* and *S. lutescens.*

Sorghum: Snowden, Kew Bull. (1935) 221–255.–Cult. *spp.* classified.

—, The cultivated races of Sorghum. London (1936) i–vii, 1–272, t. 1–4, fig. 1–31.

Sporobolus: Blake, Univ. Queensl. Pap. Dept Biol. 1 (1941) *no* 18, 3–12.–Key Queensl. *spp.*

Jansen, Act. Bot. Neerl. 1 (1952) 475–479, fig. 3–4.–Critical notes.

Stylagrostis: Mez, Bot. Arch. 1 (1922) 20.–Conspectus.

Thaumastochloa: Hubbard, in Hook. Ic. Pl. V, 4 (1936) t. 3313–3314, 6 pp.

Themeda: Camus, Bull. Mus. Hist. Nat. Paris 26 (1920) 266–273.–Key.

Jansen, Act. Bot. Neerl. 1 (1952) 479–483.–Critical notes; key to group of *T. gigantea.*

Thysanolaena: Janowski, in Mez, Bot. Arch. 1 (1922) 21–28.–Revision; key.

Triodia: Burbidge, Austr. J. Bot. 1 (1953) 121–184.–Descr.; key.

Tripsacum: Cutler & Anderson, Ann. Missouri Bot. Gard. 28 (1941) 249–269.–Prelim. survey.

Vulpia: Bor, J. Bombay Nat. Hist. Soc. 50 (1951) 340–343.–Rev. 3 Ind. *spp.*; key.

Xerochloa: Diels, Bot. Jahrb. 35 (1905) 64–68.

Zoysia: Hubbard, in Hook. Ic. Pl. V, 3 (1935) t. 3264, 1–4.–Critical notes.

BAMBUSACEAE

Blatter, E. (& R. N. Parker), The Indian bamboos brought up to date (Ind. For. 55, 1929, 541–562, 586–613).

Buse, L. H., Trib. Bambusaceae (in Miquel, Plant. Jungh. 1854, 386–394).

Camus, E. G., Les Bambusées. Monographie. Paris (1913) 215 pp.

Gamble, J. S., The Bambusaceae of British India (Ann. R. Bot. Gard. Calc. 7, 1896, xvii + 133 pp.).

McClure, F. A., The bamboo genera Dinochloa and Melocalamus (Kew Bull. 1936, 251–254).–Generic distinction.

Munro, W., A monograph of the Bambusaceae, including descriptions of all the species (Trans. Linn. Soc. Lond. 26, 1866, 1–157, t. 1–6).

Local

Malay Peninsula: Holttum, J. Arn. Arb. 27 (1946) 340.–Classification Malayan genera; key.
—, Gard. Bull. Sing. 11 (1947) 296.–Some new comb.
—, Kew Bull. (1953) 493–496.–New *Schizostachyum.*
Ridley, J. Str. Br. R. As. Soc. *no* 23 (1891) 32–33.–Listed records; no new *spp.*; no key.
—, Mat. Fl. Mal. Pen. (Monocot.) 3 (1908) 182–197.–Keys.

Java: Backer, Handb. Fl. Java pt 2 (1928) 260–289.–With valuable keys for sterile and fertile material; cult. *spp.* are included; in Dutch.

Borneo: Stapf, J. Linn. Soc. Lond. Bot. 42 (1914) 189–191.–2 new *spp.*

Philippines: Brown & Fischer, Bull. Bur. For. Philip. Isl. *no* 22 (1920) 249–310.–Keys.
Gamble, Philip. J. Sc. 5 (1910) Bot. 267–281.–Revision; keys.
—, *ibid.* 6 (1911) Bot. 289.–New *sp.*
—, *ibid.* 8 (1913) Bot. 203–206.–Additions; no key.
Merrill, Amer. J. Bot. 3 (1916) 58–64.–Identity of Blanco's *spp.*

New Guinea: Camus, J. Arn. Arb. 9 (1928) 144–145.–New *spp.*.
Chase, J. Arn. Arb. 20 (1939) 304–305.–Records.
—, *ibid.* 24 (1943) 77–78.–*Ditto.*
Pilger, Bot. Jahrb. 52 (1914) 172–176.–Descr.
Ridley, J. Bot. 24 (1886) 360.–New *Dendrocalamus.*

Genera

Arundinaria: Gamble, Kew Bull. (1912) 135–140. –Key to Sikkim Himal. *spp.*
Nakai, J. Arn. Arb. 6 (1925) 141–153.–Segregation of the genus.

Bambusa: McClure, Blumea Suppl. 3 (1946) 90–112.

Chloothamnus (*Oreiostachys*)**:** Henrard, Blumea 2 (1936) 60–73.

Melocanna: Parkinson, Ind. For. 61 (1935) 325–327.–New name for *M. humilis.*

Schizostachyum: McClure, Lingn. Sc. J. 14 (1935) 575–602.–Chin. *spp.*
—, Lingn. Sc. J. 15 (1936) 301–304.–Revised descr.
—, Blumea 2 (1936) 86–96.–Typif.; new Jav. *sp.*

GUTTIFERAE

(*incl. Hypericaceae*)

Choisy, J. D., Description des Guttifères de l'Inde, *etc.* (Mém. Soc. Phys. Hist. Nat. Genève 12^2, 1851, 381–440, t. 1–4).–Treats Wallich coll. and some Amer. *spp.*; synopsis of genera; no keys to *spp.*

Engler, A. (& R. Keller): Pflanzenfamilien ed. 2, 21 (1925) 154–237.

Planchon, J. E. & J. Triana, Mémoire sur la amille des Guttifères (Ann. Sc. Nat. Bot. IV, 13, 1860, 306–376; 14, 1860, 226–367; 15, 1861, 240–319; 16, 1862, 263–308; reprint 1862, iv + 336 pp.).

—, Sur la famille des Guttifères (Bull. Soc. Bot. Fr. 8, 1861, 26–29, 66–73, 96–100).

Vesque, J., Epharmosis sive materiae ad instruendam anatomiam systematis naturalis II. Genitalia foliaque Garciniearium et Calophyllearum (1889) 1–30, t. 1–162.–Revision of *Garcinia & Calophyllum* on an anatomical basis.

—, in DC. Mon. Phan. 8 (1893) 1–669.

Local

Borneo: Corner, Gard. Bull. Str. Settl. 10 (1939) 36–38.–Notes on some Malay *Garcinias.*
Ridley, Kew Bull. (1938) 115–123.–New *spp.*

Philippines: Elmer, Leafl. Philip. Bot. 3 (1911) 1047–1055.–New *Garcinia* from Sibuyan.
—, Leafl. Philip. Bot. 10 (1939) 3744–3748.–New *spp.*
Merrill, Philip. J. Sc. 3 (1908) Bot. 359–368.–Philip. *Garcinia*; key.
—, Philip. J. Sc. 26 (1925) 472–475; 27 (1925) 37. –New *Garcinias.*

New Guinea: Diels, Bot. Jahrb. 62 (1929) 482–483.–New *Hypericum.*
Lauterbach, Nova Guinea 8 (1910) 309–312. –Records; new *Garcinias.*
—, *ibid.* 8 (1912) 843–844.–Records; *Nouhuysia n.g.*
—, Bot. Jahrb. 58 (1923) 1–49.–Rev.; keys.
—, *ibid.* 61 (1927) 31.–New *Garcinia.*
Smith, J. Arn. Arb. 22 (1941) 343–374.–No keys, also some Melanesian *spp.*

Micronesia: Lauterbach, Bot. Jahrb. 59 (1924) 18–23.

Genera

Cratoxylon: Corner, Gard. Bull. Str. Settl. 10 (1939) 21–36.–Critical notes.
Gagnepain, Not. Syst. 1 (1909) 14–22.–Attempt to classify the Asiat. *spp.*
Korthals, in Temminck, Verh. Nat. Gesch. Bot. (1842) 175–180.

Garcinia: Pierre, Fl. For. Cochinch. 1 (1883) i–xlii, t. 54–92.–Monograph; no keys.

Hypericum: Keller, Bull. Herb. Boiss. II, 8 (1908) 175–191.–Rev. *sect. Brathys.*
Van Steenis, Bull. Jard. Bot. Btzg III, 13 (1934) 219–220.–List of Mal. *spp.*

Nouhuysia = Sphenostemon (*Aquifoliaceae).*

Ochrocarpus: Merrill, J. Arn. Arb. 26 (1945) 93–96.–Syn. of *O. odoratus* with a new species from Samoa.

Pentaphalangium: Smith, J. Arn. Arb. 22 (1941) 370–374.–No key.

Tetrathalamus = Bubbia (*Winteraceae*)

HAEMODORACEAE

Pax, F., Pflanzenfamilien ed. 2, 15a (1930) 386–390.

Steenis, C. G. G. J. van, Fl. Mal. I, 5 (1954) 111–113, fig. 1.

Local

New Guinea: Hallier *f.*, Nova Guinea 8 (1913) 902.–Record of *Haemodorum*.
Van Steenis, J. Arn. Arb. 28 (1947) 420.–*Ditto.*

HALORAGACEAE

Schindler, A. K., Pflanzenreich Heft 23 (1905) 1–133, fig. 1–36.

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1934) 217–218.–List.

Local

New Guinea: Gibbs, Contr. Fl. Phytog. Arfak Mts (1917) 159.
Mansfeld, Bot. Jahrb. 61 (1927) 26–27.–No keys.
Mattfeld, Bot. Jahrb. 69 (1938) 275–277.–New *sp.* of *Myriophyllum § Pentapteris §§ Pelonastes.*
Merrill & Perry, J. Arn. Arb. 23 (1942) 407–408.–New records.
—, J. Arn. Arb. 29 (1948) 161–162.
Went, Nova Guinea 14 (1924) 105–109.–New *spp.* of *Haloragis.*

Genera

Laurembergia: van Steenis, Arch. Hydrobiol. Suppl. 3 (1932) 315–316, fig. 5.–Account of the 2 Mal. *spp.*

HAMAMELIDACEAE

Harms, H., Pflanzenfamilien ed. 2, 18a (1930) 305–345.

Lecomte, H., Hamamelidacées du Haut-Tonkin (Bull. Mus. Hist. Nat. Paris 30, 1924, 390–393).

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1934) 218.–List mountain genera.

Local

Malay Peninsula: Symington, J. Mal. Br. R. As. Soc. 14, pt 3 (1936) 351.–Records.

Philippines: Hemsley, in Hook. Ic. Pl. IV, 9 (1907) t. 2836.–New *Sycopsis.*

Genera

Distylium: Walker, J. Arn. Arb. 25 (1944) 322–335.–Revision with key.

Embolanthera: Merrill, Philip. J. Sc. 4 (1910) Bot. 263–264.–Palawan, monotypic.

Exbucklandia (*Bucklandia* R. Br. non Pr., *Symingtonia*): van Steenis, Acta Bot. Neerl. 1 (1952) 443–444.–Nomencl. note.
—, Blumea 7 (1954) 595.—*Ditto.*

Rhodoleia: Exell, Sunyatsenia 1 (1933) 95–102.–Revision with key.

Sycopsis: Walker, J. Arn. Arb. 25 (1944) 335–341.–Revision with key; first record in New Guinea!

HERNANDIACEAE

Blume, C. L., Illigereae (in Hoeven & de Vriese, Tijd. Nat. Geschied. & Phys. 1, 1834, 142–147).–Census of *Illigera* & *Gyrocarpus*; *spp.* listed; in Latin.

Local

Malay Peninsula: Corner, Wayside trees of Malaya (1940) 323.

New Guinea: Pulle, Nova Guinea 8 (1911) 639.

Genera

Hernandia: Tuyama, Bull. Sigenkagaku Kenkyusyo 1, *no* 1 (1943) 41–44.–*H. javanica*, *H. sonora*, and a new *sp.* from the Marianes.

Illigera: Dunn, J. Linn. Soc. Lond. Bot. 38 (1908) 290–297.–Revision.
Miquel, Ann. Mus. Bot. Lugd.-Bat. 2 (1866) 213–215.–Revision Mal. *spp.*; no key.
Wu, Bot. Jahrb. 71 (1941) 177.–Key to 6 S. Chin. *spp.*

HIMANTANDRACEAE

Bailey, I. W., Nast, & A. C. Smith, The family Himantandraceae (J. Arn. Arb. 24, 1943, 190–206).–Revision; key to the 2 *spp.* of *Himantandra.*

Smith, A. C., A nomenclatural note on the Himantandraceae (J. Arn. Arb. 23, 1942, 366–368).–List of *spp.*

Local

New Guinea: Diels, Bot. Jahrb. 49 (1913) 164–165, fig. 6.–Under *Annon.*
—, *ibid.* 52 (1914) 185–186.–Emended descr.

Genera

Himantandra (*Galbulimima*): Diels, Bot. Jahrb. 55 (1918) 126–143, 1 fig.

HIPPOCRATEACEAE

Loesener, Th., Pflanzenfamilien ed. 2, 20b (1942) 198–231.

Miquel, F. A. W., Hippocrateaceae Archipelagi Indici (Ann. Mus. Bot. Lugd.-Bat. 4, 1869, 148–154).

Smith, A. C., The American species of Hippocrateaceae (Brittonia 3, 1940, 341–555, fig. 1–12).–Revision; key to genera and *spp.*; notes on Old World genera.
—, Notes on Old World Hippocrateaceae (Amer. J. Bot. 28, 1941, 438–443).–*Loeseneriella*, *Pristimera*, *Salacia*, *Salacicratea*, and *Dicarpellum*; many new comb.
—, Notes on Hippocrateaceae in Southeastern Asia (J. Arn. Arb. 26, 1945, 169–179).–Asiat. *spp.* of *Pristimera* & *Loeseneriella*; keys.

TARDIEU-BLOT, Hippocrateaceae nouvelles ou litigieuses d'Indochine (Bull. Soc. Bot. Fr. 95, 1948, 261–265).

Local

Borneo: RIDLEY, Kew Bull. (1938) 237–242.–New *spp.* in *Hippocratea* and *Salacia.*

Banka: SCHEFFER, Nat. Tijd. Ned. Ind. 31 (1870) 16–17.–New *Salacia.*

New Guinea: LOESENER, Nova Guinea 8 (1910) 281–282.

Genera

Brassiantha: SMITH, A. C., & BAILEY, J. Arn. Arb. 22 (1941) 389–394.–New Guinea.

Hippocratea: ROLFE, Kew Bull. (1918) 47–48.–Critical note on a few *spp.*

Loeseneriella: SMITH, A. C., J. Arn. Arb. 26 (1945) 169–175.–SE. Asiat. genus; possibly also in Malaysia.

Pristimera: SMITH, A. C., J. Arn. Arb. 26 (1945) 175–179.

Salacicratea: HARMS, Notizbl. Berl.-Dahlem 15 (1942) 676–677.–New *spp.* from N. Guinea & Celebes.
LOESENER, Bot. Jahrb. 63 (1930) 275.–From Melanesia & Micronesia.
SMITH, A. C., Am. J. Bot. 28 (1941) 441–442.

HYDROCARYACEAE

(*Trapaceae*)

FLEROFF, A. TH., Genus Trapa L., seine Verbreitung und systematische Uebersicht (Bull. Jard. Bot. Rép. Russ. 24, 1925, 13–45, in Russian). (*cf.* Bot. Centralbl. 151, 1927, 260.)

STEENIS, C. G. G. J. VAN, Fl. Mal. I, 4 (1949) 43–44, fig. 1.

HYDROCHARITACEAE

ASCHERSON, P., Vorarbeiten zu einer Übersicht der phanerogamen Meeresgewächse (Linnaea 35, 1867, 152–208).–Conspectus; no key.

ERNST-SCHWARZENBACH, M., Zur Blütenbiologie einiger Hydrocharitaceen (Ber. Schweiz. Bot. Ges. 55, 1945, 33–69, t. 1–2).–On *Hydrilla verticillata* and some others.

MIQUEL, F. A. W., Illustr. Fl. Arch. Ind. (1870) 51–56.–No key.

OSTENFELD, C. H., Pflanzenareale 1³ (1927) 35–38, Karten 21–24.—Distr. of marine genera.

Local

Malay Peninsula: RIDLEY, Mat. Fl. Mal. Pen. (Monocot.) 1 (1907) 3–6.–Keys.

Java: BACKER, Handb. Fl. Java pt 1 (1925) 57–64.–Keys; in Dutch.

Celebes: HALLIER *f.*, Meded. Rijksherb. Leiden *no* 26 (1915) 7–8.–*Boottia mesenterium.*

New Guinea: GRAEBNER, Bot. Jahrb. 49 (1912) 68–69.–*Vallisneria gigantea.*
HALLIER, Nova Guinea 8 (1913) 915–917.–2 new *Hydrocharis*, record of *Vallisneria.*
SOLEREDER, Meded. Rijksherb. Leiden *no* 21 (1914) 2 pp.–Anat. new Pap. *spp.*

Genera

Blyxa: VAN STEENIS, Trop. Natuur 18 (1929) 197–200, fig. 1–3.–Distr. 2 Mal. *spp.*

Boottia: DANDY, J. Bot. 70 (1932) 328.–Reduct. of *Hydrocharis renifolia.*
GÜRKE, Festschr. ASCHERSON (1904) 533–547.–Notes on trop. Afr. *spp.* of *Boottia & Ottelia.*
MERRILL & METCALF, Lingn. Sc. J. 17 (1938) 567–570.–New Chin. *sp.*

Echinodorus (*Ranalisma*): VAN STEENIS, Arch. f. Hydrobiol. Suppl. 9 (1932) 240, footnote 3.–Nomencl.

En(h)alus: TROLL, Planta 125 (1931) 427–456, 15 fig.–Biology.

Halophila: BALFOUR, Trans. Bot. Soc. Edinb. 13 (1878) 290–343, pl. 8–12.–Mainly morphol.
OSTENFELD, Philip. J. Sc. 4 (1909) Bot. 67–68.–*H. ovata.*
SETCHELL, Amer. Midl. Nat. 69 (1935) 560–577.–Geogr. distr.

Hydrocharis: HALLIER *f.*, Nova Guinea 8 (1913) 916–917).–2 new *spp.*; survey Mal. *spp.*

Ottelia (*Boottia, Oligolobos*): DANDY, J. Bot. 72 (1934) 132–139.–Revision; list of *spp.*; no key; *Boottia* reduced.
—, *ibid.* 73 (1935) 209–217, fig. 1.–*Ottelia* in China; key.
GÜRKE, Festschr. ASCHERSON (1904) 533–547.–Notes on trop. Afr. *spp.* of *Boottia & Ottelia.*

HYDROPHYLLACEAE

BACKER, C. A., Fl. Mal. I, 4 (1952) 207–209, 1 fig.

CHOISY, J., Description des Hydroléacées (Mém. Soc. Phys. & Hist. Nat. Genève 6, 1833, 95–122, t. 1–3).–Revision; descr.; no key.

BENTHAM, G., Review of the Order of Hydrophylleae (Trans. Linn. Soc. 17², 1835, 267–282).–Descr. of genera and *spp.*; no key.

BRAND, A., Pflanzenreich Heft 59 (1913) 1–210, fig. 1–39.

Local

Java: BACKER, Onkruidfl. Jav. Suiker. (1931) 532–534.

Genera

Hydrolea (*Nama*): HITCHCOCK, Amer. J. Bot. 20 (1933) 415–430.–Taxonomy.

Nemophila: CONSTANCE, Univ. Calif. Publ. Bot. 19 (1941) 341–398.–Rev.; key.

Phacelia: HOWELL, Proc. Cal. Ac. Sc. IV, 25 (1944) 357–376.–Revision sect. *Miltitzia*; key.

HYPERICACEAE

See Guttiferae

HYPOXIDACEAE

See Amaryllidaceae

ICACINACEAE

(*Peripterygiaceae*)

BAILLON, H. E., Deuxième étude sur les Mappiées (Adansonia 10, 1872, 261–282; 11, 1875, 239–273, 292–312, 366–373; 12, 1876–79, 220–254, 282–296).

BECCARI, O., Malesia 1 (1877) 105–134, t. 3–8, (1878) 255–256, (1883) 257.–Complete list of Mal. *spp.* with descr. of new *spp.*

HOWARD, R. A., Studies of the Icacinaceae. Preliminary taxonomic notes (J. Arn. Arb. 21, 1940, 461–488).–Crit. notes; key to genera.

—, Studies of the Icacinaceae II (*ibid.* 23, 1942, 55–78).–Mostly extra-Mal. genera.

—, Studies of the Icacinaceae IV. Consideration of the New World genera (Contr. Gray Herb. 142, 1942, 3–60).

—, Studies of the Icacinaceae VIII (Lloydia 6, 1943, 144–154).–Descr. new *spp.*

SLEUMER, H., Beiträge zur Kenntnis der Icacinaceen und Peripterygiaceen (Notizbl. Berl.-Dahlem 15, 1940, 228–257).

—, Pflanzenfamilien ed. 2, 20b (1942) 322–396.

Local

Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 86 (1922) 325–326.–New *Phytocrene.*

STAPF, Kew Bull. (1906) 71–72.–New *spp.*

Philippines: ELMER, Leafl. Philip. Bot. 10 (1939) 3748–3750.–New *spp.*

MERRILL, Philip. J. Sc. 26 (1925) 467–468.–New *Mappia.*

New Guinea: BIRNIE, Nova Guinea 14 (1927) 275–277.

ENGLER, Bot. Jahrb. 16 (1893) Beibl. 39, p. 13. –New *Polyporandra.*

PULLE, Nova Guinea 8 (1912) 657–660.

RIDLEY, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 27–30.–3 New genera.

SCHELLENBERG, Bot. Jahrb. 58 (1923) 155–177.–Keys to *spp.*

Micronesia: SCHELLENBERG, Bot. Jahrb. 59 (1924) 17.–New *Urandra* from Palau.

Genera

Cantleya: HOWARD, J. Arn. Arb. 21 (1940) 479–481.

Cardiopteris (*Peripterygium*): WALL. *ex* ROYLE, Illustr. Bot. Him. Mts (1834) 136.–Short descr.

BLUME, Rumphia 3 (1849) 206, t. 177.–As a distinct family *Cardiopterideae.*

HASSKARL, Tijd. Nat. Geschied. & Phys. 10 (1843) 142; Cat. Hort. Bog. (1844) 234–235; Retzia 1 (1855) 64–65.

BECCARI, Nuov. Giorn. Bot. Ital. 9 (1877) 100–108, t. 8.–Emended descr.

SLEUMER, Pflanzenfamilien ed. 2, 20b (1942) 397–400.–As a distinct family *Peripterygiaceae.*

Citronella (*Villaresia, Chariessa, Pleuropetalon*): HOWARD, J. Arn. Arb. 21 (1940) 471–479.

—, Contr. Gray Herb. 142 (1942) 60–92.–Revision; keys.

Codiocarpus: HOWARD, Brittonia 5 (1943) 53–57.

Gonocaryum: SCHEFFER, Ann. Jard. Bot. Btzg 1 (1876) 96–102.

Lophopyxis: HOLTHUIS & LAM, Blumea 5 (1942) 205–208.

Medusanthera (*Lasianthera, Tylecarpus, Stemonurus p.p.*): HOWARD, J. Arn. Arb. 21 (1940) 469–471.

—, Lloydia 6 (1943) 134–143.–Revision; key.

Merrilliodendron (*Peekeliodendron*): KANEHIRA, Bot. Mag. Tokyo 48 (1934) 920–921.

SLEUMER, Notizbl. Berl.-Dahlem 13 (1937) 509–512.

Nothapodytes: HOWARD, J. Arn. Arb. 23 (1942) 66–73.–Key.

Phytocrene: MIQUEL, Ann. Mus. Lugd.-Bat. 3 (1867) 247–248.

Polyporandra: KOORDERS, Versl. Gew. Verg. Akad. Wet. A'dam 27 Febr. 1909, vol. 17, 780–782, Proc., p. 763–765.

Pseudobotrys: MOESER, in FEDDE, Rep. 10 (1912) 310–311.

Urandra (*Stemonurus p. p.*): HOWARD, J. Arn. Arb. 21 (1940) 462–469.

THWAITES, in HOOK. J. Bot. & Kew Gard. Misc. 7 (1855) 211–212.

ILLICIACEAE

SMITH, A. C., The families Illiciaceae and Schisandraceae (Sargentia 7, 1947, 1–224, 41 fig.).–Revision; key!

IRIDACEAE

BAKER, J. G., Handbook of the Irideae. London 1892.

DIELS, L., Pflanzenfamilien ed. 2, 15a (1930) 463–505.

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 220.–List mountain *spp.*

Local

Sumatra: MERRILL, Not. Nat. Acad. Nat. Sc. Philad. *no* 47 (1940) 2.

Java: BACKER, Handb. Fl. Java 3 (1924) 116–130. –Also cult. *spp.*; keys; in Dutch.

Borneo: STAPF, Trans. Linn. Soc. Lond. II, Bot. 4 (1894) 241–242.

New Guinea: DIELS, Bot. Jahrb. 62 (1929) 462.

GIBBS, Contr. Fl. Phytog. Arfak Mts (1917) 101.

VON MUELLER, Trans. R. Soc. Victoria pt 2 (1889) 34.

WENT, Nova Guinea 14 (1924) 114.

Genera

Crocus: MAW, A monograph of the genus Crocus. London (1886) 1–326, xx, index, t. (col.) 1–67.–No keys.

Iris: LAWRENCE, Gentes Herb. 8 (1953) 346–371.–Reclassification; sections.

Neomarica (*Marica*): SPRAGUE, Kew Bull. (1928) 278–281.

Sisyrinchium: BICKNELL, Bull. Torr. Bot. Club 26–28 (1899–1901).–Segregation; keys; no complete monograph.

IRVINGIACEAE

See Simaroubaceae

JUGLANDACEAE

Local

Java: KOORDERS & VALETON, Bijdr. Booms. Java 5 (1900) 161–177.

Philippines: ELMER, Leafl. Philip. Bot. 9 (1934) 3194–3197.–Two new *spp.*

QUISUMBING, Philip. J. Sc. 76 (1944) 37.

New Guinea: SCHLECHTER, Bot. Jahrb. 50 (1913) 66–67.

JUNCACEAE

BACKER, C. A., Fl. Mal. I, 4 (1951) 210–215, fig. 1–2.

BUCHENAU, F. G. PH., Monographia Juncacearum (Bot. Jahrb. 12, 1890, 1–495, t. 1–3, fig. 1–9).–Monogr.; keys.

—, Pflanzenreich Heft 25 (1906) 1–284.

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 220–221.–List.

STEUDEL, E. G., Enumeratio plantarum Glumacearum pars II. Stuttgart (1855) 290–314.–Enum. descr. in Latin.

VIERHAPPER, F., Pflanzenfamilien ed. 2, 15a (1930) 192–224.

Local

India: BUCHENAU, Bot. Jahrb. 6 (1885) 187–232, t. 2–3.–Revision, specially Himal. *spp.*; keys.

New Guinea: DIELS, Bot. Jahrb. 62 (1929) 461–462.

Genera

Juncus: RIDLEY, J. Bot. 73 (1935) 342–343.–*Spp.* of Java & Sumatra.

JUNCAGINACEAE

(*Scheuchzeriaceae*)

BUCHENAU, F. G. PH., Pflanzenreich Heft 16 (1903) 1–20, fig. 1–9.

STEENIS, C. G. G. J. VAN, Fl. Mal. I, 4 (1949) 56–57, fig. 1.

Local

New Guinea: VAN STEENIS, J. Arn. Arb. 28 (1947) 419.

LABIATAE

BENTHAM, G., Labiatarum genera et species: *etc.* (1832–36) lxviii + 783 pp.

BRIQUET, J., Fragmenta Monographiae Labiatarum I (Bull. Soc. Bot. Genève 5, 1888, 20–122); II (Bull. Herb. Boiss. 2, 1894, 119–141); III (*ibid.* 689–724); IV (*ibid.* 4, 1896, 676–696, 762–808, 847–878); V (Ann. Conserv. Jard. Bot. Genève 2, 1898, 102–251).

DUNN, S. T., A key to the Labiatae of China (Not. R. Bot. Gard. Edinb. 6, 1915, 127–190).–Keys to genera & *spp.*

EPLING, C., Synopsis of the South American Labiatae (in FEDDE, Rep. Beih. 85, 1935–1937, 1935, 1–96, 1936, 97–288, 1937, 289–341).

JUNELL, S., Zur Gynäceummorphologie und Systematik der Verbenaceen und Labiaten, *etc.* (Symb. Bot. Uppsala 1, *no* 4, 1934, 1–219, fig. 1–257).–Delimitation of the families on the basis of ♀ morph.; result strongly deviating from current opinion.

MUKHERJEE, S. K., A revision of the Labiatae of the Indian Empire (Rec. Bot. Surv. India 14, 1940, viii + 228 pp.).

PRAIN, D., Noviciae Indicae III. Some additional species of Labiatae (J. As. Soc. Bengal 59, ii, 1890, 294–318).–Add. to Fl. Br. Ind.

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 221–223.–List mountain plants.

Local

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 148–149.

—, Pap. Mich. Ac. Sc. Arts & Lett. 19 (1934) 191–194.–New *spp.*

Malay Peninsula: FURTADO, Gard. Bull. Str. Settl. 4 (1929) 415.–Key of *Hyptis* in Mal. Pen.

—, *ibid.* 4 (1929) 416–419.–Account of *Ocimum*; key.

PRAIN, Kew Bull. (1908) 114–115.–*Acrymia n.g.*; monotypic.

RIDLEY, J. Str. Br. As. Soc. *no* 50 (1908) 105–108. –Survey.

Philippines: ELMER, Leafl. Philip. Bot. 9 (1934) 3197.–New *Pogostemon.*

PRAIN, Kew Bull. (1908) 116.–New *Pogostemon.*

New Guinea: MANSFELD, Bot. Jahrb. 62 (1921) 376–381.–Full account; keys.

Genera

Achyrospermum: BRUCE, Kew Bull. (1936) 47–60. –Afr. *spp.*; key.

Ceratanthus: TAYLOR, J. Bot. 74 (1936) 33–41.–Survey.

Cymaria (*Anthocoma*): PRAIN, Ann. Bot. 6 (1892) 214–217.–Syn. of *C. acuminata.*

Gomphostemma: PRAIN, Ann. R. Bot. Gard. Calc. 3 (1891) 228–273, t. 75–105.–Revision; key.

Hyptis: EPLING, Kew Bull. (1936) 278–280.–List distr. of Old World *spp.*

—, Rev. Mus. La Plata n. s., 7. Bot. (1949) 153–497, fig. 1–42 (maps).–Complete revision; keys; in Span.

Lavandula: CHAYTOR, J. Linn. Soc. Lond. Bot. 51 (1937) 153–204.–Revision; keys.

GREEN, Kew Bull. (1932) 295–297.–Nomencl.

Microtoena: PRAIN, Bull. Soc. Bot. Fr. 42 (1895) 417–427.–Revision; key.

Pogostemon: PRAIN, Kew Bull. (1908) 78–82.–*P. cablin* (patchouly).

Salvia § Calosphace: EPLING, in FEDDE, Rep. Beih. 110 (1938–1939) 1–380.

LAURACEAE

ALLEN, C. K., Studies in the Lauraceae. I. Chinese and Indo-Chinese species of Litsea, Neolitsea, and Actinodaphne (Ann. Missouri Bot. Gard. 25, 1938, 361–434).

—, *Ditto.* V. Some Eastern Asiatic species of Beilschmiedia and related genera (J. Arn. Arb. 23, 1942, 444–463.)–*Lauromerrillia n. g.*

GAMBLE, J. S., New Lauraceae from the Malayan region (Kew Bull. 1910, 142–153, 253); II (*ibid.* 218–228); III (*ibid.* 312–321); IV (*ibid.* 357–368). –New *spp.* from the Mal. Pen., also some from New Guinea & Borneo. No key.

KOSTERMANS, A. J. G. H., Studies in South American Malpighiaceae, Lauraceae and Hernandiaceae, especially of Surinam. Thesis Utrecht, (1936). 70 pp. (Repr. in Med. Bot. Mus. en Herb.

Univ. Utrecht *no* 25).–Contains also notes on Mal. *Laur.*

—, Revision of the Lauraceae I (Rec. Trav. Bot. Néerl. 33, 1936, 719–757).–On American genera.

—, *ditto* II (*ibid.* 34, 1937, 500–609).–*Ditto.*

—, A historical survey of Lauraceae (J. Sc. Res. Indon. 1, 1952, 83–95, 113–127, 141–159).–Chronol. review; many new comb.; index to scientific names.

LECOMTE, H., Lauracées de Chine et d'Indo-Chine (Nouv. Arch. Mus. Hist. Nat. V, 5, 1913, 43–120, t. 3–9).–No keys.

LIOU, HO, Contribution à l'étude systématique et phytogéographique des Lauracées de Chine et d'Indochine. Thèse, Paris (1932) 1–207.–Monographic; descr. and keys.

MEISSNER, K. F., Lauraceae (in DC. Prod. 15, 1, 1864, 1–260).

MEZ, C., Lauraceae Americanae monographice descriptae (Jahrb. Kön. Bot. Gart. Berlin 5, 1889, 1–556).

—, Spicilegium Laureanum (Arb. aus den Kgl. Bot. Gart. Breslau 1, Heft 1, 1892, 71–166).–Georg. distr. of genera; additions to his monogr. on the Amer. *Laur.*

NAKAI, T., On the Japanese species of the tribe Litseae of Lauraceae (J. Jap. Bot. 14, 1938, 117–195).

Local

Sumatra: KURZ, Flora 55 (1872) 171–172.–Disc. *Litsea rugosa.*
MERRILL, Contr. Arn. Arb. 8 (1934) 61–65.
RIDLEY, J. Str. Br. R. As. Soc. *no* 87 (1923) 89–90.–New *sp.*
—, Kew Bull. (1926) 79.

Malay Peninsula: CORNER, Gard. Bull. Str. Settl. 10 (1939) 276–278.–*Cinnamomum, Lindera & Phoebe spp.*
HENDERSON, Gard. Bull. Str. Settl. 7 (1933) 120–121, t. 31.–New *Endiandra.*
SYMINGTON, Kew Bull. (1937) 319.–Reduction of *Alseodaphne crassipes.*

Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 85 (1922) 191–197.–New *spp.*
AIRY SHAW, Kew Bull. (1939) 434–438 (*sphalm.* 534–538).–Also new *spp.*

Philippines: ELMER, Leafl. Philip. Bot. 2 (1908) 375–384.–Descr. new *spp.*; no key.
—, *ibid.* 2 (1910) 703–728.–*Ditto.*
—, *ibid.* 10 (1939) 3750–3757.–*Ditto.*
MERRILL, Philip. J. Sc. 1 (1906) Suppl. 56–58.
—, *ibid.* 12 (1917) Bot. 125–141.–New *spp.*
—, *ibid.* 27 (1925) 23.–Two new *spp.*
QUISUMBING, Philip. J. Sc. 76 (1944) 40–41.–Two new *spp.*
– & MERRILL, *ibid.* 37 (1928) 146–149.–Three new *spp.*
WHITE, Kew Bull. (1933) 46.–New name in *Cryptocarya.*

New Guinea: ALLEN, J. Arn. Arb. 23 (1942) 112–131, 133–155.–Many new *spp.* and a *n.g.*; no key.
KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 57 (1943) 185–192.–New *spp.*
KOSTERMANS, Bull. Bot. Gard. Btzg III, 18 (1950) 435–443.–New *spp.* and critical notes.
LAUTERBACH, Nova Guinea 8 (1912) 819–820.
TESCHNER, Bot. Jahrb. 58 (1923) 380–440.–Keys.
—, *ibid.* 58 (1924) 492–495.–New *spp.* of *Cinnamomum*; no key.

Solomon Islands: WHITE, J. Arn. Arb. 31 (1950) 83–86.

Genera

Caryodaphnopsis: AIRY SHAW, Kew Bull. (1940) 74–76.–Segregate of *Notaphoebe* to which added a Philippine '*Persea*'.
—, in HOOK. Ic. Pl. 35 (1943) t. 3436.

Cinnamomum (*Camphorina*): ALLEN, J. Arn. Arb. 20 (1939) 44–62.–Crit. notes on Asiat. *spp.*
BLUME, Rumphia 1 (1835) 25–45.
CAMMERLOHER, Bull. Jard. Bot. Btzg III, 7 (1924) 446–497.–Neth. Ind. *spp.*; key.
MERRILL, Bot. Gaz. 70 (1920) 84–85.–Reduction *Camphorina.*
MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 254–270, 317.

Dehaasia: BLUME, Rumphia 1 (1835) 161–164.

Dryadodaphne = Levieria (*Monimiaceae*), *cf.* KOSTERMANS, Rec. Trav. Bot. Néerl. 34 (1937) 605.

Eusideroxylon: SYMINGTON, in HOOK. Ic. Pl. 35 (1940) t. 3409.–Second *sp.* from Borneo.
TEYSMANN & BINNENDIJK, Nat. Tijd. Ned. Ind. 25 (1863) 289–294.–Orig. descr.
DE WIT, Bull. Bot. Gard. Btzg III, 18 (1949) 200–208.–Revision.

Lindera: ALLEN, J. Arn. Arb. 22 (1941) 1–31.–Critical notes; no key.

Neocinnamomum: ALLEN, J. Arn. Arb. 20 (1939) 62–63.–Chin. *spp.*
LIOU, in Lauracées de Chine et d'Indochine. 1932.
MERRILL, Contr. Arn. Arb. 8 (1934) 64.–Sumatra record.

Neolitsea (*Bryantea* RAFIN., *Tetradenia* NEES, *non* BTH.): GAMBLE, Kew Bull. (1911) 172.
MERRILL, Philip. J. Sc. 1 (1906) Suppl. 56–57.
—, J. Arn. Arb. 29 (1948) 198–201.

Persea: BLAKE, J. Wash. Acad. Sc. 10 (1920) 9.
AIRY SHAW, in HOOK. Ic. Pl. 35 (1943) t. 3472 (& 3436).

Pseudocryptocarya: TESCHNER, Bot. Jahrb. 58 (1923) 411–413.–New Guinea.

Stemmatodaphne: GAMBLE, in HOOK. Ic. Pl. IV, 10 (1913) t. 2984.–Mal. Pen.; *aff. Phoebe.*
AIRY SHAW, Kew Bull. (1940) 76–77.

LECYTHIDACEAE

(*Barringtoniaceae*)

BLUME, C. L., Notice sur quelques Barringtoniées de l'Archipel des Indes (Flore des Serres 7, 1851, 21–25).

KNUTH, R., Pflanzenreich Heft 105 (1939) fam. 219a, 82 pp.

KORTHALS, P. W., Bijdrage tot de kennis der Myrtaceae (Ned. Kruidk. Arch. 1, 1846, 205–206).

MIERS, J., On the Lecythidaceae (Trans. Linn. Soc. Lond. 30, 1874, 157–318).

—, On the Barringtoniaceae (Trans. Linn. Soc. Lond. II, Bot. 1, 1875, 47–118, t. 10–18).–Monographic; key to the genera; no keys to *spp.*

WHITE, C. T., A revised account of the Queensland Lecythidaceae (Proc. Linn. Soc. N. S. Wales 44, 1920, 822–825).–No key.

Local

Java: BACKER, Schoolfl. Java (1911) 527–530.–In Dutch; key.

Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 77 (1917) 204–206.–Two new *spp.* of *Barringtonia.*
RIDLEY, Kew Bull. (1938) 284–285.–Three new *spp.*
AIRY SHAW, Kew Bull. 1 (1950) 137–138.–New *sp.*

New Guinea: LAUTERBACH, Nova Guinea 8 (1910) 313–315.
—, *ibid.* 8 (1912) 845.
—, Bot. Jahrb. 57 (1922) 341–353.–Keys.
MERRILL & PERRY, J. Arn. Arb. 21 (1940) 292–296.–New *spp.*; no key.

Melanesia: LAUTERBACH, Bot. Jahrb. 45 (1911) 362–363.–Two new *Barringtonias.*
RECHINGER, in FEDDE, Rep. 11 (1912) 183–184.–New *Barringtonia.*

Genera

Barringtonia: LÜTJEHARMS & VAN OOSTSTROOM, Blumea 3 (1938) 95–105.–Two new *Barringtonias.*

Chydenanthus: AIRY SHAW, Kew Bull. (1949) 152.

Petersianthus (*Petersia* WELW., *non* KLOTZSCH): MERRILL, Philip. J. Sc. 11 (1916) Bot. 200–201.–Census of the genus under this new name (Africa, Philippines).

LEEACEAE

See Vitaceae

LEGUMINOSAE

(*incl. Caesalpiniaceae, Mimosaceae, Papilionaceae*)

BAKER J. G., & D. Oliver, in Fl. Trop. Afr. 2 (1871) 1–364.

BAKER, E. G., The Leguminosae of tropical Africa. 3 pts. London (1926–30) 953 pp.

BENTHAM, G., Notes on Mimoseae, with a short synopsis of species (in HOOK. J. Bot. 4, 1842, 323–418; HOOK. Lond. J. Bot. 1, 1842, 318–392, 494–528; 3, 1844, 82–112, 195–226; 4, 1845, 577–622; 5, 1846, 75–108).

—, Enumeration of Leguminosae indigenous to Southern Asia, *etc.* (in HOOK. Lond. J. Bot. 2, 1843, 423–481, 559–613; *ibid.* 3, 1844, 338–365; *ibid.* 7, 1848, 580–657).

—, Synopsis of the Dalbergiae (J. Linn. Soc. Bot. 4, 1860, Suppl. 1–134).

—, Description of some new genera and species of tropical Leguminosae (Trans. Linn. Soc. 25, 1866, 297–320, t. 33–43).–Mostly African, some Asiat.

—, Revision of the suborder Mimoseae (Trans. Linn. Soc. 30, 1875, 335–664, t. 66–70).

BURKART, A., Las Leguminosas Argentinas, ed. 2. Buenos Aires (1952).

GAGNEPAIN, F., Mimosées nouvelles (Not. Syst. 2, 1911, 56–62).–New Mal. *spp.* of *Entada, Adenanthera & Parkia.*

PELLEGRIN, F., Les Légumineuses du Gabon (Mém. Inst. Ét. Centrafr. 1, 1948, 284 pp.).

PRAIN, D., Some additional Leguminosae (J. As. Soc. Beng. 66, ii, 1897, 347–518).–Additions to Fl. Br. India; incl. the Malay Peninsula.

SCHINDLER, A. K., Die Desmodiinen in der botanischen Literatur nach LINNÉ (in FEDDE, Rep. Beih. 49, 1928, 1–371).–Bibl.; no keys and descr.

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 223.–List mountain *spp.*

WIT, H. C. D. DE, Revision of Malaysian Bauhinieae.–The MS of this large monograph has been in the hands of the Keeper of the Herb. Bog. for about 4 years and was intended to be published in Reinwardtia in 1955.

Local

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 72–79.
RIDLEY, J. Mal. Br. R. As. Soc. *no* 87 (1923) 58.–List.

Malay Peninsula: HENDERSON, Gard. Bull. Str. Settl. 7 (1933) 99–101.—List; one new *Bauhinia.*
PRAIN, J. As. Soc. Bengal 66, ii (1897) 21–275.

Java: BACKER, Voorl. Schoolfl. Java (1908) 66–112.–In Dutch; keys.
—, Schoolfl. Java (1911) 289–443.–In Dutch; keys.
—, Bull. Jard. Bot. Btzg III, 2 (1920) 323–324.–New *sp.* of *Bauhinia* and *Crotalaria.*
—, Bull. Jard. Bot. Btzg III, 16 (1939) 107–110.–*Teyleria n. g.*; *Tephrosia n. comb.*
—, Bekn. Fl. Java (em. ed.) pt 5 (1941) fam. 118–120.–In Dutch; keys.
—, Blumea 5 (1945) 508–515.–Crit. notes; new *spp.*
BENTHAM, in MIQUEL, Pl. Junghuhn. (1852) 205–270.
HASSKARL, Flora (1842) Beibl. 57–114.–New and emend. *spp.*
—, Tijd. Nat. Gesch. & Phys. 11 (1844) 49–112.–Descr. of *Papil.*
—, Nat. & Geneesk. Arch. 2 (1845) 58–71, 183–199, 341–361.–New descr. Jav. *Papil.*
ZOLLINGER, Nat. & Geneesk. Arch. Ned. Ind. 3 (1846) 51–82.–Enum.; descr. new *spp.*

Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 76 (1917) 84–86.–Records & new *spp.*
—, Philip. J. Sc. 11 (1916) Bot. 77–92.–Many new *spp.* & records.
—, *ibid.* 13 (1918) Bot. 73–74.–New *Crudia.*
—, *ibid.* 29 (1926) 372–375.–List Banguey Isl.
MIQUEL, F. A. W., Anal. Bot. Ind. 1 (1850) 7–12 (repr. from Verh. Kon. Ned. Inst. 1e kl. 3e reeks, vol. 3).
RIDLEY, Kew Bull. (1929) 254–258.–New *spp.*, some from the Mal. Pen.
—, Kew Bull. (1938) 276–280.–Many new records; new *spp.* in *Baphia, Saraca,* and *Spatholobus.*
SMITH, Ic. Bog. 3 (1907) t. 230–231.–New *Millettia*; *cf. Whitfordiodendron.*

Philippines: DUNN, Philip. J. Sc. 6 (1911) Bot. 315–317.–Revision *Millettia*; key!

Elmer, Leafl. Philip. Bot. 1 (1907) 220–232.–New *gen. & spp.*
—, *ibid.* 2 (1910) 689–701.–New *gen. & spp.*
—, *ibid.* 9 (1934) 3198–3200.–Two new *spp.*
—, *ibid.* 10 (1939) 3757–3758.–New *Mezoneurum.*
Merrill, Philip. J. Sc. 5 (1910) Bot. 1–136.–Full account; keys.
—, *ibid.* 7 (1912) Bot. 235.–Nomencl.
—, *ibid.* 27 (1925) 25–26.–New *Bauhinia.*
—, *ibid.* 30 (1926) 396–399.–New *spp.* from Sulu.
— & Quisumbing, *ibid.* 82 (1953) 326–328.–New records.
Quisumbing, Philip. J. Sc. 41 (1930) 324–326.–New *Derris.*
Quisumbing & Merrill, Philip. J. Sc. 37 (1928) 151–153.–Three new *spp.* in *Bauhinia, Mucuna,* & *Rhynchosia.*

Celebes: Oliver, J. Linn. Soc. Lond. Bot. 15 (1877) 98–99.–New *Phanera.*

Moluccas: Holthuis & Lam, Blumea 5 (1942) 186–196.–Morotai; Talaud.

New Guinea: Bailey, Ann. Rep. Br. New Guinea (1901–1902) App. (1902).
—, Queensl. Agric. J. (1901) 410–411.–New *Cassia.*
—, *ibid.* 24 (1910) 20–21.–*Mucuna var.*
Baker, Brittonia 2 (1937) 318.–New *Desmodium.*
—, J. Arn. Arb. 20 (1939) 329–330.–New *Adenanthera.*
Harms, Bot. Jahrb. 55 (1918) 38–58.–New *spp.*; no key.
—, Notizbl. Berl.-Dahlem 7 (1920) 28–30.–Three new *Mucunas.*
Kostermans, Bull. Bot. Gard. Btzg III, 18 (1950) 443–448.–New *Koompassia* and *Inocarpus.*
Merrill & Perry, J. Arn. Arb. 23 (1942) 391–407.–Brass coll.
—, *ibid.* 29 (1948) 155–157.–Clemens coll.
Pulle, Nova Guinea 8 (1910) 369–387.–Records.
—, *ibid.* 8 (1911) 649–653.–*Ditto.*
Schumann, Bot. Jahrb. 9 (1887) 201–204.–*Ditto.*
Warburg, Bot. Jahrb. 13 (1891) 321–337, 453–454.–*Ditto.*
—, *ibid.* 18 (1893) 193–194.
White, Proc. R. Soc. Queensl. 34 (1922) 32–37.–List.
—, J. Arn. Arb. 8 (1927) 130.–New *Maniltoa.*
—, *ibid.* 10 (1929) 219–224, 273.–List.
—, *ibid.* 31 (1950) 88–89.–Two new *Albizzias.*
— & Francis, Proc. R. Soc. Queensl. 38 (1927) 230–232.–Records and new *Albizzia.*

Genera

Adenanthera: Baker, J. Arn. Arb. 20 (1939) 329–330.–New *sp.*

Afzelia (*Pahudia*); Léonard, Reinwardtia 1 (1950) 61–65.–Reduction of *Pahudia.* List of *spp.*
Metcalf, Lingn. Sc. J. 19 (1940) 257–258.–New record for SE. China of *Pahudia martabanica* Prain.
Meijer Drees, Bull. Jard. Bot. Btzg III, 16 (1938) 96–102.–Key.
—, Tectona 31 (1938) 851–864.
Prain, Ind. For. 29 (1900) 310–312.–Revision of Asiat. *spp.*; key.
—, Sc. Mem. Med. Off. Army India 12 (1901) 1–17.
De Wit, Bull. Bot. Gard. Btzg III, 17 (1941) 139–154.–New revision; key.

Albizzia: Fournier, Ann. Sc. Nat. IV, Bot. 15 (1861) 161–178.–No key.
Von Mueller, J. Bot. 10 (1872) 7–11.–Defin. Austr. *spp.*; relations to allied genera.
Ricker, J. Wash. Acad. Sc. 8 (1918) 242–246.–Key to Chin. & Form. *spp.*; no descr.; collectors numbers enum.
Wu, Bot. Jahrb. 71 (1941) 180–182.–Key to some Chin. *spp.*

Alysicarpus: Sedgwick, J. Ind. Bot. 1 (1919) 14–18.–*A. rugosus* and allies.

Archidendron: de Wit, Bull. Jard. Bot. Btzg III, 17 (1941) 256–272.–Revision; key.
—, Reinwardtia 2 (1952) 69–96.–New revision.
—, Webbia 9 (1954) 458–459.–New *sp.* from New Guinea.

Atylosia (*Cantharospermum*): Sprague, Kew Bull. (1927) 134–135.–Nomencl.

Baphia: Ridley, Kew Bull. (1938) 280.–2nd Mal. *sp.*

Bauhinia: Chen, J. Arn. Arb. 19 (1938) 129–133.–New *spp.* from China.
Gagnepain, C. R. Ass. Fr. 43me sess. Le Hâvre 1914 (1915) 411–426.–Distr. & classif. E. Asiat. & Mal. *spp.*; key; no descr.; coll. numbers.
Korthals, in Temminck, Verh. Nat. Geschied. Bot. (1841) 77–92.–Descr. new *spp.*

Brownea: Pittier, Contr. U. S. Nat. Herb. 18 (1916) 145–157.–Rev. of *spp.* of Panama & Venezuela.

Butea: Anonymous, Kew Bull. (1908) 381.–A new *sp.* with notes on the genus.
Blatter, J. Ind. Bot. Soc. 8 (1929) 133–138.–Revision of the genus. *Non vidi.*
Prain, Kew Bull. (1908) 381–387.–New *sp.* and crit. notes.

Caesalpinia: Dandy & Exell, J. Bot. 76 (1938) 175–180.–Nomencl. of 3 common *spp.*
Fischer, Bot. Gaz. 18 (1893) 121–123.–Reduction of *Hoffmannseggia* and list of North Amer. *spp.*
Petch, Ann. R. Bot. Gard. Perad. 9 (1925) 299–305.–Nomencl.

Canavalia: Chatterjee, J. Ind. Bot. Soc. 28 (1949) 83–95, 5 pl.–Indian *spp.*
Piper, U. S. Dep. Agric. Circ. *no* 110 (1913) 29–36, t. 3.–Data on *C. ensifolia* & *C. gladiata.*
—, Proc. Biol. Soc. Wash. 30 (1917) 174–178.–Notes & descr. of 2 new *spp.*, one from Luzon; *C. turgida* reduced to *C. microcarpa* (DC.) Piper comb. nov.
—, Contr. U. S. Nat. Herb. 20 (1925) 555–588.–Revision Amer. *spp.*; key.
— & Dunn, Kew Bull. (1922) 129–145.–Rev.; key to Old World *spp.*

Cassia: Bentham, Trans. Linn. Soc. 27 (1871) 503–591, t. 60–63.–Revision.
Corner, M. A. H. A. Mag. 5 (1935) 37–50.–Account of Mal. Pen. *spp.*; key.

PETCH, Ann. R. Bot. Gard. Perad. 9 (1924) 229–236.–*C. mimosoides & C. leschenaultiana.*
STEYAERT, Bull. Jard. Bot. Brux. 20 (1950) 233–268.–§ *Chamaecrista*, Asiat. & Afr. *spp.*
DE WIT, Webbia 11 (1954) 197–292.–Rev.; keys.

Cicer: POPOV, Bull. Appl. Bot. of Gen. & Plant-Breed. 21 (1929) 1–240, fig. 1–48.–Apparently revision; in Russ. with Latin descr.; summary. *Non vidi.*

Clianthus (*Sarcodum*): MERRILL, J. Bot. 66 (1928) 264–265.–Gen. nomencl.

Clitoria: BENTHAM, J. Linn. Soc. Lond. Bot. 2 (1858) 33–44.–Synopsis.

Copaifera (*Pseudosindora*): DWYER, Brittonia 7 (1951) 143–172.–Revision Central Amer., West Indian & S. Amer. *spp.*; key.
DE WIT, Webbia 9 (1954) 459–463.–Bornean tree; first record in Malaysia.

Crotalaria: BAKER, J. Linn. Soc. Lond. Bot. 42 (1914) 241–425.–Rev. Afr. *spp.*; key.
GAGNEPAIN, Bull. Soc. Bot. Fr. 61 (1914) 282–289, 310–315.–Division of the genus into 2 groups and enum. of their *spp.*
SANTAPAU, J. Bombay Nat. Hist. Soc. 51 (1953) 960–962.–Key to Deccan *spp.*
SENN, Contr. Gray Herb. *no* 125 (1939) 317–370. –Repr. from Rhodora 41.–N. Amer. *spp.*; key.

Crudia: PRAIN, J. As. Soc. Beng. 73, ii (1904) 199–200.–Born. *sp.*
DE WIT, Bull. Bot. Gard. Btzg III, 18 (1950) 407–434.–Not *incl.* Philippines; revision; key.

Cynometra: HARMS, Notizbl. Berl.-Dahlem 3 (1902) 186–188.–New *spp.* from Philip. & Papua.

Dalbergia: PITTIER, J. Wash. Acad. Sc. 12 (1922) 54.–Mexican & Central Amer. *spp.*; key; descr.; enum. of coll.
PRAIN, J. As. Soc. Beng. 70, ii (1901) 39–65.–List of 74 Asiat. and Mal. *spp.*; no key.
—, Ann. R. Bot. Gard. Calc. 10 (1905) 1–114, t. 1–91.–Revision; key.

Dansera: VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 413–416.–Sumatra.
STEYAERT, Reinwardtia 2 (1953) 351–355.–Reduced to subgenus of *Dialium*; new comb.

Derris: BACKER, Blumea 5 (1945) 513–514.–Key to some Jav. *spp.*
BLAKE, S. F., J. Wash. Acad. Sc. 19 (1929) 472–475.–Distinction of *Deguelia* from *Derris*; transfer of 7 Mal. *spp.* of *Derris* to *Deguelia*.
GAGNEPAIN, Not. Syst. 2 (1913) 341–350.–Asiat. *spp.*; key.
WHITE, Kew Bull. (1929) 309–310.–Queensl. *sp.*

Desmodium *s. l.*: SCHINDLER, Bot. Jahrb. 54 (1916) 51–68.
—, in FEDDE, Rep. 20 (1924) 136–155.–Amer. *spp.* of *Meibomia*, a segregate of *Desmodium.*
—, in FEDDE, Rep. 20 (1924) 266–286.–*Dicerma, Phyllodium, Pteroloma, Hanslia, Dendrolobium, Codariocalyx, Hegnera* and other segregates of *Desmodium.*
—, in FEDDE, Rep. 21 (1925) 1–21.–New *spp.* and comb.
—, in FEDDE, Rep. Beih. 49 (1928) 1–371.–Bibl.; syn.

Dialium: PRAIN, Ind. For. 22 (1896) 460–461.–Vern. names of *spp.*
STEYART, Bull. Soc. R. Bot. Belg. 84 (1951) 29–43.–Subdivisions.
—, Reinwardtia 2 (1953) 351–355.–*Dansera* and *Uittienia* are reduced to subgenera of *Dialium.*
DE WIT, Blumea 7 (1953) 320–321.–Descr. 8 new *spp.* precursory to revision.

Dolichos: CRAIB, Kew Bull. (1914) 76–77.–*D. hosei* from Borneo.
MILNE-REDHEAD, Kew Bull. (1905) 353–354.–*D. falcatus* in Africa.

Dunbaria: WU, Bot. Jahrb. 71 (1941) 182–185.–Key to Chin. *spp.*

Endertia: VAN STEENIS & DE WIT, Bull. Bot. Gard. Btzg III, 17 (1947) 323–327.–Borneo.

Entada: RIDLEY, J. Bot. 58 (1920) 195–196.

Eriosema: STANER & DE CRAENE, Ann. Mus. Congo Belge, Bot., II, 1 (1934) 41–92.–Congo *spp.*; key.

Erythrina: BOERLAGE, Teysmannia 3 (1892) 535–542.–Indonesian *spp.*; no key.
KRUKOFF, Brittonia 3 (1939) 205–337.–American *spp.*.
—, J. Arn. Arb. 20 (1939) 225–233.–Prelim. not. Asiat.-Polyn. *spp.*
MCCLINTOCK, Baileya 1 (1953) 53–58, fig. 38–40.–Key to cult. *spp.*
REIJNVAAN & DOCTERS VAN LEEUWEN, Trop. Natuur 21 (1932) 193–199.

Erythrophloeum: PLANCHON, Ann. Mus. Col. Marseille 15 (1907) 161–304, fig. 1–107.–Deals with many extra-Mal. *spp.*
—, *ibid.* 19 (1911) 303–329, t. 3–4.–Anat. morph. *E. densiflorum.*

Fissicalyx: BENTHAM, Trans. Linn. Soc. 23 (1861) 389.

Flemingia: LI, Amer. J. Bot. 31 (1944) 224–228.–Nomencl.

Fordia: DUNN, Kew Bull. (1911) 62–64.–Revision; key.

Glycine: PIPER, J. Amer. Soc. Agron. 6 (1914) 75–84.–Nomencl.
— & W. J. MORSE, The Soybean. xv + 329, fig. 1–84.–On *G. soja.*

Indigofera: BAKER, J. Bot. 41 (1903) 185–194.–Trop. Afr. *spp.*
BURKART, Darwiniana 4 (1942) 145–178, fig. 1–6.–Argentine *spp.*; revision; key; in Spanish.
GAGNEPAIN, Not. Syst. 3 (1915) 111–123.–General observations on structure of indument; descr. new *spp.* of China and Indo-China.
PRAIN & BAKER, J. Bot. 40 (1902) 60–67, 136–144.–Critical notes on old *spp.*; no key.

Inocarpus: FOSBERG, J. Wash. Acad. Sc. 31 (1941) 93–96.–Nomencl. *sp.*
KOSTERMANS, Bull. Bot. Gard. Btzg III, 18 (1950) 446–448.–New *sp.* New Guinea.

Inga: PITTIER, Contr. U. S. Nat. Herb. 18 (1916) 173–223, t. 81–105.–Revision; descr.; list; no key.

Intsia: MEIJER DREES, Bull. Jard. Bot. Btzg III, 16 (1938) 87–96.–Key.
—, Tectona 31 (1938) 851–864.

De Wit, Bull. Bot. Gard. Btzg III, 17 (1941) 139–154.–Newest revision.

Kalappia: Kostermans, Reinwardtia 1 (1952) 451–456.–New gen. from E. Malaysia.

Kingiodendron: Burtt, Kew Bull. (1936) 460–462. –Melan. *spp.*

De Wit, Bull. Bot. Gard. Btzg III, 18 (1949) 211–212.

Koompassia (*Abauria*): Beccari, Malesia 1 (1877) 169–171.

Kostermans, Bull. Bot. Gard. Btzg III, 18 (1950) 443–446.–New *sp.* from N. Guinea.

Taubert, Ber. Deut. Bot. Ges. 10 (1892) 640–642.

De Wit, Bull. Bot. Gard. Btzg III, 17 (1947) 309–322.–Revision.

Lespedeza: Franchet, Rev. Hort. 62 (1890) 225–227.–W. Chin. *spp.*

Hochreutiner, Rhodora 36 (1934) 390–392.–Nomencl. gen. name.

Ricker, Rhodora 36 (1934) 130–132.–Nomencl. gen. name.

Schindler, in Fedde, Rep. 11 (1912) 338–347. –*Campylotropis* segregated from *Lespedeza.*

—, Bot. Jahrb. 49 (1913) 570–658.–No key.

Lonchocarpus: Pittier, Contr. U. S. Nat. Herb. 20 (1917) 37–93.–Centr. Amer. *spp.*

White, Kew Bull. (1929) 309–310.–Austral. *spp.*

Lupinus: Zhukovsky, Bull. Appl. Bot. Gen. & Plant-Breed. 21, 1 (1928–29) 241–294.–Descr. Old World *spp.* and some New World ones; key; in Russian, Engl. summary.

Maniltoa: Harms, Notizbl. Berl.-Dahlem 3 (1902) 189–191.–Synopsis; new *spp.*

White, J. Arn. Arb. 8 (1927) 130.–New *sp.*

Mastersia: Harms, in Fedde, Rep. 9 (1911) 367–369.–Revision; no key.

Medicago: Urban, Verh. Bot. Ver. Brandenb. 15 (1873) 1–85.–Revision; key.

Melilotus: Schulz, Bot. Jahrb. 29 (1900) 660–735, t. 6–8.–Revision; key.

Mezoneurum: Prain, J. As. Soc. Beng. 61, ii (1892) 130–131.–New *sp.* Andamans.

Millettia: Dunn, Philip. J. Sc. 6 (1911) Bot. 315–317.–New *spp.*

—, J. Linn. Soc. Lond. Bot. 41 (1912) 123–243.–Revision.

Gagnepain, Not. Syst. 2 (1911) 350–367.–New *spp.* Indo-China.

Mimosa: Burkart, Darwiniana 8 (1948) 9–231, fig. 1–31, t. 1–26.–Argentine *spp.*; keys; in Spanish.

Gamble, Kew Bull. (1920) 1–6, fig. 1–7.–Indian *spp.*; key.

Robinson, Proc. Amer. Ac. Arts & Sc. 33 (1898) 305–331.–Revision North American & Mexican *spp.*

Monarthrocarpus (*Desmofischera*): Holthuis, Blumea 5 (1942) 188–192.

Kostermans, Reinwardtia 1 (1952) 456–457.

Merrill, Philip. J. Sc. 5 (1910) Bot. 89.

Mucuna (*Stizolobium*): Burck, Ann. Jard. Bot. Btzg 11 (1893) 183–190.–Revision; no key.

Dyer, Kew Bull. (1931) 464.–*M. gigantea.*

Harms, Notizbl. Berl.-Dahlem 7 (1920) 372–374.–Three new Pap. *spp.*

Piper, Proc. Biol. Soc. Wash. 30 (1917) 51–62.

Myroxylon: Harms, Notizbl. Berl.-Dahlem 5 (1908) 85–98.–Revision; no key.

Neptunia: Robinson, Proc. Amer. Ac. Arts & Sc. 33 (1898) 332–334 (repr. in Contr. Gray Herb. new ser. 13).–Revision Amer. *spp.*

Ormocarpum: Teysmann & Binnendijk, Nat. Tijd. Ned. Ind. 27 (1864) 54–56.–New *spp.*

Ormosia: Jackson, Trans. Linn. Soc. 10 (1811) 360, t. 25.

Merrill & Chen, Sargentia 3 (1943) 77–120.–Chin. & Indo-Chin. *spp.*; key.

Prain, J. As. Soc. Beng. 69, ii (1900) 175–186. –List of Asiat. *spp.*; key.

—, J. As. Soc. Beng. 73, ii (1904) 45–46.–Add. to prec. item.

Padbruggea: Dunn, Kew Bull. (1911) 197–198.–Key.

Pahudia = Afzelia.

Parkia: Burkill, Dict. (1935) 1668–1671.

Chevalier, Bull. Mus. Hist. Nat. Paris (1910) 169–174.–Afr. *spp.*

Phaseolus: Bailey, Gentes Herb. 4 (1940) 336–341. –*Ph. lunatus* and relatives.

Peekelia: Harms, Notizbl. Berl.-Dahlem 7 (1920) 370–371.–Segr. from *Phaseolus*; Papua.

Prosopis: Burkart, Darwiniana 4 (1940) 57–128, fig. 1–15, t. 1–23.–Monogr.; keys; in Span.

Pterocarpus: Prain, Ind. For. 26 (1900) 397–412. –Revision; key.

Airy Shaw, Kew Bull. (1937) 63–64, 477–479.

Pueraria: Bentham, J. Linn. Soc. Lond. Bot. 9 (1867) 121–125.–Revision.

Ohwi, Tokyo Sc. Mus. *no* 18 (1947) 16.–New comb.

Samanea: Merrill, J. Wash. Acad. Sc. 6 (1916) 42–48.–Segr. of *Pithecellobium.*

Saraca (*Leucostegane*): Ridley, Kew Bull. (1929) 257.–New *sp.* Borneo.

Serianthus: Guillaumin, Not. Syst. 2 (1911) 374–376.–New Caled. *spp.*

Kostermans, Reinwardtia 2 (1953) 357–359, fig. 1.–New *sp.*

Sesbania: Sprague & Milne-Redhead, Kew Bull. (1939) 159–162.–Nomencl. of *S. aculeata.*

Sindora: Symington, Kew Bull. (1938) 73–79, t. –Notes on Mal. Pen. *spp.*

De Wit, Bull. Bot. Gard. Btzg III, 18 (1949) 5–82.–Revision; key.

Sophora: Gagnepain, Not. Syst. 3 (1914) 12–21.–Key to Asiat. *spp.*; misc. new *spp.*

Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 421–428.–Revision; key.

Stylosanthes: Taubert, Abh. Bot. Ver. Prov. Brandenb. 32 (1890) 1–34.–Monogr.; keys.

Tephrosia: Backer, Bull. Jard. Bot. Btzg III, 16 (1939) 110.–New name for Salajar *sp.*

Teyleria: Backer, Bull. Jard. Bot. Btzg III, 16 (1939) 107–109.

Uittienia: van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 416–419.–Borneo.

Steyaert, Reinwardtia 2 (1953) 351–355.–Reduced to subgenus of *Dialium*; new comb.

Vandasia (*Kennedya* or *Hardenbergia retusa*): BACKER, Ic. Bog. 3 (1908) 167–169, t. 265.–Papua.
DOMIN, Bibl. Bot. 89 (1926) 220.

Vigna: PIPER, Bull. U. S. Dep. Agric. Bur. Pl. Ind. 229 (1912).

Voandzeia: HARMS, Notizbl. Berl.-Dahlem 5 (1912) 253–258.
STAPF, Kew Bull. (1912) 209–213.

Whitfordiodendron (*Adinobotrys*, *Whitfordia*): BURKILL, Kew Bull. (1935) 319.
DUNN, Kew Bull. (1911) 193–197.–Rev.; key.
—, *ibid.* (1912) 363–364.–Adjustment.
ELMER, Leafl. Philip. Bot. 2 (1910) 689.
MERRILL, Philip. J. Sc. 29 (1926) 373.

LEMNACEAE

HEGELMAIER, F., Die Lemnaceen. Eine monographische Untersuchung. Leipzig (1868) 169 pp.

—, Systematische Übersicht der Lemnaceen (Bot. Jahrb. 21, 1895, 268–305).

KURZ, S., Enumeration of Indian Lemnaceae (J. Linn. Soc. Lond. Bot. 9, 1867, 264–268).

—, J. Bot. 5 (1867) 115–116.–*Ditto* of Austral. *spp.* and additions to latter paper.

LAWALRÉE, A., La position des Lemnaceae et leur classification (Bull. Soc. Bot. Roy. Belg. 77, 1945, 27–38).–Affinity is with *Najadaceae* and not with *Araceae*!

Local

Java: BACKER, Handb. Fl. Java pt 3 (1924) 1–2.–In Dutch; key.

Genera

Wolffia: MIQUEL, Ned. Kruidk. Arch. 3 (1853) 425–429.–New *sp.*

LENTIBULARIACEAE

BARNHART, J. H., Segregation of genera in Lentibulariaceae (Mem. N. Y. Bot. Gard. 6, 1916, 39–64, fig. 1–25).–Key to segregate genera.

BENJAMIN, L., Neue Gattungen und Arten der Utricularien, nebst einer neuen Einteilung der Gattung Utricularia (Linnaea 20, 1847, 299–315). –Synopsis; no keys.

LLOYD, F. E., *Utricularia* (Biol. Rev. 10, 1935, 72–110, fig. 1–35).

—, Notes on *Utricularia*, with special reference to Australia, with descriptions of four new species (Vict. Naturalist 1936, 91–112).

OLIVER, D., The Indian species of *Utricularia* (J. Linn. Soc. Lond. Bot. 3, 1859, 170–190).–Incl. notes on Mal. & Born. *spp.*; no key.

Local

Java: BACKER, Bekn. Fl. Java (em. ed.) 8 (1949) fam. 194.
VAN STEENIS, Arch. f. Hydrobiol. Suppl. 11 (1932) 330–332, fig. 8 (i–v).–Records & details on 5 *spp.*

New Guinea: MELCHIOR, Bot. Jahrb. 62 (1929) 382–385.

LILIACEAE

BAKER, J. G., Revision of the genera and species of Tulipeae (J. Linn. Soc. Bot. 14, 1875, 211–310).

—, Revision of the genera and species of the Asparagaceae (*ibid.* 14, 1875, 508–632).

—, Revision of the genera and species of Anthericeae and Eriospermeae (*ibid.* 15, 1877, 253–363).

—, A synopsis of Colchicaceae and the aberrant tribes of Liliaceae (J. Linn. Soc. Bot. 17, 1879, 405–510).–*Ditto.*

—, A synopsis of Aloineae and Yuccoideae (J. Linn. Soc. Bot. 18, 1880, 148–241).–*Ditto.*

BERGER, A., Liliaceae-Asphodeloideae-Aloineae (Pflanzenreich Heft 33, 1908, 1–347, fig. 1–14).

BROWN, N. E., Notes on the genera Cordyline, Dracaena, Pleomele, Sansevieria & Taetsia (Kew Bull. 1914, 273–279).

CANDOLLE, A. DE, Smilacées (in DC. Mon. Phan. 1, 1878, 1–217).–Contains revisions of *Smilax*, *Heterosmilax*, and *Rhipogonum*.

GAGNEPAIN, F., Les Aspidistrées d'Indochine (Bull. Mus. Hist. Nat. Paris II, 6, 1934, 189–192).

KRAUSE, K., Pflanzenfamilien ed. II, 15a (1930) 227–386.

TRELEASE, W., The Yucceae (Rep. Missouri Bot. Gard. 13, 1902, 27–133, t. 1–99).–Revision; key.

Local

Sumatra: RIDLEY, J. Fed. Mal. St. Mus. 8, 4 (1917) 117–118.–Incl. also some new *Peliosanthes*.

Malay Peninsula: RIDLEY, J. Bot. 34 (1896) 162–168.–*Dracaena* in Mal. Pen.
—, J. Str. Br. R. As. Soc. *no* 31 (1898) 91–98.–Mal. Pen. *Peliosanthes*.
—, Mat. Fl. Mal. Pen. (Monocot.) 2 (1907) 86–108.–Keys.

Java: BACKER, Handb. Fl. Java pt 3 (1924) 45–80.–Important; key; many cultivated species included; in Dutch.

Borneo: MERRILL, Philip. J. Sc. 29 (1926) 355–356. —New *Pleomele*.
RIDLEY, Sarawak Mus. J. 1² (1912) 38.–New *Dracaena*.

Philippines: MERRILL & QUISUMBING, Philip. J. Sc. 82 (1953) 323.–Syn. of a *Peliosanthes*.

New Guinea: HALLIER *f.*, Nova Guinea 8 (1914) 989–1003.
KRAUSE, Bot. Jahrb. 59 (1925) 547–567.
—, Nova Guinea 14 (1927) 173–179.
LAUTERBACH, Bot. Jahrb. 50 (1913) 290–300.

Genera

Aletris: FRANCHET, in MOROT, J. de Bot. 10 (1896) 178–180, 195–203.–Reduces *Metanarthecium*; key to Asiat. *spp.* of *Aletris*.
MASUMUNE, Bull. Soc. Bot. Fr. 84 (1937) 18.–New *sp.* of Sumatra & Borneo.

Allium: BAKER, J. Bot. 12 (1874) 289–295.–Asiat. *spp.*
REGEL, Alliorum adhuc cognitarum monographia. Petersburg (1875) 1–266.
STEARN, Herbertia 11 (1944) 11–34, 45–63, fig. 117–120, t. 255–262.–Distr. & classif. sect. of Old World *spp.*
—, *ibid.* 226–245, fig. 122, t. 263–267.–Synon. and nomencl. of *A. odorum* & *tuberosum;* improved key to allied *spp.*

VVEDENSKY, *ibid.* 65–225.–Key to 225 *spp.* occurring in the URSS, a translation by AIRY SHAW from the Flora URSS 4 (1935) 112–280.

Aloe: REYNOLDS, G. W., The Aloes of South Africa (1950) xxiv + 520 pp., 572 fig., 77 (col.) tab. –Revision with descr. & syn. of 132 S. Afr. *spp.*; keys.

Astelia: SKOTTSBERG, Kungl. Svensk. Vetensk. Handl. III, 14, *no* 2 (1934) 3–106.–Monograph; key.

Chlorophytum: VON POELLNITZ, Ber. Deut. Bot. Ges. 61 (1943) 126–131.—Afr. *spp.*; div. of genus.

Dianella: SCHLITTLER, Mitt. Bot. Mus. Univ. Zürich 163 (1940). Inaug. Diss. 284 pp.–Monograph; keys.

—, Blumea 6 (1948) 200–228.–Rev. of Mal. *spp.*; key.

Disporum: DON, Trans. Linn. Soc. 18 (1841) 513–524.–Monogr.

Dracaena (*Cordyline*): BAKER, J. Bot. 11 (1873) 261–266.–Synopsis of Indian *spp.* of *Dracaena* & *Cordyline*.

ROTHERT, Bull. Dép. Agric. Ind. Néerl. 24 (1909) 1–15.–Anat. diff. between *Dracaena* & *Cordyline*.

Haworthia: VON POELLNITZ, in FEDDE, Rep. 31 (1932) 82–91.

Hemerocallis: BAILEY, Gent. Herb. 2 (1930) 143–156, fig. 80–86.–Key.

Hosta: MAEKAWA, J. Fac. Sc. Imp. Univ. Tokyo sect. iii, Bot. 5 (1940) 317–425.–Monogr.; keys.

Lilium: BAKER, J. R. Hort. Soc. 26 (1901) 335–345.—Add. to ELWES's monogr.

ELWES, A monograph of the genus *Lilium*. London 1880, xv + 84 pp., 49 tab.—Suppl. by GROVE, 58 pp., 16 tab. (1933–1936).

WAUGH, Bot. Gaz. 27 (1899) 235–254, 340–360, fig. 1–14.–Conspectus of the genus; key to *spp.*

WILSON, The lilies of Eastern Asia. London 1925, 124 pp.

WOODCOCK & STEARN, Lilies of the World, their cultivation and classification (1950) 461 pp.–*Non vidi.*

Metanarthecium (*cf. Aletris*): MASUMUNE, Bull. Soc. Bot. Fr. 84 (1937) 18–19.–New *sp.* from the Philippines.

Ophiopogon (*Chloopsis, Mondo*): BAILEY, Gentes Herb. 2 (1929) 3–37.–Nomencl.; *nom. cons.*

FARWELL, Amer. Midl. Nat. 7 (1921) 41–43.–Nomencl.

HASSKARL, Flora 9 (1851) 481–486.

Petrosavia (*Protolirion*): BECCARI, Nuovo Giorn. Bot. Ital. 3 (1871) 7–11, t. 1.–Type descr.

HUTCHINSON, Kew Bull. (1933) 156–157.–Reduction of *Protolirion*.

RIDLEY, Ann. Bot. 9 (1895) 55–57.

VAN STEENIS, Trop. Natuur 23 (1934) 52.–Reduction of *Protolirion*; key.

Pleomele: RIDLEY, J. Bot. 68 (1930) 177–181.–Asiat. *spp.*

Sansevieria: BROWN, Kew Bull. (1915) 185–261.–Monogr.; key!

Tupistra: BAKER, J. Linn. Soc. Bot. 14 (1875) 580–581.

KURZ, J. As. Soc. Beng. 44, ii (1875) 199.–New *sp.* from Tenasserim.

LINACEAE[1]

HALLIER *f.*, H., Beiträge zur Kenntnis der Linaceae (DC. 1819) DUMORT. (Beih. Bot. Centralbl. 39, ii, 1921, 1–178).–A very wide delimitation of the family, not accepted by present workers.

MIQUEL, F. A. W., Revue des Linées, indigènes dans l'Archipel Indien (Ill. Fl. Arch. Ind. 1870, 67–71).–Very incomplete treatment.

PLANCHON, E., Sur la famille des Linées (in HOOK. Lond. J. Bot. 6, 1847, 588–603).

WINKLER, Hub., Pflanzenfamilien ed. 2, 19a (1931) 82–130.

Local

Sumatra: MERRILL, Pap. Mich. Acad. Sc. 23 (1938) 180.

Borneo: RIDLEY, Kew Bull. 1930, 74–75.–*Ixonanthes.*

Philippines: ELMER, Leafl. Philip. Bot. 10 (1939) 3758.

Moluccas: MERRILL, Philip. J. Sc. 11 (1916) Bot. 277.–New *Hugonia* from Ambon.

New Guinea: LAUTERBACH, Bot. Jahrb. 52 (1915) 115–117.

PULLE, Nova Guinea 8 (1910) 391.

WENT Jr, Nova Guinea 14 (1924) 112.

Genera

Ctenolophon: BECCARI, Malesia 1 (1877) 119–120. –Under *Icacinaceae*.

OLIVER, Trans. Linn. Soc. Lond. 28 (1873) 515–516, t. 43.—Under *Olacineae*.

Indorouchera (*Rouchera p. p.*): HALLIER *f.*, Beih. Bot. Centralbl. 39, ii (1916) 50–53.–Census.

Ixonanthes: HALLIER *f.*, Beih. Bot. Centralbl. 39, ii (1916) 6–11.–Census.

Philbornea: HALLIER *f.*, Arch. Néerl. Sc. Exact. Nat. III B, 1 (1912) 104–111.–Also general notes on affinities.

Schuurmansia & **Schuurmansiella**: HALLIER *f.*, Rec. Trav. Bot. Néerl. 10 (1914) 340–351.–Segregates of *Durandea*.

LOASACEAE

GILG, E., Pflanzenfamilien ed. 2, 21 (1925) 522–543.

URBAN, I., Monographia Loasacearum (Nova Act. Acad. Caes. Leop.-Carol. Nat. Cur. 76^1, 1900, liv, 1–370, t. 1–8).

LOBELIACEAE

See Campanulaceae

LOGANIACEAE

(*incl. Buddleiaceae*)

BENTHAM, G., Notes on Loganiaceae (J. Linn. Soc. Bot. 1, 1857, 52–114).–Discussion of & key to the genera; enum. of *spp.* not mentioned in DC. Prod. or those emended; of small genera all *spp.* enumerated but no keys; descr. many new *spp.*

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(1) EXELL & MENDONÇA have segregated *Linaceae* into a number of related families among which *Ixonanthaceae*, *Hugoniaceae* and *Ctenolophonaceae* (Consp. Fl. Angol. 1, 1951, 242–248).

Blume, C. L., Museum Botanicum Lugduno-Batavum 1 (1850) 163–174, 238–240.–Enum.

Cammerloher, H. C., Bull. Jard. Bot. Btzg III, 5 (1923) 294–333.–Unsatisfactory revision of Indonesian *spp.*

Klett, W., Umfang und Inhalt der Loganiaceen (in Mez, Bot. Arch. 5, 1924, 312–338).–Key and treatment of genera.

Local

Sumatra: Merrill, Contr. Arn. Arb. 8 (1934) 137–138.
—, Pap. Mich. Acad. Sc. 23 (1937) 188–189 (1938).–*Cynoctonum*; new *Fagraea.*

Malay Peninsula: Henderson, Gard. Bull. Str. Settl. 7 (1933) 113–115, t. 28.–2 new *Fagraeas.*

Java: Bakhuizen van den Brink Jr, Blumea 6 (1950) 382–383.–Crit. notes.

Borneo: Merrill, J. Str. Br. R. As. Soc. *no* 77 (1917) 231–237.–New *spp.*
—, J. Mal. Br. R. As. Soc. 1 (1923) 27.

Philippines: Elmer, Leafl. Philip. Bot. 2 (1909) 595–601.–Key & descr. *Fagraea.*
—, *ibid.* 3 (1910) 857–860.–Notes; new *Fagraeas.*
Merrill, Philip. J. Sc. 27 (1925) 49.–New *Fagraea.*
—, *ibid.* 37 (1928) 190.–New *Geniostoma.*

New Guinea: Cammerloher, Nova Guinea 14 (1924) 115–118.
Gilg, Bot. Jahrb. 54 (1916) 156–197.
Hiern, Nova Guinea 8 (1909) 201–202.
Kanehira & Hatusima, Bot. Mag. Tokyo 56 (1942) 157–166.–Several new *spp.* in *Buddleia*, *Couthovia*, *Fagraea* and *Geniostoma.*
Merrill & Perry, J. Arn. Arb. 23 (1942) 408–416.
Moore, J. Bot. 66 (1928) 105.–New *Fagraea.*
—, *ibid.* 67 (1929) 49.–New *Fagraea* & *Couthovia.*

Genera

Buddleia: Cammerloher, Bull. Jard. Bot. Btzg III, 5 (1923) 334–335.
Gagnepain, Not. Syst. 2 (1912) 182–194.–Rev. Asiat. *spp.*
Marquand, Kew Bull. (1930) 177–208.–Rev. Old World *spp.*

Couthovia (*Crateriphytum*, *Neuburgia*): Blume, Mus. Bot. 1 (1850) 156–157.
Koorders, Bull. Inst. Bot. Btzg *no* 16 (1902) 6–12.–Diagn. *Crateriphytum.*
—, Abbildung und Beschreibung von *Crateriphytum moluccanum* Scheff. Batavia 1919, pp. 1–8, t. 1 a–b.
Markgraf, Bot. Jahrb. 61 (1927) 222.

Fagraea: Blume, Rumphia 2 (1836) 25–36.–Descr. & fig. some *spp.*
Miquel, Ann. Mus. Lugd.-Bat. 2 (1866) 216–218, t. 5–6.–List.

Geniostoma: Valeton, Bull. Inst. Bot. Btzg *no* 12 (1902) 1–28.

Strychnos: Blume, Rumphia 1 (1835) 66–72, t. 25–26.
Hill, Kew Bull. (1911) 281–302.–Various Asiat. & Philip. *spp.*
—, *ibid.* (1917) 121–210.–Rev. Ind. & Mal. *spp.*; keys; illustr.
—, *ibid.* (1919) 238–239.–*S. nux-vomica* in Cochin-China.

LORANTHACEAE

Danser, B. H., On the taxonomy and the nomenclature of the Loranthaceae of Asia and Australia (Bull. Jard. Bot. Btzg III, 10, 1929, 291–373). –System; generic key; nomenclator and general notes.

—, The Loranthaceae of the Netherlands Indies (*ibid.* 11, 1930, 233–519).–Complete revision of Mal. Loranth. save the Philippines; keys.

—, A new system for the genera of Loranthaceae-Loranthoideae with a nomenclator for the Old World species of this subfamily (Verh. Kon. Akad. Wet. A'dam, afd. Natuurk. 29, 1933, 4–129).

—, Miscellaneous notes on Loranthaceae 1–6 (Rec. Trav. Bot. Néerl. 31, 1934, 223–236).

—, *ditto* 7–8 (*ibid.* 751–760.)

—, *ditto* 9–15 (Blumea 2, 1936 34–59).

—, *ditto* 16–18 (*ibid.* 3, 1938, 34–59).

—, *ditto* 19–24 (*ibid.* 3, 1940, 389–404).

Engler & Krause, Pflanzenfamilien ed. 2, 16b (1935) 98–203.

Korthals, P. W., Aanteekeningen over eenige soorten *Loranthus* (Tijd. Nat. Gesch. & Phys. 3, 1836, 187–202).–Embryol.

—, Verhandeling over de op Java, Sumatra en Borneo verzamelde Loranthaceae (Verh. Bat. Gen. K. & W. 17, 1839, 199–288, pl. 1–2).Repr. p. 1–92.

Local

Indo-China & Siam: Danser, Bull. Jard. Bot. Btzg III, 16 (1938) 1–63; additions *ibid.* (1940) 235–267.–Keys.

Sumatra: Danser, in Merrill, Contr. Arn. Arb. 8 (1934) 53–54.

Malay Peninsula: King, J. As. Soc. Beng. 56, ii (1887) 89–100.–Perak *spp.*; no key.

Java: Danser, Candollea 6 (1936) 457–459.–List.

Borneo: Danser, Rec. Trav. Bot. Néerl. 31 (1934) 237–247.–Sarawak.
—, *ibid.* 31 (1934) 229–235, 751–758.–Mt Kinabalu.
—, Blumea 2 (1936) 39–42; 3 (1938) 36–37.
—, *ibid.* 4 (1941) 259–260.–New *Macrosolen.*

Celebes: Danser, Blumea 2 (1936) 37–39.

Philippines: Danser, Rec. Trav. Bot. Néerl. 30 (1933) 464–481.–On *Thaumasianthes.*
—, Philip. J. Sc. 58 (1935) 1–151.–Complete revision.
—, Blumea 3 (1940) 393–394.–New *Lepidellas.*
Elmer, Leafl. Philip. Bot. 3 (1911) 1067–1075.–Various new *spp.* Mt Apo.
—, *ibid.* 6 (1913) 1959–1971.–New *spp.* Mt Urdaneta.
—, *ibid.* 9 (1934) 3201–3202.–New *sp.*
Merrill, Philip. J. Sc. 3 (1909) Bot. 129–153. –Revision.
—, *ibid.* 30 (1926) 391–392.–New *sp.* from Samar.
—, *ibid.* 29 (1926) 477–478.–New *Ginalloa.*

New Guinea: DANSER, Brittonia 2 (1936) 131–134.
—, Blumea 3 (1938) 37–59; *ibid.* 3 (1940) 394–401.–CARR, BRASS, and CLEMENS coll.
KRAUSE, Nova Guinea 14 (1924) 100–104.
—, Bot. Jahrb. 57 (1922) 464–495.
—, *ibid.* 62 (1929) 474–475.–New *sp.*
LAUTERBACH, Nova Guinea 8 (1910) 289–290.
—, *ibid.* 8 (1912) 815–816.
Solomon Islands: DANSER, J. Arn. Arb. 16 (1935) 206–209.
Melanesia: DANSER, Bull. Jard. Bot. Btzg III, 14 (1936) 73–98.
—, Candollea 6 (1936) 457–459.

Genera

Korthalsella: DANSER, Rec. Trav. Bot. Néerl. 31 (1934) 758–760.
—, Bull. Jard. Bot. Btzg III, 14 (1937) 115–159. –Revision.
—, *ibid.* 16 (1940) 329–342.–Suppl. to revision.
MEKEL, Blumea 1 (1935) 312–319.–Status of *K. dacrydii.*
WASSCHER, Blumea 4 (1941) 320–321.–Distr. of *K. dacrydii.*
Thaumasianthes: DANSER, Rec. Trav. Bot. Néerl. 30 (1933) 464–481.–New gen. Philip.
Viscum: DANSER, Blumea 4 (1941) 261–319.–Rev. Indo-Austr. *spp.*

LOWIACEAE

WINKLER, HUB., Pflanzenfamilien ed. 2, 15a (1930) 541.

Local

Malay Peninsula: HENDERSON, Gard. Bull. Str. Settl. 7 (1933) 125–126.–New *sp.*
RIDLEY, J. Str. Br. Roy. As. Soc. *no* 32 (1899) 183–184.–Enum.
—, Mat. Fl. Mal. Pen. (Monocot.) 2 (1907) 61–62.–Key.

LYTHRACEAE

KOEHNE, E., Lythraceae monographice describuntur (Bot. Jahrb. 1, 1880, 142–178, 240–266, 305–335, 436–458; 2, 1881, 136–176; 3, 1882, 129–155, 319–352, 395–429; 4, 1883, 12–37, 386–431; 5, 1884, 95–132; 6, 1885, 1–48; 7, 1885, 1–61).
—, Pflanzenreich 17 (1903) 1–326.
—, Lythraceae, Nachträge (Bot. Jahrb. 41, 1907, 74–110).–Additional to monogr.; enum.

Local

Java: BACKER, Onkruidfl. Jav. Suiker. (1930) 460–466.–Herbac. genera only.
KOORDERS & VALETON, Bijdr. Booms. Java 1 (1894) 186–205.
Philippines: MERRILL & QUISUMBING, Philip. J. Sc. 82 (1953) 332.–Record of a *Cuphea.*
New Guinea: MANSFELD, Bot. Jahrb. 61 (1927) 23–25.
MERRILL & PERRY, J. Arn. Arb. 22 (1941) 268–269.
PULLE, Nova Guinea 8 (1911) 675.

Genera

Ammannia: BLATTER & HALLBERG, J. Bomb. Nat. Hist. Soc. 25 (1918) 701–722; *ibid.* 26 (1918) 210–217.–Rev. Ind. *spp.*
Rotala: BLATTER & HALLBERG, J. Bomb. Nat. Hist. Soc. 25 (1918) 701–722; *ibid.* 26 (1918) 210–217. –Rev. Ind. *spp.*; keys.

MAGNOLIACEAE

(*excl. Illiciaceae, Schisandraceae, and Winteraceae*)

DANDY, J. E., The genera of Magnolieae (Kew Bull. 1927, 257–264).–Key to genera; descr. of new *spp.* & gen.
—, Three new Magnolieae (J. Bot. 66, 1928, 46–48).
— & GOOD, Pflanzenareale II. Reihe, Heft 5 (1929) Karte 41–43.
GAGNEPAIN, F., Quelques synonymes de Magnoliacées (Bull. Soc. Bot. Fr. 76, 1929, 738–739). –Nomencl. correct.
KING, G., The Magnoliaceae of British India (Ann. R. Bot. Gard. Calc. 3 (2) 1891, 197–226, t. 38–74).
KORTHALS, P. W., Bijdrage tot de kennis der Indische Magnoliaceae (Ned. Kruidk. Arch. 2, 1851, 91–98).–Repr. with other titel & separ. pagin. 1–8.
MIQUEL, F. A. W., Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 68–73.–*Talauma, Michelia, Manglietia.*

Local

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 57.
Malay Peninsula: DANDY, Kew Bull. (1928) 183–193.
Java: BLUME, Flora Javae fasc. 19–20 (1829).
Philippines: WARBURG, in PERKINS, Fragm. Fl. Philip. 3 (1905) 171.–New *Talauma.*
New Guinea: DIELS, Bot. Jahrb. 54 (1917) 239–245.
—, Nova Guinea 14 (1924) 75–79.
KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 57 (1943) 147–153.–*Aromadendron.*
PULLE, Nova Guinea 8 (1912) 633–634.
SCHLECHTER, Bot. Jahrb. 50 (1913) 70–72.
WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 228.

Genera

Bubbia & Drimys. See *Winteraceae.*
Illicium. See *Illiciaceae.*
Kadsura. See *Schisandraceae.*
Magnolia: DANDY, J. R. Hort. Soc. 52 (1927) 260–264.–Key to all *spp.*
Michelia: DANDY, J. Bot. (1929) 222–224.–New *spp.* Indo-China.
Pachylarnax: DANDY, J. Bot. 71 (1933) 312.–2nd *spp.*
Schisandra. See *Schisandraceae.*
Talauma: DANDY, Kew Bull. (1927) 419–420.–Syn. *T. gitingensis.*

MALPIGHIACEAE

JUSSIEU, A. de, Monographie des Malpighiacées (Arch. Mus. Paris 3, 1843, 5–152, 255–616; repr. 1845, 1–368).

Niedenzu, F., Ueber eine neue Eintheilung der Malpighiaceae (Ber. Deut. Bot. Ges. 8, 1890, 190–194).–General.

—, Malpighiaceae palaeotropicae II (Verz. d. Vorles. Akad. Braunsweig 1924, 1–19).

—, Pflanzenreich Heft 91, 93, 94 (1928) 1–870, fig. 1–48.

Local

India: Blatter, E., A proposed revision of the Flora of British India (J. Ind. Bot. Soc. 9, 1930, 140–150).

Indo-China: Arènes, Not. Syst. 11 (1943) 62–80.

Malaysia: Arènes, Reinwardtia 3 (1954) 67–74. –Descr. new *spp.*

Philippines: Merrill, E. D., Philip. J. Sc. 5 (1910) 186–191.–Key Philip. *Hiptages.*

Genera

Aspidopterys: Hutchinson, Kew Bull. (1917) 91–103.–Revision.

Tristellateia: Arènes, Mém. Mus. Hist. Nat. Paris 21 (1947) 275–330.–Monogr.

MALVACEAE

Baker, E. G., Synopsis of genera and species of Malveae (J. Bot. 28, 1890, 15–18, 140–145, 207–213, 239–243, 339–343, 367–371; 29, 1891, 49–53, 164–172, 362–366; 30, 1892, 71–78, 136–142, 235–240, 290–296, 324–332; 31, 1893, 68–76, 212–217, 267–273, 334–338, 361–368).

Bentham, G., Notes on Malvaceae and Sterculiaceae (J. Proc. Linn. Soc. Bot. 6, 1862, 97–107). –Generic distinction.

Edlin, H. L., A critical revision of certain taxonomic groups of the Malvales (New Phytol. 34, 1935, 1–20, 122–143).

Gürke, M., Beiträge zur Systematik der Malvaceen (Bot. Jahrb. 16, 1893, 330–385).

Hochreutiner, B. P. G., Malvaceae novae vel minus cognitae (Ann. Cons. Jard. Bot. Genève 6, 1902, 10–59).–Mixed notes; no keys.

—, Notulae in Malvaceas, *etc.* (Ann. Cons. Jard. Bot. Genève 20, 1917, 107–172).–Mixed notes; no keys.

—, Les relations des Malvacées avec les Sterculiacées (C. R. Soc. Phys. & Hist. Nat. Genève 42, 1925, 112–113).

Howard, R. A., Atkinsia gen. nov., Thespesia, and related West Indian genera of the Malvaceae (Bull. Torr. Bot. Club 76, 1949, 89–100).

Hutchinson, J. B., Notes on the classification and distribution of genera related to Gossypium (New Phytol. 46, 1947, 123–141).–Key to these genera; incl. also *Thespesia*; key to *spp.* of *Cienfugosia.*

Local

Sumatra: Merrill, Contr. Arn. Arb. 8 (1934) 101.

Borneo: Merrill, Sarawak Mus. J. 3 (1928) 528.
Ridley, Kew Bull. (1938) 221.–Few records.
Airy Shaw, in Hook. Ic. Pl. V, 4 (1939) t. 3377. –*Hibiscus borneensis.*

Java: Backer, Schoolfl. Java (1911) 111–130.– In Dutch; keys.
Hasskarl, Flora 25, ii (1842) Beibl. 38–39.
—, Plant. Jav. Rar. (1848) 300–306.
Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 402.–*Hibiscus venustus* Bl.

Lesser Sunda Islands: Warburg & Ulbrich, Notizbl. Berl.-Dahlem 7 (1920) 365.–*Hibiscus sumbawanus.*

New Guinea: Hochreutiner, Nova Guinea 14 (1924) 159–166.
Ulbrich, Notizbl. Berl.-Dahlem 14 (1939) 367–368.–2 new *Hibiscus.*
White, Proc. R. Soc. Queensl. 34 (1922) 43–44.–Listed records.
—, J. Arn. Arb. 10 (1929) 238–239.–Listed records.

Genera

Abelmoschus: Hochreutiner, Candollea 2 (1924) 83–87.–List.

Abutilon: Gagnepain, Not. Syst. 1 (1909) 67–72.– Classif. Asiat. *spp.*
Garcke, Bot. Jahrb. 15 (1893) 480–493.– Notes; no descr.; no keys.

Cephalohibiscus: Ulbrich, Notizbl. Berl.-Dahlem 12 (1935) 494–500, fig. 6.–Melanesia.

Gossypium: Aliotta, Ann. R. Scuola Sup. Agric. Portici 5 (1903) 111 pp.
Hutchinson, New Phytologist 46 (1947) 123–141.–Classif. & distr. of the genus and related genera.
—, Silow & Stephens, The evolution of Gossypium and the differentiation of the cultivated cottons. Oxford Univ. Press. (1947) xi + 160 pp., 10 fig.–Monogr.; keys.
Roberty, Candollea 7 (1938) 297–360; 9 (1942/3) 19–103; 10 (1943–46) 345–398.
Watt, Revision of the genus *Gossypium.* London 1907.
—, Kew Bull. (1926) 193–210.–Descr.; no key.
—, Kew Bull. (1927) 321–356.–*Ditto.*
Zaitsev, Bull. Appl. Bot. Gen. & Plant-Breed. 18 (1927–1928) 1–65.–Contr. classif.

Hibiscus (*Abelmoschus*): Hochreutiner, Ann. Cons. Jard. Bot. Genève 4 (1900) 23–191, 9 fig.
Tien Hsiang Ho, Bot. Bull. Ac. Sin. 1 (1947) 45–52.–Key to Kwantung *spp.*

Malachra: Gürke, Bot. Jahrb. 16 (1892) 345–361. –Monograph, in Latin; key.

Malvastrum: Gray, Bonplandia 5 (1857) 292–298.

Malvaviscus: Schery, Ann. Missouri Bot. Gard. 29 (1942) 183–244.–Revision.

Papuodendron. See *Bombacaceae.*

Pavonia: Ulbrich, Bot. Jahrb. 57 (1920) 54–184. —Stress on Afr. *spp.*

Pseudoabutilon: Fries, Kungl. Vetensk. Handl. Stockholm 43 (1908) *no* 4.

Sida: Gagnepain, Not. Syst. 1 (1909) 27–32.– Asiat. *spp.*
Gandoger, Bull. Soc. Bot. Fr. 71 (1924) 627–633.–Key.

Sidalcea: Eling Roush, Ann. Missouri Bot. Gard. 18 (1931) 117–244.–Monogr.

Sphaeralcea: Kearney, Univ. Calif. Publ. Bot. 19 (1925) 1–128.–N. Am. *spp.*

Thespesia: BAKER, J. Bot. 35 (1897) 50–54.–Revision; partial key.
HUTCHINSON, New Phytologist 46 (1947) 134–138.–Revision; key.

Urena: HOCHREUTINER, Ann. Cons. Jard. Bot. Genève 5 (1901) 131–146.–Key to var. of *U. lobata*.

Wissadula: FRIES, Kungl. Vetensk. Handl. Stockholm 43 (1908) *no* 4, 114 pp., 10 tab.

MARANTACEAE

EICHLER, A. W., Beiträge zur Morphologie und Systematik der Marantaceen (Abh. K. Preuss. Akad. Wiss. Berl. 1883 (1884) 1–99, t. 1–7).

GAGNEPAIN, F., Zingiberacées et Marantacées nouvelles de l'herbier du Muséum (Bull. Soc. Bot. Fr. 50, 1903, 586–590; *ibid.* 51, 1904, 164–182).

LOESENER, TH., Pflanzenfamilien ed. 2, 15a (1930) 654–693.

SCHUMANN, K., Pflanzenreich Heft 11 (1902) 1–184.

Local

Malay Peninsula: RIDLEY, J. Str. Br. Roy. As. Soc. *no* 32 (1899) 175–182.–Enum.
—, Mat. Fl. Mal. Pen. (Monocot.) pt 2 (1907) 55–61.–Keys.

Philippines: PERKINS, Fragm. Fl. Philip. 1 (1904) 68–73.–Revisions; keys.

New Guinea: SCHULZE, Bot. Jahrb. 69 (1938) 265–267.–New *Phryniums*; no key.

Genera

Cominsia: VALETON, Bull. Jard. Bot. Btzg III, 2 (1920) 351–353.–Revision; key.

Donax: ROLFE, J. Bot. 45 (1907) 242–244.–Nomencl.; revision.

Schumannianthes: ROLFE, J. Bot. 45 (1907) 244. Revision.

MARTYNIACEAE

See Pedaliaceae

MELASTOMATACEAE

BAKHUIZEN VAN DEN BRINK Jr, R. C., A contribution to the knowledge of the Melastomataceae occurring in the Malay Archipelago especially in the Netherlands Indies (Rec. Trav. Bot. Néerl. 40, 1943, 1–391).–Partial revision; keys. Preissued reprint.

BLUME, C. L., Over eenige Oostindische, bijzonder Javaansche Melastomaceae (in VAN HALL, *c.s.*, Bijdr. Nat. Wet. 6, 1831, 211–268).–In German in Flora 15, 2 (1831) 465–479, 481–496, 497–512, 513–528.
—, Mus. Bot. Lugd.-Bat. 1 (1849) 5–13, 17–25, 33–41, 49–56; *ibid.* (1851) 353–363.–Enum.

COGNIAUX, in DC. Mon. Phan. 7 (1891) 1–1256. –Now very incomplete monograph.

GUILLAUMIN, A., Contribution à l'étude des Mélastomatacées d'extrême Orient I (Not. Syst. 2, 1913, 301–329); II (Bull. Soc. Bot. Fr. 60, 1913, 86–92); III (*ibid.* 273–276, 337–345, 362–371, 401–406).

KORTHALS, P. W., Bijdrage tot de kennis der Indische Melastomataceae (in TEMMINCK, Verh. Nat. Gesch. Bot. 1844, 218–255).

LI, HUI-LIN, Studies in the Melastomataceae of China (J. Arn. Arb. 25, 1944, 1–42).–Keys.

MIQUEL, F. A. W., Melastomataceae Teysmanno et De Vriese in Celebes et insulis Moluccis collectae (Ann. Mus. Bot. Lugd.-Bat. 1, 1864, 216–217).–Small list.

NAUDIN, C., Melastomacearum quae in Musaeo parisiensi continentur Monographicae descriptionis et secundum affinitates distributionis tentamen (Ann. Sc. Nat. Bot. III, 12, 1849, 196–284; 13, 1849, 25–39, 126–159, 273–303, 347–362; 14, 1850, 53–76, 115–165; 15, 1851, 43–79, 276–345; 16, 1851, 83–246; 17, 1852, 305–382; 18, 1852, 85–154, 257–294).

TRIANA, J., Les Melastomacées (Trans. Linn. Soc. 28, 1871, 1–188).

Local

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 113–116.–Enum.
RIDLEY, J. Mal. Br. R. As. Soc. *no* 87 (1923) 60.
—, Kew Bull. (1925) 81–82.–Bencoolen records.
—, Arch. Hydrobiol. Suppl. 11 (1932) 312–314, fig. 4.–New *Sonerila.*

Malay Peninsula: CORNER, Gard. Bull. Str. Settl. 10 (1939) 299–301.–Key Mal. Pen. *Melastomas.*
HENDERSON, J. Fed. Mal. Stat. Mus. 13 (1927) 219.
—, J. Mal. Br. R. As. Soc. 5 (1927) 247–250.–List; new *Sonerila.*
—, Gard. Bull. Str. Settl. 7 (1933) 103–105.–Misc. records.

Borneo: DIELS & HACKENBERG, Bot. Jahrb. 60 (1926) 312.
MERRILL, Sarawak Mus. J. 3 (1928) 539–541.
RIDLEY, J. Str. Br. Roy. As. Soc. *no* 63 (1912) 59–60.–New *Sonerila.*
SCHWARTZ, Mitt. Inst. Allg. Bot. Hamb. 7 (1931) 237–257.–Many new *spp.*

Celebes: BAKHUIZEN VAN DEN BRINK Jr, Blumea 5 (1945) 582–584.–2 new *Sonerilas.*

Philippines: ELMER, Leafl. Philip. Bot. 4 (1911) 1191–1230.
—, *ibid.* 9 (1934) 3202–3205.–3 new *spp.*
—, *ibid.* 10 (1939) 3649–3672.–Mt Irosin new *spp.*
MERRILL, Philip. J. Sc. 8 (1913) Bot. 207–250, 335–360.–Revision Philip. *spp.* and *gen.*; keys.
—, *ibid.* 12 (1917) Bot. 337–360.–List new *spp.*
— & QUISUMBING, *ibid.* 37 (1928) 177–185.–New *spp.*; *Eisocreochiton n.g.*

Moluccas: HOLTHUIS & LAM, Blumea 5 (1942) 219–221.–List Talaud & Morotai.
MERRILL, Philip. J. Sc. 11 (1916) Bot. 298–299. –Some Ambon records; one new *Dissochaeta.*

New Guinea: MANSFELD, Nova Guinea 14 (1927) 199–207.
—, Bot. Jahrb. 60 (1925) 105–143.–Rev.; keys.
MARKGRAF, Brittonia 2 (1936) 141–144.–Some new *spp.*
MERRILL & PERRY, J. Arn. Arb. 24 (1943) 422–439.

MUELLER, in WING's South. Sc. Rec. N. S. 2 (1886) 8–9.–New *Medinilla*.
OHWI, Bot. Mag. Tokyo 57 (1943) 1–20.–List KANEHIRA coll.; many new *spp*.

Genera

Astronidium (*Naudiniella*): MARKGRAF, Notizbl. Berl.-Dahlem 12 (1934) 47–50.
Blastus: SPARE, Kew Bull. (1929) 317–319.–Rev.; key.
Creochiton: WAGNER, Sitz. Ber. Kais. Akad. Wiss. Wien Math. Naturw. Kl. 115 (1907) 411–427.–Morphol.
Enaulophyton: VAN STEENIS, Bull. Jard. Bot. Btzg III, 12 (1932) 194–198.–Monotypic; Natuna Isl.
Krassera: SCHWARTZ, Mitt. Inst. Allg. Bot. Hamburg 7 (1931) 247–250.–Borneo.
Melastoma: GUILLAUMIN, Not. Syst. 2 (1913) 311–323.–Key.
Memecylon: BENTHAM, J. Linn. Soc. Bot. 5 (1861) 77–78.–CUMING's coll.
Osbeckia: GAMBLE, J. Ind. Bot. Soc. 1 (1919) 60–61.–3 new Ind. *spp*.
GUILLAUMIN, Not. Syst. 2 (1913) 305–311.–Key.
Phaulanthus: RIDLEY, J. Str. Br. R. As. Soc. *no* 57 (1910) 41–44.–6 *spp*.
Plethiandra: BURKILL, J. Str. Br. R. As. Soc. *no* 77 (1917) 265–269.–Sarawak.
Pternandra (*Kibessia*): BURKILL, Kew Bull. (1935) 319.–*Kibessia* reduced to *Pternandra*.
Sonerila: STAPF, Ann. Bot. 6 (1892) 291–323.–Revision.
Triuranthera: BACKER, Bull. Jard. Bot. Btzg III, 2 (1920) 319–320.–Borneo, Java, monotypic.

MELIACEAE

CANDOLLE, C. DE, in DC. Mon. Phan. 1 (1878) 399–752, t. 6–9.–World monograph.
HARMS, H., Zur Kenntnis einiger Malayischen Meliaceen (Notizbl. Berl.-Dahlem 15, 1941, 472–478).–Listed new *spp*. and records.
—, in Pflanzenfamilien ed. 2, 19b1 (1940) 1–172.
MIQUEL, F. A. W., Monographia Meliacearum Archipelagi Indici (Ann. Mus. Lugd.-Bat. 4, 1868, 1–64).
PELLEGRIN, F., Sur les genres Aglaia, Amoora et Lansium (Not. Syst. 1, 1909–1911, 284–290).–Disc. gen. distinction.

Local

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 81–84.–List.
Malay Peninsula: HENDERSON, Gard. Bull. Str. Settl. 7 (1933) 90–95, t. 17.–3 new *spp*.
Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 76 (1917) 87–89.–2 new *Aglaias*.
—, J. Str. Br. R. As. Soc. *no* 86 (1922) 315–318.–New *spp*.
RIDLEY, Kew Bull. (1930) 364–372.–New *spp*.
SCHWARTZ, Mitt. Inst. Allg. Bot. Hamb. 7 (1931) 235–236.
AIRY SHAW, Kew Bull. (1940) 254–258.–Many new records.
Java: ADELBERT, Blumea 6 (1948) 313–322.
CANDOLLE, C. DE, Ann. Cons. Jard. Bot. Genève 15–16 (1911–1913) 245–247.–List coll. HOCHREUTINER.
KOORDERS & VALETON, Ic. Bog. 1 (1897–1901); 2 (1903–1906).–Several *spp*. fig.
Lesser Sunda Islands (& Celebes): DE CANDOLLE, Med. Rijksherb. Leiden *no* 22 (1914) 7–10.–New records.
Celebes: KOORDERS, Suppl. vol. 1 Flora N.O. Celebes 1 (1918) 23–27.
—, Suppl. vol. 2 *ditto* 2 (1922) t. 34–44.
—, Suppl. vol. 3 *ditto* 3 (1922) 19–24.
Moluccas: MERRILL, Philip. J. Sc. 11 (1916) Bot. 278–280.–Records; new *Dysoxylum*.
Philippines: ELMER, Leafl. Philip. Bot. 9 (1934) 3205–3206.–A new *Aphanamixis*.
—, *ibid*. 9 (1937) 3273–3395.–New *spp*. & records.
MERRILL, Philip. J. Sc. 9 (1914) Bot. 531–541.–New *spp*.
—, *ibid*. 26 (1925) 459–462.–New *spp*.
PERKINS, Notizbl. Berl.-Dahlem 4 (1903) 78–79.–2 new *spp*.
—, Fragm. Fl. Philip. (1904) 30–35.–List new rec. & *spp*.
QUISUMBING & MERRILL, Philip. J. Sc. 37 (1928) 156–158.–2 new *spp*.
New Guinea: DE CANDOLLE, Bull. Herb. Boiss. II, 3 (1902) 161–180.–List; also *spp*. of New Caledonia & Samoa.
—, Nova Guinea 8 (1910) 423–426.
—, *ibid*. 8 (1914) 1011–1017.
HARMS, Bot. Jahrb. 72 (1942) 158–205.–Many new *spp*.; no keys.
KURATA, Bull. Tokyo Univ. For. *no* 35 (1947) art. 6, 198–199.–New *Vavaea*.
MERRILL & PERRY, J. Arn. Arb. 21 (1940) 296–327.
—, *ibid*. 22 (1941) 256–258.
—, *ibid*. 29 (1948) 157.
WHITE, Proc. R. Soc. Queensl. 34 (1922) 38–39.–Small list of records.
—, *ibid*. 38 (1927) 234–237.–Some new *spp*.
Polynesia: SMITH, A. C., Contr. U.S. Nat. Herb. 30 (1952) 469–522.–Rev. of *Xylocarpus*, *Vavaea*, *Aglaia*, and *Dysoxylum*.

Genera

Aglaia (*Oncostemma*): AIRY SHAW, Kew Bull. (1949) 166.–Some crit. notes.
Amoora: HAINES, Kew Bull. (1920) 238–242.–Crit. note *A. spectabilis*.
Cedrela = Toona.
Chisocheton (*Clemensia*): AIRY SHAW, in HOOK. Ic. Pl. (1937) t. 3333.–Descr. new *sp*. in § *Clemensia*.
Chukrassia (*Chickrassia*): LIVERA, Ann. R. Bot. Gard. Perad. 9 (1925) 307–308.–Revision; key!
Dysoxylum (*Piptosaccos*): FEDTSCHENKO, Svensk Bot. Tidskr. 19 (1924) 490–493.–Crit. note syn.
Flindersia. See *Rutaceae*.
Heynea (*Ailanthopsis*): GAGNEPAIN, Not. Syst. 13 (1947) 62–63.

Munronia: HARMS, Ber. Deut. Bot. Ges. 35 (1917) 74–82.

Pseudocarapa: MERRILL & PERRY, J. Arn. Arb. 21 (1940) 315–316.

Reinwardtiodendron: PERKINS, Fragm. Fl. Philip. 1 (1904) 74–76.

Sandoricum: MERRILL, J. Bot. 61 (1923) 172–174, 200.–*S. koetjape.*

Swietenia: BLAKE, J. Wash. Acad. Sc. 10 (1920) 286–297.

ROLFE, Kew Bull. (1919) 201–207.–Crit. notes.

Toona (*Cedrela*): BURKILL, Gard. Bull. Str. Settl. 5 (1930) 120–122.–Mal. Pen. list.

DE CANDOLLE, Rec. Bot. Surv. Ind. 3 (1908) 357–376.–Rev. Indo-Mal. *spp.*

HUI LIN LI, Trop. Woods 79 (1944) 16–24.–Chin. *spp.*

SYMINGTON, Mal. For. 4 (1935) 119–126.–Mal. Pen. *spp.*

Vavaea (*Lamiofrutex*): BURTT, Kew Bull. (1935) 303–304.–Crit. notes.

VAN STEENIS, Bull. Bot. Gard. Btzg III, 18 (1950) 457.–Geogr. distr.

—, Act. Bot. Neerl. 1 (1952) 93–94.–Reduction *Lamiofrutex.*

Walsura (*Napaeodendron*): PELLEGRIN, Not. Syst. 1 (1909–1911) 227–229.–New *spp.* Tonkin.

SYMINGTON, Kew Bull. (1937) 319.

Xylocarpus: PARKINSON, Ind. For. 60 (1934) 136–143, t. 15–17.–Indian *spp.*

RIDLEY, Kew Bull. (1938) 288–292.

MENISPERMACEAE

BECCARI, O, Malesia 1 (1877) 135–165.

DIELS, L., Pflanzenreich Heft 46 (1910) 1–345, fig. 1–93.

MIERS, J., A few remarks on the Menispermaceae (Ann. Mag. Nat. Hist. II, 7, 1851, 33–45).–Concise revision; annnotated generic list; no descr. or keys to *spp.*

—, On the Menispermaceae (Ann. Mag. Nat. Hist. III, 13, 1864, 1–15, 122–135, 315–323, 486–491; 14, 1865, 97–103, 252–261, 363–374).

—, A complete monograph of the Menispermaceae (Contr. Bot. 3, 1864–71, 1–402, pl. 88–154).

MIQUEL, F. A. W., Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 80–88.

Local

Riu Kiu: YAMAMOTO, Trans. Nat. Hist. Soc. Formosa 29 (1939) 195–200.

Java: BACKER, Schoolfl. Java (1911) 37–47.

Philippines: DIELS in ELMER, Leafl. Philip. Bot. 4 (1911) 1161–1167.–Synopsis of Philip. *spp.*

—, Philip. J. Sc. 8 (1913) Bot. 157–158.–3 new *spp.*

ELMER, Leafl. Philip. Bot. 10 (1939) 3760–3762. –New *Tinospora.*

New Guinea: DIELS, Nova Guinea 8 (1910) 283; 8 (1912) 869; 14 (1924) 80.

—, Bot. Jahrb. 52 (1914) 187–190.

KANEHIRA & HATUSIMA, Tokyo Bot. Mag. 56 (1942) 471–474.

Genera

Juppia = Zanonia (*Cucurbitaceae*).

Peripetasma = Dioscorea (*Dioscoreaceae*).

Stephania: YAMAMOTO, Trans. Nat. Hist. Soc. Formosa 26 (1936) 239–243.–Japan. & Formosan *spp.*

MIMOSACEAE

See Leguminosae

MOLLUGINACEAE

See Aizoaceae

MONIMIACEAE

BECCARI, O., Malesia 1 (1877) 186–193.

MONEY, L. M., I. W. BAILEY & B. G. L. SWAMY, The morphology and relationships of the Monimiaceae (J. Arn. Arb. 31, 1950, 372–404).

PERKINS, J., Pflanzenreich, Nachtr. Heft 49 (1911) 1–67.

—, Einige neue Asiatische Monimiaceae (Bot. Jahrb. 45, 1911, 422–425).

—, Uebersicht über die Gattungen der Monimiaceae sowie Zusammenstellung der Abbildungen und der Literatur über die Arten dieser Familie bis zum Jahre 1925. Engelmann (Leipzig), 1925, 55 pp., 47 fig.

— (& GILG, E.), Pflanzenreich Heft 4 (1901) 1–122.

Local

New Guinea: GILG & SCHLECHTER, Bot. Jahrb. 55 (1918) 195–201.

—, *ibid.* 58 (1923) 244–248.

KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 56 (1942) 249–262.

PERKINS, Nova Guinea 8 (1912) 867–868.

—, Bot. Jahrb. 52 (1912) 191–218.

SMITH, J. Arn. Arb. 22 (1941) 231–252.–No key.

Queensland: FRANCIS, Kew Bull. (1931) 457–458.

Genera

Levieria (*Dryadodaphne, Isomerocarpa*): KOSTERMANS, Rec. Trav. Bot. Néerl. 34 (1937) 605.

MOORE, J. Bot. 61 (1923) Suppl. 109.–Descr. *Dryadodaphne* in *Laur.*

SMITH, A. C., J. Arn. Arb. 23 (1942) 442–443.–S. maintains that *Dryadodaphne* is different from *Levieria.*

MONOTROPACEAE

See Ericaceae

MORACEAE

For Ficus see below

MIQUEL, F. A. W., Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 210–214.

RENNER, O., Beiträge zur Anatomie und Systematik der Artocarpeen und Conocephaleen, insbesondere der Gattung Ficus (Bot. Jahrb. 39, 1907, 319–448).

TRÉCUL, A., Mémoire sur la famille des Artocarpées (Ann. Sc. Nat. Bot. III, 8, 1847, 38–157, t. 1–6).

Local

Borneo: Merrill, Plant. Elm. Born. (1929) 45–50. –List.

Philippines: Merrill, Philip. J. Sc. 19 (1921) 49–69.–New *spp.*
Warburg, in Perkins, Fragm. Fl. Philip. (1905) 165–167.

New Guinea: Diels, Bot. Jahrb. 67 (1935) 171–177.
White, Proc. R. Soc. Queensl. 34 (1922) 23.–List.

Genera

Antiaris: Blume, Rumphia 1 (1836) 46–59, 171–173.
Merrill, Philip. J. Sc. 2 (1907) Bot. 111–112.

Artocarpus: Beccari, Nelle For. Borneo (1902) 625–636.–Born. & Pap. *spp.*
Corner, Gard. Bull. Str. Settl. 10 (1939) 56–81.
Elmer, Leafl. Philip. Bot. 2 (1909) 609–626.–Synopsis & key to Philip. *spp.*
Fosberg, J. Wash. Acad. Sc. 31 (1941) 93.–Nomencl.
King, Ann. R. Bot. Gard. Calc. 2 (1889) 1–16, t. 1–14.–Revision Ind. *spp.*
Quisumbing, Philip. J. Sc. 72 (1940) 331–335.–*A. camansi* Blanco.

Morus: Hotto, Jap. J. Bot. 52 (1938) 363–368.–Syst. cult. Jap. *Morus.*
Nakai, J. Arn. Arb. 8 (1927) 234–238.

Parartocarpus: Smith, Bull. Jard. Bot. Btzg III, 4 (1932) 233–234; *ibid.* 6 (1924) 80.

Paratrophis: van Steenis, J. Bot. 72 (1934) 89.–Syn. *P. glabra.*

Poikilospermum (*Conocephalus*): Merrill, Contr. Arn. Arb. 8 (1934) 47–52.–Complete list.
Miquel, Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 203.–Type descr.
Petrucci, Nuovo Giorn. Bot. Ital. n.s. 9 (1902) 213–230.–Revision.

Taxotrophis: Hutchinson, Kew Bull. (1918) 147–152.–Revision; key!

Ficus

Barrett, M. F., Bull. Torr. Bot. Club 73 (1946) 321–325.–Misc. notes.

—, *ibid.* 76 (1949) 53–64.–Syn. *F. retusa.*

Corner, E. J. H., A revision of the Malayan species of Ficus: § Covellia and § Neomorphe (J. Mal. Br. R. As. Soc. 11, 1933, 1–65).

—, A revision of Ficus, subg. Synoecia (Gard. Bull. Str. Settl. 10, 1939, 82–161).

Diels, L., Ueber ungewöhnliche Abwandlungen des Ficus-Rezeptaculums (Flora 28, 1933, 28–33).–*Dammaropsis* reduced to *Ficus.*

King, G., Observations on the genus Ficus with special reference to the Indo-Malayan and Chinese species (J. Linn. Soc. Bot. 24, 1887, 27–44).

—, The species of Ficus of the Indo-Malayan and Chinese countries (Ann. R. Bot. Gard. Calc. 1, 1, 1887, xiii, 1–66; *ibid.* 1, 2, 1888, 67–185).–Almost a revision.

Miquel, F. A. W., Prodromus monographiae Ficuum (Hook. Lond. J. Bot. 6, 1847, 514–588; *ibid.* 7, 1848, 64–78, 109–116, 221–236, 425–442, 451–471).

—, Annotationes de Ficus speciebus (Ann. Mus. Lugd.-Bat. 3, 1867, 214–235, 260–300).–No keys.

Sata, N., A monographic study of the genus Ficus from the point of view of economic botany (Contr. Inst. Hort. & Econ. Bot., Fac. of Agric. Taihoku Imp. Univ. *no* 32, 1944, 289 pp.).–*Non vidi.*

Local

Sumatra: King, J. As. Soc. Bengal 56, ii (1888) 65–67.–Forbes coll.

Java: Backer, Blumea 6 (1948) 302–309.–Critical list.

Borneo: Merrill, J. Str. Br. R. As. Soc. *no* 76 (1917) 80–81.

Celebes: Teysmann & de Vriese, Nat. Tijd. Ned. Ind. 23 (1861) 212–214.–*Bosscheria n.g.* (= *Ficus*).

Philippines: Elmer, Leafl. Philip. Bot. 1 (1906) 187–205.–Misc. *spp.* from Leyte.
—, *ibid.* 1 (1906) 42–62.–Misc. *spp.* from Benguet.
—, *ibid.* 1 (1907) 236–261.–Misc. *spp.* from Tayabas.
—, *ibid.* 2 (1908) 531–551.–Misc. *spp.* from S. Negros.
—, *ibid.* 4 (1911) 1232–1270.–Misc. *spp.* from Davao.
—, *ibid.* 4 (1911) 1307–1325.–Misc. *spp.* from Sibuyan.
—, *ibid.* 4 (1912) 1363–1397.–Misc. *spp.* from Palawan.
—, *ibid.* 7 (1914) 2359–2415.–Misc. *spp.* from N. Agusan.
—, *ibid.* 9 (1937) 3397–3487.–Misc. *spp.* from Sorsogon.
Quisumbing, Philip. J. Sc. 41 (1930) 316–317.–3 *spp.*
Warburg, in Perkins, Fragm. Fl. Philip. (1905) 194–202.–New *spp.*

Moluccas: Merrill, Philip. J. Sc. 11 (1916) Bot. 264–265.–2 new *spp.* from Ambon.

New Guinea: Diels, Bot. Jahrb. 67 (1935) 177–235.–Keys.
King, J. As. Soc. Beng. 55, ii (1886) 394–411.–Forbes, Beccari, d'Albertis coll.
—, Ann. R. Bot. Gard. Calc. I, App. 1 (1888) 1–9.
—, J. As. Soc. Beng. 56, ii (1888) 61–65.–Beccari & d'Albertis coll.
Rechinger, in Fedde, Rep. 11 (1912) 179–181.–Some new *spp.*, partly from the Solomon Isl.
Summerhayes, J. Arn. Arb. 10 (1929) 142–154, 206–209.–Brass coll.
—, *ibid.* 14 (1933) 62.–Some corrig.
—, *ibid.* 22 (1941) 81–109.–List Brass coll.

Solomon Islands: Rechinger, in Fedde, Rep. 11 (1912) 179–181.–New *spp.*

Micronesia: Diels, Bot. Jahrb. 69 (1938) 398–400. –Key.

MORINGACEAE

Pax, F., Pflanzenfamilien ed. 2, 17b (1936) 693–698.

Steenis, C. G. G. J. van, Fl. Mal. I, 4 (1949) 45–46, 1 fig.

MUSACEAE

(*excl. Lowiaceae*)

Baker, J. G., A synopsis of the genera and species of Musaceae (Ann. Bot. 7, 1893, 189–222).

Loesener, Th., Ueber Musaceen, im besonderen über Heliconia (Verh. Bot. Ver. Prov. Brandenb. 57, 1915–1916, 211–214).

Schumann, K., Pflanzenreich Heft 1 (1900) 1–45, fig. 1–10.

Winkler, Hub., Pflanzenfamilien ed. 2, 15a (1930) 505–541, fig. 224–235.

—, Pflanzenareale 1. Reihe, Heft 2 (1926) maps 11–12.

Local

Sumatra: Ridley, Kew Bull. (1926) 90.–Descr. *Musa sumatrana.*

Malay Peninsula: Ridley, J. Str. Br. Roy. As. Soc. *no* 32 (1899) 182–183.–Enum.
—, Mat. Fl. Mal. Pen. (Monocot.) pt 2 (1907) 62–64.–Key.

Java: Backer, Handb. Fl. Java 3 (1924) 130–141.

Philippines: Quisumbing, Philip. Agric. Rev. 12 (1919) 1–90.
Teodoro, Philip. J. Sc. 10 (1915) Bot. 379–421.

New Guinea: Lauterbach, Bot. Jahrb. 50 (1913) 306–307.
Mueller, Vict. Nat. 13 (1896) 53–55.

Genera

Heliconia: Backer, Bull. Jard. Bot. Btzg III, 2 (1920) 315–319.–Key *H. indica* & *bihai.*

Lowia. See *Lowiaceae.*

Musa: Baker, Kew Bull. (1894) 229–314.–Repr. as Kew Bull. Addit. Ser. *no* 6 (1906) 1–88, 9 fig.
Cheesman, Kew Bull. 1947 (1948) 97–117; *ibid.* (1948) 11–28, 145–157; *ibid.* (1949) 24–28, 133–137, 445–452; *ibid.* (1950) 27–31, 151–155. –Critical descr. & notes.
MacDaniels, Bern. P. Bish. Mus. Bull. 190 (1947) 56 pp.–*Fe'Banana* in connection with migrations in Polynesia.
Quisumbing, Philip. Agric. Rev. 12 (1919) 1–90. –Cult. var.
Rant, Nat. Tijd. Ned. Ind. 94 (1934) 103–111.– *M. troglodytarum* from Moluccas.
Simmonds, Kew Bull (1953) 571–574 (1954).– Descr. 2 new *spp.*, one from New Guinea, one from the Solomon Islands.

Ravenala: Winkler, Pflanzenfamilien ed. 2, 15a (1930) 532–533.–Key.

MYOPORACEAE

Bloembergen, S., The genus Myoporum in the Netherlands Indies (Blumea 3, 1938, 179–182).

—, Fl. Mal. I, 4 (1951) 265–266, fig. 1.

Kraenzlin, F., Beiträge zur Kenntnis der Familie der Myoporinae R.Br. (in Fedde, Rep., Beihefte 54, 1929, 129 pp.).–Revision; keys.

Local

New Guinea: Kraenzlin, in Fedde, Rep. 22 (1926) 338.

MYRICACEAE

Backer, C. A., Fl. Mal. I, 4 (1951) 276–279, fig. 1.

Chevalier, A., Monographie des Myricacées (1901–1902) 1–257 (Repr. from Mém. Soc. Nat. Sc. Math. & Nat. Cherbourg 32, 1901, 85–340).

Vloten-van den Berg, O. van & Vloten, H. van, in Kirchner, Loew & Schroeter, Lebensgeschichte der Blütenpflanzen Mitteleuropas 2, 1 (1928) 559–599.

Local

New Guinea: Markgraf, Bot. Jahrb. 59 (1925) 540.

MYRISTICACEAE

Blume, C. L., Rumphia 1 (1836) 174–191.–List.

Warburg, O., Zur Charakterisierung und Gliederung der Myristicaceen (Ber. Deut. Bot. Ges. 13, 1895, 82–95).

—, Monographie der Myristicaceen (Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 68, 1897, 1–680, t. 1–25).

Local

Malay Peninsula: Henderson, Gard. Bull. Str. Settl. 7 (1933) 120, t. 30.–New *Horsfieldia.*
Airy Shaw, Kew Bull. (1948) 251–252.–New *Myristica.*

Borneo: Diels & Hackenberg, Bot. Jahrb. 60 (1926) 308.–New *Myristica.*
Airy Shaw, Kew Bull. (1939) 439–445.–List Sarawak Exp.

Philippines: Elmer, Leafl. Philip. Bot. 3 (1911) 1057–1066.–New *spp.*
—, *ibid.* 10 (1939) 3763–3764.–New *Horsfieldia.*
Merrill, Philip. J. Sc. 30 (1926) 394–395.– New Sulu *Knema.*
Quisumbing & Merrill, Philip. J. Sc. 37 (1928) 144–145.–New Palawan *Knema.*
Warburg, in Perkins, Fragm. Fl. Philip. (1904) 49–50.–New records.

New Guinea: Markgraf, Bot. Jahrb. 67 (1935) 143–170.–Keys.
—, J. Arn. Arb. 10 (1929) 77.–New var. of *Myr. fatua.*
Pulle, Nova Guinea 8 (1911) 635–637.
Smith, J. Arn. Arb. 22 (1941) 60–80.–New *spp.*

Micronesia: Kanehira, J. Dep. Agr. Kyushu Imp. Univ. 4 (1935) 319–320.–List.
Markgraf, Bot. Jahrb. 69 (1938) 395–397.– Keys.

Genera

Myristica: King, Ann. R. Bot. Gard. Calc. 3 (1891) 275–331, t. 106–174.–Rev. Ind. *spp.*
Miquel, Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 205–207.–List.
–, *ibid.* 2 (1865) 46–51.–Completed list.
Smith, Bull. Torr. Bot. Club 68 (1941) 397–406. –Rev. Pac. *sp.*; key.

MYRSINACEAE

BLUME, C. L., Aegicereae (in HOEVEN & DE VRIESE, Tijd. Nat. Geschied. & Phys. 1, 1834, 147–153).–Census; descr. listed; in Latin.

CANDOLLE, A. DE, Review of the Natural Order Myrsineae (Trans. Linn. Soc. 17, 1834, 95–138).–No keys.

GROSZE, A., Anatomisch-systematische Untersuchungen der Myrsinaceen (Bot. Jahrb. 41, 1907, Beibl. 96, 1–46, fig. 1–31).–Types of indument, epidermis, *etc.*

MEZ, C., Pflanzenreich Heft 9 (1901) 1–437, fig. 1–61.–See for additions under New Guinea.

NAKAI, T., Nova Flora Japonica: 'Ardisiaceae'. Tokyo & Osaka (1943) 1–170, fig. 1–42.–In Latin and Japanese. Nomenclature deviates widely from the usual one.

SCHEFFER, R. H. C. C., De Myrsinaceis Archipelagi Indici. Thesis, Utrecht (1867) 1–113, 1 tab. –In Latin; keys, descr.

—, Nat. Tijd. Ned. Ind. 31 (1870) 363–375.—List of records; some new *spp.*

—, *ibid.* 32 (1871) 419–426.

Local

East Asia: WALKER, Philip. J. Sc. 73 (1940) 1–258. –Revision; keys.

—, J. Arn. Arb. 23 (1942) 344–355, 2 fig.–Additions.

Siam: FLETCHER, Not. R. Bot. Gard. Edinb. 20 (1948) 106–120.–Concise revision; keys; no references. For descr. *cf.* Kew Bull. (1936) 42–47; *ibid.* (1937) 26–40 and enum. in Fl. Siam. En. 2 (1938) 325–352.

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 129–134.–Important list.

—, Pap. Mich. Acad. Sc. 19 (1934) 184–186. –*Embelia*, *Maesa n. sp.*

RIDLEY, Kew Bull. (1926) 71–72.–2 new *Ardisias*.

Borneo: MERRILL, Philip. J. Sc. 30 (1926) 85.–New *Ardisia.*

—, Sarawak Mus. J. 3 (1928) 543–545.–2 new *Ardisias.*

—, Pl. Elm. Born. (1929) 234–237.–3 new *Ardisias* listed & records.

PHILIPSON, J. Bot. 77 (1939) 101–106.–Important list.

RIDLEY, Kew Bull. (1934) 120.–New *sp.*

AIRY SHAW, Kew Bull. (1939) 411–417 (*sphalm.* 511–517).–List RICHARDS coll.

Philippines: ELMER, Leafl. Philip. Bot. 2 (1908) 439–444.–New *spp.*

—, *ibid.* 2 (1910) 659–675.–*Ditto.*

—, *ibid.* 10 (1939) 3764–3766.–*Ditto.*

MERRILL, Philip. J. Sc. 5 (1910) Bot. 212–223.–New *spp.*

—, *ibid.* 12 (1917) Bot. 143–158.–New *spp.* of *Ardisia*, *Discocalyx*, and *Maesa.*

—, *ibid.* 26 (1925) 484–485.–*Ardisia* New *sp.*

—, *ibid.* 27 (1925) 45–46.–*Embelia n. sp.*

—, *ibid.* 30 (1928) 420–421.–New *Discocalyx.*

—, *ibid.* 41 (1930) 341–342.–New *Maesa.*

MEZ, Philip. J. Sc. 1 Suppl. (1906) 271–276.

—, in FEDDE, Rep. 3 (1906) 97–104.–1 new *Maesa*, 4 *Ardisias*, 1 *Amblyanthopsis*, 1 *Discocalyx.*

—, *ibid.* 16 (1920) 309–312, 410–425.–3 new *Maesa*, 13 *Ardisias*, 3 *Discocalyx*, 2 *Jubilarias*, 2 *Embelias*, 1 *Rapanea.*

QUISUMBING, Philip. J. Sc. 41 (1930) 341–343.–*Maesa n. sp.*

—, *ibid.* 76 (1944) 52–53.–*Loheria n. sp.*

— & MERRILL, *ibid.* 37 (1928) 185–187.–*Maesa & Discocalyx n. sp.*

Moluccas: MERRILL, Philip. J. Sc. 11 (1916) Bot. 300–302.–Ambon records; new *Maesa.*

New Guinea: KANEHIRA & HATUSIMA, Tokyo Bot. Mag. 57 (1943) 215–234.–Many new *spp.*

MEZ, Bot. Arch. 1 (1922) 125–128, 230, 255–256. –New *spp.* in *Maesa*, *Ardisia*, *Conandrium.*

—, *ibid.* 2 (1922) 34, 173–176, 210–212, 259–260. –New *spp.* of *Ardisia*, *Conandrium*, *Discocalyx*, *Loheria*, *Grenacheria*, *Rapanea.*

—, *ibid.* 6 (1924) 131–132.–New *spp.* in *Maesa & Rapanea.*

WHITE, J. Bot. 65 (1927) 248.–New *Ardisia.*

—, J. Arn. Arb. 10 (1929) 257–258.–Listed LANE-POOLE coll.

Genera

Abromeitia: MEZ, Bot. Arch. 1 (1922) 100.

Apoia = Sarcosperma (*Sarcospermataceae*).

Ardisia: WALKER, J. Wash. Acad. Sc. 29 (1939) 256–261.–Key to *A. crispa & crenata.*

Embelia: WALKER, Lingn. Sc. J. 10 (1931) 475–480.–*Embelia scandens* and allies; key.

Fittingia: MEZ, Bot. Arch. 1 (1922) 105–106.

Labisia (*Angiopetalum*): VAN STEENIS, Fl. Mal. Bull. 4 (1948) 109; Bull. Bot. Gard. Btzg III, 17 (1948) 459.–Prop. cons. *Labisia.*

Rapanea (*Hunsteinia*), *sec.* HATUSIMA, June 1944, unpublished.

Tapeinosperma: PHILIPSON, J. Bot. 77 (1939) 102–103.–Bornean *spp.*

MYRTACEAE

BURRET, M., Myrtaceen Studien I (Notizbl. Berl.-Dahlem 15, 1941, 479–550).–Crit. notes; mostly extra-Malaysian, many New Caledonian; list of *Rhodomyrtus*; no keys.

—, Myrtaceen Studien II (in FEDDE, Rep. 50, 1941, 50–60).–Extra-Malaysian; few New Caled.

CANDOLLE, A. P. DE, Mémoire sur la famille des Myrtacées (Mém. Soc. Phys. & Hist. Nat. Genève 9, 1841, 301–361, t. 1–22).–General discussion various genera.

KORTHALS, P. W., Bijdrage tot de kennis der Myrtaceae (Ned. Kruidk. Arch. 1, 1846, 185–205).–List with descr. of new *spp.*

VRIESE, W. H. DE, Plant. Ind. Batav. Orient. (1856) 63–79, pl. 5.–Listed records.

Local

India: GAMBLE, J. Ind. Bot. Soc. 1 (1919) 60.–Short diagnoses of some SE. Ind. *spp.*

China: MERRILL & PERRY, J. Arn. Arb. 19 (1938) 191–247.–Rev. of fam.; keys.

Indo-China: MERRILL & PERRY, J. Arn. Arb. 19 (1938) 99–116.–List *Syzygium*; no keys.

Mal. Peninsula: HENDERSON, Gard. Bull. Sing. 11 (1947) 299–338, 18 fig.–New *spp. Eugenia.*

—, *ibid.* 12 (1949) 1–293, 54 fig.–Important revision of 138 *spp.* and *var.* of *Eugenia* (*Syzygium*); keys.

—, *ibid.* 14 (1953) 1–3.–New *Tristania.*

Java: AMSHOFF, Blumea 5 (1945) 495–502.–List Jav. *spp.* under *Syzygium.*

BACKER, Schoolfl. Java (1911) 494–532.–Key Jav. *spp.*

Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 77 (1917) 206–231.–Descr. mainly *Eugenia* & *Tristania.*

—, *ibid. no* 79 (1919) 19–27.–List with new *spp.*

—, *ibid. no* 86 (1922) 335–337.–New *Eugenia* & *Xanthomyrtus.*

—, Sarawak Mus. J. 3 (1928) 532–534, 537 (*partim*).–Listed records.

—, Mitt. Inst. Allg. Bot. Hamburg 7 (1937) 269.–Small list.

MERRILL & PERRY, Mem. Am. Acad. Arts & Sc. 18 (1939) 135–202.–Rev. Born. *spp.*; keys; descr.

MIQUEL, Anal. Bot. Ind. 1 (1850) 12–29, t. 1–10 repr. from Verh. Kon. Ned. Inst. 1e kl. 3e reeks, vol. 3.–List & new *spp.*

RIDLEY, J. Bot. 68 (1930) 10–17, 33–39.–List of *Eugenias* & *Tristanias.*

AIRY SHAW, Kew Bull. (1949) 117–125.–In *Syzygium* 4 new *spp.* and several new comb.; key to *Aphanamyrtus* group.

Philippines: MAIDEN, Proc. U. S. Nat. Mus. 26 (1903) 691–692.–Identification *Eucalyptus.*

ELMER, Leafl. Philip. Bot. 4 (1912) 1399–1444.–Descr. *Eugenia spp.*

—, *ibid.* 7 (1914) 2343–2358.–*Ditto*; various *Myrt.*

—, *ibid.* 10 (1939) 3767–3770.

MERRILL, Philip. J. Sc. 10 (1915) Bot. 207–225.–New *spp.* of *Eugenia.*

—, *ibid.* 11 (1916) Bot. 21–25.–*Ditto.*

—, *ibid.* 19 (1921) 289–308.

—, *ibid.* 27 (1925) 39–43.–4 new *Eugenias.*

—, *ibid.* 79 (1950) 351–430.–Nomenclatural readjustments under *Syzygium.*

QUISUMBING, Philip. J. Sc. 41 (1930) 337–340.–2 new *Eugenias.*

— & MERRILL, *ibid.* 37 (1928) 175–177.–New *Eugenia* & *Tristania.*

Moluccas: MERRILL, Philip. J. Sc. 11 (1916) Bot. 296–297.–New *Eugenia* from Ambon.

New Guinea: DIELS, Bot. Jahrb. 57 (1922) 356–426, 1 fig.–Keys.

—, Nova Guinea 14 (1924) 85–96.

LAUTERBACH, Nova Guinea 8 (1910) 319–323.

—, *ibid.* 8 (1912) 849–855.

MERRILL & PERRY, J. Arn. Arb. 23 (1942) 233–265, 267–297.–Many new *spp.*; no keys.

RECHINGER, in FEDDE, Rep. 11 (1912) 183.–Some new *Syzygiums.*

WHITE, Proc. R. Soc. Queensl. 34 (1922) 47–48.–Listed records.

—, J. Arn. Arb. 23 (1942) 79–92, 1 pl.–Mostly capsular-fruited genera; many new *spp.*; no keys.

—, *ibid.* 32 (1951) 139–149, pl. 1.–New *spp.* & records, incl. Moluccas and Solomon Isl.

N. Australia: CHEEL and MAIDEN, in EWART & DAVIES, Fl. North. Terr. (1917) 203–210, 290–317.–*Eucalyptus*; key to infraspec. taxa in *Melaleuca leucadendron.*

New Caledonia: GUILLAUMIN, Bull. Soc. Bot. Fr. 81 (1934) 3–17.

—, *ibid.* 85 (1939) 626–653.

Fiji: PERRY, J. Arn. Arb. 31 (1950) 350–371.

Genera

Acmena (*Xenodendron*): MERRILL & PERRY, J. Arn. Arb. 19 (1938) 1–20.–Synopsis.

Aphanomyrtus (*Pseudoeugenia*): KOORDERS & VALETON, Ann. Jard. Bot. Btzg Suppl. II (1898) 145–151, Taf. 6–8.–A segregate from *Eugenia.*

MERRILL, Blumea Suppl. 1 (1937) 107–111.

AIRY SHAW, Kew Bull. (1949) 121.–Key.

VALETON, in FEDDE, Rep. 4 (1907) 234–235.

Basisperma: WHITE, J. Arn. Arb. 23 (1942) 84–85.

Cleistocalyx (*Acicalyptus*): MERRILL & PERRY, J. Arn. Arb. 18 (1937) 322–344, 1 pl.–Revision; no key. Segregate of *Eugenia s.l.*

Cloezia: BAKER *f.*, J. Linn. Soc. Lond. Bot. 45 (1921) 309–310.–New Caled. *spp.*; key.

Eucalyptopsis: WHITE, J. Arn. Arb. 32 (1951) 139–144, pl. 1.

Eucalyptus: BLAKE, Austr. J. Bot. 1 (1953) 185–352, 35 pl.–Principally N. Australian, but also considering Mal. *spp.*; keys.

BLAKELY, A key to the Eucalypts, with descriptions of 500 species and 138 varieties; and a companion to J. H. MAIDEN's Critical Revision of the genus Eucalyptus. Sydney (1934) 339 pp.

BURBIDGE, Trans. R. Soc. South Austr. 71 (1947) 137–167.–Key to S. Austr. *spp.*

MAIDEN, A critical revision of the genus Eucalyptus. Sydney (1903–1933) 8 vols, 75 pts.–For key see BLAKELY.

MUELLER, J. Linn. Soc. Bot. 3 (1859) 81–101.–Conspectus; descr. new *sp.*; no key.

Eugenia (*Jambosa*): Several authors maintain *Eugenia s.l.* as a genus. See HENDERSON in Malaya. DIELS and MERRILL & PERRY advocate splitting Mal. *spp.* into *Syzygium*, *Jossinia*, *Acmena*, *Cleistocalyx*, *Tetraeugenia*, *Aphanomyrtus.*

GAGNEPAIN, Bull. Soc. Bot. Fr. 64 (1917) 94–103.–Discussion characters for delimitation of *spp.*

Jossinia: MERRILL, J. Arn. Arb. 31 (1950) 329–333.

—, Philip. J. Sc. 79 (1950) 356–360.–Reinstatement of *Jossinia.*

Kjellbergiodendron: BURRET, Notizbl. Berl.-Dahlem 13 (1936) 101–106, fig. 5.

MERRILL, J. Arn. Arb. 33 (1952) 162–165.

VAN STEENIS, Act. Bot. Neerl. 1 (1952) 440–442, fig. 2.–Revision.

Melaleuca: VAN STEENIS, Tectona 32 (1939) 863–864.–Some records & fig.; in Dutch; no keys.

Octamyrtus: DIELS, Bot. Jahrb. 57 (1922) 373–376.
WHITE, J. Arn. Arb. 32 (1951) 143–147.–Key.
Osbornia: VAN STEENIS, Trop. Natuur 25 (1936) 194–196, fig. 1–2.
Psidium: RANT, Ann. Jard. Bot. Btzg 41 (1930) 27–32, tab. 8–12.
Syncarpia (*Nania*): MIQUEL, J. Bot. Néerl. 1 (1861) 292–297, pl. 3.
Syzygium: MERRILL & PERRY, Mem. Am. Acad. Arts & Sc. 18 (1939) 135–202.–Rev. Born. *spp.*
—, J. Arn. Arb. 19 (1938) 99–116.–Rev. Indo-Chin. *spp.*
Tetraeugenia (a segregate from *Eugenia*): MERRILL, J. Str. Br. R. As. Soc. *no* 77 (1917) 230–231.
AIRY SHAW, Kew Bull. (1949) 123.
Xanthomyrtus: DIELS, Bot. Jahrb. 57 (1922) 362–367.
MERRILL, Philip. J. Sc. 30 (1926) 415–416.
—, Sarawak Mus. J. 3 (1928) 533.
Xanthostemon: GUGERLI, in FEDDE, Rep. Beih. 120 (1940) 1–149, t. 1–16. Also Thesis, Zürich. –Keys; descr.; unsatisfactory.
MERRILL, J. Arn. Arb. 33 (1952) 150–162.–Corrections for latter paper.
Whiteodendron: VAN STEENIS, Act. Bot. Neerl. 1 (1952) 436–440, fig. 1.–New genus from Borneo.

NAJADACEAE

RENDLE, A. B., A systematic revision of the genus Najas (Trans. Linn. Soc. Bot. II, 5, 1899, 379–436; *ibid.* 1900, 437–444, t. 39–42).–Monograph; keys!
—, Pflanzenreich Heft 7 (1901) 1–21, fig. 1–5.

Local

Java: BACKER, Handb. Fl. Java 1 (1924) 51.–Key; in Dutch.
KOCH, Ber. Schweiz. Bot. Ges. 44 (1935) 339–342.–New *spp.*
Bali: VAN STEENIS, Arch. Hydrobiol. Suppl. Bd 11 (1932) 271–272, fig. 2.–*Najas marina.*

Genera

Najas: BRAUN, J. Bot. 2 (1864) 274–279, 2 fig.–Revision.
MIKI, Tokyo Bot. Mag. 49 (1935) 773–778, fig. 6–8.–Key to Japan. *spp.*

NEPENTHACEAE

BECCARI, O., Revista delle Specie del Genere Nepenthes (Malesia 3, 1886, 1–15, t. 1–3).–List; no key.
DANSER, B. H., The Nepenthaceae of the Netherlands Indies (Bull. Jard. Bot. Btzg III, 9, 1928, 249–438, fig. 1–36).–Complete revision of Mal. *spp.*; key.
HARMS, H., Pflanzenfamilien ed. 2, 17b (1936) 728–765, fig. 453–472.
KORTHALS, P. W., in TEMMINCK, Verh. Nat. Gesch. Bot. (1840) 1–44, t. 1–4, 13–15, 20–22.
MACFARLANE, J. M., Pflanzenreich Heft 36 (1908) 1–92, fig. 1–19.–Monograph.

Local

Sumatra: DANSER, Bull. Jard. Bot. Btzg III, 13 (1935) 465–467.–New *sp.* S. Sumatra.
—, *ibid.* 16 (1940) 268–271.–New *sp.* N. Sumatra.
MIQUEL, Ill. Fl. Arch. Ind. 1 (1870) 1–8, t. 1–6.–List; *n. spp.*
Borneo: DANSER, Mitt. Inst. Allg. Bot. Hamburg 7 (1931) 217–221, 1 fig.–List 4 *spp.*
—, Bull. Jard. Bot. Btzg III, 13 (1935) 467–469.–Crit. notes.
HOOKER *f.*, Trans. Linn. Soc. 22 (1859) 415–424, t. 69–74.–Synopsis; no key.
MACFARLANE, Kew Bull. (1925) 35–37.–New *sp.* (*N. decurrens*).
Philippines: MACFARLANE, Contr. Bot. Lab. Univ. Penns. 3 (1911) 207–210, t. 1–2.–2 new *spp.*
—, Philip. J. Sc. 33 (1927) 127–140.–Revision; key.
New Guinea: MACFARLANE, Nova Guinea 8 (1911) 339–341.

NYCTAGINACEAE

HEIMERL, A., Pflanzenfamilien ed. 2, 16c (1934) 86–134, 587.
SKOTTSBERG, C., Act. Hort. Gothob. 2 (1926) 231–232.–Replaces *Calpidia* by *Ceodes.*
STANDLEY, P., The Nyctaginaceae of Northwestern South America (Publ. Field Mus. 11, 1931, 73–114).–Keys.

Local

New Guinea: MERRILL & PERRY, J. Arn. Arb. 20 (1939) 327–329.–4 *Ceodes.*
PULLE, Nova Guinea 8 (1910) 353.
—, *ibid.* 8 (1912) 629–630.
VALETON, Bot. Jahrb. 52 (1915) 101–103.
Hawaii: SKOTTSBERG, Svensk Bot. Tidskr. 30 (1936) 722–743, 6 fig.; *ibid.* 35 (1941) 364.–Arbor. *spp.*
Polynesia: HEIMERL, Occ. Pap. Bern. P. Bish. Mus. 13 (1937) 27–47.–List.

Genera

Boerhaavia: BACKER, Onkruidfl. Jav. Suiker. (1930) 233–237.–Key Jav. *spp.*
Bougainvillea: HEIMERL, Denkschr. Akad. Wiss. Wien 70 (1900) 98–124.–Key; descr.
Ceodes (*Calpidia*): HEIMERL, Oester. Bot. Zeitschr. 63 (1913) 279–290.–List.
Pisonia: BARGAGLI-PETRUCCI, Nuovo Giorn. Bot. Ital. new ser. 8 (1901) App. 603–625, t. 4.–Rev. Mal. *spp.*; key.
AIRY SHAW, Kew Bull. (1952) 87–97, map.–Syn.; distr.; ecol. *P. grandis* with crit. notes on other *spp.*
ST JOHN, Webbia 8 (1951) 225–228, 1 fig.–Distr. *P. grandis.*

NYMPHAEACEAE

CASPARY, R., Nymphaeaceae (in MIQ. Ann. Mus. Bot. Lugd.-Bat. 2, 1866, 241–256).–Also extra-Mal.; no key.

Henkel, F., F. Rehnelt & L. Dittmann, Das Buch der Nymphaeaceen. Darmstadt (1907) 1–158, plates and many fig. – Monograph; uses; cultivation methods; new species; keys.

Planchon, J. E., Étude sur les Nymphéacées (Ann. Sc. Nat. III, Bot. 19 (1853) 17–63.– Census of genera & *spp.*; no key.

—, Enumération succincte des espèces de la famille des Nymphéacées (Revue Hortic. Paris IV, 2, 1853, 62–68).–Conspectus.

Local

Java: Backer, Schoolfl. Java (1911) 48–51.

New Guinea: Merrill & Perry, J. Arn. Arb. 23 (1942) 388–390.
Pulle, Nova Guinea 8 (1910) 361.

Genera

Barclaya: Miquel, Ill. Fl. Arch. Ind. (1870) 43–44. –2 *spp.*; no key.
Wallich, Trans. Linn. Soc. Lond. 15 (1827) 442–448, t. 18.–Type descr.

Brasenia: van der Meer Mohr, Trop. Natuur 26 (1937) 33–34.

Cabomba: Fassett, Castanea 18 (1953) 116–128. –Monograph; key.

Nymphaea: Conard, Publ. Carnegie Inst. Wash. 4 (1905) 1–279, t. 1–30.–Monograph.
Dietrich, Allg. Gartenzeit. 21 (1853) 353–355, 364, 370–372, 379–380, 386–388, 395–396, 406–407.

NYSSACEAE

Wangerin, W., Pflanzenreich Heft 41 (2) (1910) 1–20, fig. 1–4.

Wasscher, J., Nyssa in the Netherlands Indies (Blumea 1, 1935, 343–350).–Revision.

—, Fl. Mal. I, 4 (1948) 29–31, fig. 1.

OCHNACEAE

Bartelletti, V., Studio monografico intorno alle famiglia delle Ochnaceae e specialmente delle Specie Malesi (Malpighia 15, 1901 (an 1902?) 105–174, t. 5–11).–No keys.

Gilg, E., Beiträge zur Kenntnis der Ochnaceae, besonders im Hinblick auf die neueste Bearbeitung dieser Pflanzenfamilie durch van Tieghem (Festschrift Ascherson 1904, 97–118).

—, Pflanzenfamilien ed. 2, 21 (1925) 53–87.

Planchon, J. E., Sur le genre Godoya et ses analogues, avec des observations sur les limites des Ochnacées et une revue des genres et espèces de ce groupe (in Hook. Lond. J. Bot. 5, 1846, 584–600, 644–656, pl. 19–22; *ibid.* 6, 1847, 1–31).–No keys.

Tieghem, P. van, Sur les Ochnacées (Ann. Sc. Nat. VIII, Bot. 16, 1902, 161–416).–Disc. of genera; no *spp.* mentioned; no keys.

—, Constitution nouvelle de la famille des Ochnacées (in Morot, J. Bot. 16, 1902, 181–212).– Delimitation of the family with a key to the genera.

Local

Borneo: Diels & Hackenberg, Bot. Jahrb. 60 (1926) 310–311.–*Euthemis*, 2 records.
Ridley, Kew Bull. (1930) 76–77.–List records.
Airy Shaw, Kew Bull. (1940) 249–252.–List Richards coll.; key to *Neckia.*

Philippines: Merrill & Quisumbing, Philip. J. Sc. 82 (1953) 329–330, t. 2.–*Neckia* from Samar.

New Guinea: Pulle, Nova Guinea 8 (1911) 667.
Smith, J. Arn. Arb. 22 (1941) 524–528.–No key; *Schuurmansia.*

Genera

Euthemis: Hallier *f.*, Beih. Bot. Centralbl. 34, ii (1916) 30–34.–No key.

Neckia (*?Gomphia*): Airy Shaw, Kew Bull. (1940) 252.–Key to *spp.*

Ouratea: Hallier *f.*, Beih. Bot. Centralbl. 34, ii (1916) 34–35.–2 *spp.*; no key.

Schuurmansia: Hallier *f.*, Rec. Trav. Bot. Néerl. 10 (1913) 345–351.–Rev.; no key.
Merrill, Philip. J. Sc. 11 (1916) Bot. 2, 19–20.– Record & new *spp.* from the Philippines.
Miquel, Ill. Fl. Arch. Ind. (1870) 66–67.– Moluccas, 1 *sp.*
Smith, J. Arn. Arb. 10 (1929) 524–528.–Descr. 4 Pap. *spp.*

Schuurmansiella: Hallier *f.*, Rec. Trav. Bot. Néerl. 10 (1913) 344–345.–1 *sp.*
Ridley, Kew Bull. (1930) 77.

OENOTHERACEAE

See Onagraceae

OLACACEAE

(*incl. Erythropalaceae*)

Blume, C. L., Mus. Bot. Lugd.-Bat. 1 (1850) 245–251.–List, incl. also *Icac.*, *Opil.*

Sleumer, H. O., Pflanzenfamilien ed. 2, 16b (1935) 5–32.

Valeton, Th., Critisch overzicht der Olacineae. Thesis, Groningen (1886) 1–280, t. 1–6.

Local

Java: Backer, Schoolfl. Java (1911) 220–230.– Incl. also *Icac.*, *Opil.*

Borneo: Ridley, Kew Bull. (1931) 33–35.–List; 3 new *Olax spp.*

Philippines: Elmer, Leafl. Philip. Bot. 10 (1939) 3770–3771.–New *Strombosia.*

New Guinea: Schellenberg, Bot. Jahrb. 58 (1923) 157–158.–Short list.

Genera

Erythropalum: Fagerlind, Svensk Bot. Tidskr. 40 (1946) 9–14.–Morph., embr.
Quisumbing & Merrill, Philip. J. Sc. 37 (1928) 143–144.–Aberrant Philip. *sp.*
Sleumer, Pflanzenfamilien ed. 2, 20b (1942) 401–403.–As a distinct family *Erythropalaceae.*

Fissipetalum = Erycibe (*Convolvulaceae*).

Phytocrene: Miquel, Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 247–248.–No key.

Schoepfia: Engler, Pflanzenfamilien, Nachtr. (1897) 145–146.–Sect. key.
Van Steenis, Reinw. 1 (1952) 467–481, 2 fig.

Scorodocarpus: Beccari, Nuovo Giorn. Bot. Ital. 9 (1877) 100, 273–276, t. 11 (fig. 12–17).– Descr. *S. borneensis.*

Tropidopetalum = Bouea (*Anacardiaceae*).

Ximenia: BECCARI. Nuovo Giorn. Bot. Ital. 9 (1877) 276–279, t. 11 (fig. 1–11).–Record *X. americana* from New Guinea.
SARGENT, Trees & Shrubs 2 (1913) 127–132, pl. 154.

OLEACEAE

DECAISNE, J., Monographie des genres Ligustrum et Syringa (Nouv. Arch. Mus. Hist. Nat. Paris II, 2, 1879, 16–38, t. 1–3).–Descr.; no keys.

KNOBLAUCH, E., Zur Kenntnis einiger Oleaceen-Genera (Bot. Centralbl. 61, 1894, 81–87, 129–136).–Lists; no keys.

LINGELSHEIM, A., Oleaceae-Oleoideae-Fraxineae & Syringeae (Pflanzenreich Heft 72, 1920, 1–125, fig. 1–11, 1–11, map).–*Forsythia*, *Fraxinus*, *Schrebera*, and *Syringa*.

Local

Siam: KERR, Kew Bull. (1938) 127–133.–New *spp.*

Sumatra: BAKHUIZEN VAN DEN BRINK Jr, Blumea 6 (1950) 383–384.–*Jasm. multiflorum* and its infraspecific taxa.
MERRILL, Pap. Mich. Acad. Sc. 19 (1934) 186–188.—2 new *Jasminums*, 1 new *Linociera*.
MERRILL, Contr. Arn. Arb. 8 (1934) 136–137.–Listed records.

Borneo: FISCHER, Kew Bull. (1932) 294.–New *Jasminum*.
RIDLEY, Kew Bull. (1934) 121–123.–3 new *Jasminums*; 1 *Linociera*.
AIRY SHAW, in HOOK. Ic. Pl. 33 (1935) t. 3282.–New *Jasminum*.

Philippines: ELMER, Leafl. Philip. Bot. 5 (1913) 1651–1657.–List *Linociera*.
—, *ibid.* 9 (1934) 3208–3209.–New *Ligustrum*.
MERRILL, Philip. J. Sc. 27 (1925) 48–49.–New *Linociera*.
QUISUMBING & MERRILL, Philip. J. Sc. 37 (1928) 187–190.–New *Linociera*, *Jasminum*, and *Ligustrum*.

Moluccas: MERRILL, Philip. J. Sc. 11 (1916) Bot. 304–306.–2 new *spp.* from Ambon and Celebes.

New Guinea: KNOBLAUCH, Notizbl. Berl.-Dahlem 11 (1934) 1029–1031.–New *Linociera*.
KOBUSKI, J. Arn. Arb. 21 (1940) 328–335.–List; descr.; no key.
LINGELSHEIM, Nova Guinea 14 (1927) 329–331. –List.
—, Bot. Jahrb. 61 (1927) 1–22.–Keys.
WHITE, Proc. Linn. Soc. N.S.W. 51 (1926) 297. –New *Jasminum*.
—, J. Arn. Arb. 10 (1929) 259.–3 *spp.* listed.

Genera

Fraxinus: BOERLAGE & KOORDERS, Nat. Tijd. Ned. Ind. 56 (1896) 185–190, t. 1–2.–E. Java.
LINGELSHEIM, Bot. Jahrb. 40 (1908) 185–223.–Revision; no keys.
WESMAEL, Bull. (Mém.) Soc. Bot. Belg. 31 (1892) 69–117.–Synopsis; no key.

Jasminum: KOBUSKI, J. Arn. Arb. 13 (1932) 145–179.–Synops. Chin. *spp.*; keys.

Ligustrum: HÖFKER, Mitt. Deut. Dendr. Ges. 24 (1915) 51–66, t. 1–6.–Revision; keys.
MANSFELD, Bot. Jahrb. 59 (1924) Beibl. 132, 19–75.–Precurs. notes to monogr.

Myxopyrum: HILL, Kew Bull. (1910) 37–44.–Revision; key.

Schrebera: KOSTERMANS, Reinwardtia 2 (1953) 360–362, fig. 2.–Borneo record; new *sp.*

Syringa: MCKELVEY, S. D., The Lilac, a monograph. New York (1928) i–xiv, 1–581, t. 1–171.–Complete monograph with keys to the *spp.*

ONAGRACEAE

(*Oenotheraceae*)

Local

Java: BACKER, Onkruidfl. Jav. Suiker. (1930) 467–472.–Key.

New Guinea: DIELS, Bot. Jahrb. 62 (1929) 485 486.–2 new *Epilobiums*.
PULLE, Nova Guinea 8 (1910) 395.
—, *ibid.* 8 (1911) 681.
WARBURG, Bot. Jahrb. 16 (1892) 15, 23–24.–*Epilobium prostratum n. sp.*

Genera

Epilobium: HAUSSKNECHT, Monographie der Gattung Epilobium. (1884) i–viii, 1–318, pl. 1–23.
LÉVEILLÉ, Iconographie du genre Epilobium. Le Mans (1910) 1–328, t. 1–272.–Unreliable work.

Fuchsia: MUNZ, Proc. Calif. Acad. Sc. IV, 25 (1943) 1–139, t. 1–16.–Revision; keys.

Jussieua: BACKER, Trop. Natuur 3 (1914) 55–63.–Key Jav. *spp.*
BRENAN, Fl. Trop. E. Afr. (Onagrac.) (1953) 6–20, fig. 3–4.–Key; critical treatment.
FAWCETT, J. Bot. 64 (1926) 10–13.–Interpr. Linnean *spp.*
HARA, J. Jap. Bot. 28 (1953) 289–294.–*Jussieua* is reduced to *Ludwigia*; necessary recomb.
LÉVEILLÉ, Bull. Soc. Bot. Fr. 54 (1907) 421–427. –Revision; list; no key.
LIVERA, Ann. R. Bot. Gard. Perad. 9 (1924) 199–200.–Key to Ceylon *spp.*
MUNZ, Darwiniana 4 (1942) 179–284, t. 1–20, 2 fig., 9 maps.–Full monogr. of New World *spp.*
RIDLEY, J. Bot. 59 (1921) 257–260.–No key.

OPILIACEAE

SLEUMER, H. O., Pflanzenfamilien ed. 2, 16b (1935) 33–43.

Local

Indo-China: GAGNEPAIN, Suppl. Fl. Gén. Indo-Chine (1946) 731–734.–Descr. & key *Lepionurus* BL.

Philippines: MERRILL, Philip. J. Sc. 29 (1926) 477. –A new *sp.* of *Melientha*.

New Guinea: LAUTERBACH, Nova Guinea 8 (1912) 817–818.–Descr. *Gjellerupia* (= *Lepionurus*).

Genera

Lepionurus (*Gjellerupia*): HATUSIMA, Bot. Mag. Tokyo 65 (1952) 109–111.–Reduction.

ORCHIDACEAE

(*excl. Apostasiaceae*)

Bentham, G., Notes on Orchideae (J. Linn. Soc. Lond. Bot. 18, 1881, 281–360).–System of the family with notes on genera; no descr. of *spp.*

Kraenzlin, F., Orchidacearum genera et species 1 (1901) i–viii, 1–986; 2, 1 (1904) 1–143, t. 1–16.–With keys to *spp.* but not covering whole family.

—, Pflanzenreich Heft 45 (1910) 1–382, fig. 1–35.–*Dendrobiinae: Dendrobium, Desmotrichum, Diplocaulobium, Sarcopodium.*

—, *ibid.* Heft 50 (1) (1911) 1–182, fig. 1–35.–*Orchidaceae-Monandrae-Dendrobiinae: Dendrobium, Sarcopodium, Diplocaulobium, Desmotrichum, Eria, Trichotosia, Porpax, Chitonanthera.*

—, *ibid.* 50 (2) (1911) 1–46, fig. 1–5.–*Orchidaceae, Monandrae-Thelasiinae: Phreatia, Thelasis.*

Lindley, J., The genera and species of Orchidaceous plants (1830–40) i–xiii, 1–553.–Keys to the genera.

—, Folia Orchidacea. Enumeration of the known species of Orchids. 9 parts. London (1852–59) 1–300.–Keys to subgenera and sections, sometimes to *spp.*

Mansfeld, R., Ueber das System der Orchidaceae-Monandrae (Notizbl. Berl.-Dahlem 13, 1937, 666–676).–Key to tribes & subtribes.

Pfitzer, E., Beiträge zur Systematik der Orchideen (Bot. Jahrb. 19, 1895, 1–42).

—, Pflanzenreich Heft 12 (1903) 9–132, fig. 1–41.–Monogr. *Paphiopedilum.*

— & Kraenzlin, F., Pflanzenreich Heft 32 (1907) 1–169, fig. 1–54.–*Orchidaceae-Monandrae-Coelogyninae: Coelogyne (Ptychogyne), Dendrochilum, Gynoglottis, Hologyne, Crinonia, Chelinostele, Chelonanthera, Pholidota, Camelostalix.*

Reichenbach, H. G., Orchides (in Walpers, Ann. Bot. Syst. 6, 1861, 167–933).–Enum. world's orchids; sometimes partial keys.

Schlechter, R., Monographie der Podochilinae (Mém. Herb. Boiss. *no* 21, 1900, 1–78).—*Podochilus* (*incl. Appendicula*), *Lobogyne, Thelasis, Oxyanthera.* Keys!

—, Die Polychondreae (Neottiinae Pfitz.) und ihre systematische Einteilung (Bot. Jahrb. 45, 1911, 375–410).–Key to subtribes; review of and key to the genera of the *Gastrodiinae*; keys to species of *Epipogum, Didymoplexis, Nervilia,* and *Gastrodia.*

—, Die Orchideen, ihre Beschreibung, Kultur und Züchtung, Handbuch für Orchideen Liebhaber, Züchter und Botaniker (1915) 1–836, fig. 1–230, t. 1–12. Ed. 2 (1927) xii + 959, 250 fig., 16 tab.–Descr.; no keys.

—, Das System der Orchidaceen (Notizbl. Berl.-Dahlem 9, 1926, 563–591).–Synopsis of names.

Smith, J. J., Artificial key to the orchid genera of the Netherlands Indies, *etc.* (Blumea 1, 1934, 194–215).–Comprising the whole of Malaysia.

Mixed contributions to Malaysia

Ames, O., *c.s.*, Orchidaceae, *etc.* North Easton, Mass. 1–7 (1905–1922).

Blume, Rumphia 1 (1836) 195–201, t. 67–70.–Col. pl. & descr. *Vanilla, Galeola.*

—, *ibid.* 4 (1849) 38–56, t. 192–200B.–Various orch. with plates.

—, Mus. Bot. Lugd.-Bat. 1 (1849) 29–32, 46–48, 60–64, 112.

—, *ibid.* 2 (1856) 172–190.–Lists of *spp.* of various genera.

—, Collection des Orchidées les plus remarquables de l'Archipel Indien et du Japon (1858) i–vi, 1–190, t. 1–66.–Miscell. descr. This is a republication with minor changes of Blume's Flora Javae nova series vol. 1 (1858). See under Java.

—, Monographie des Anectochilus, Goodyera et genres voisins, *etc.* (Belg. Hort. 11, 1861, 369–378, t. 1 (fig. 1–7).–Condensed from the above; key to genera; descr. of a number of *spp.*

King & Pantling, Some new Indo-Malayan Orchids (J. As. Soc. Beng. 66, 1897, 578–605).

Lindley, Sertum Orchidaceum: A wreath of the most beautiful orchidaceous flowers (1837–42) t. 1–49.–Descr. and plates; no keys.

Reichenbach, Orchidaceae in Walper's Annales 6 (1861) 167–933.–Synopsis.

—, Orchidiographische Beiträge (Linnaea 41, 1877, 17–98).–New descr. partly Malaysian.

—, Xenia Orchidacea. Beitr. zur Kenntnis der Orchideen 1 (1854–58) 1–245, t. 1–100; 2 (1862–74) 1–232, t. 101–200; 3 (by Kraenzlin) (1900) 1–193, t. 200–300.

Reichenbachia, Orchids illustrated and described by F. Sander. Abbildungen, Beschreibungen und Kulturanweisungen der schönsten Orchideen. Published by Sander. 2 series, in 4 vols (48 parts). London and Berlin (1886–1895) folio, with 192 col. pl.–Descr. & plates; no keys.

Schlechter, Neue Orchidaceen der Flora des Monsun-Gebietes (Bull. Herb. Boiss. II, 6, 1906, 295–310, 453–472).–Mixed diagn.

—, Orchidaceae novae vel criticae (in Fedde, Rep. 3, 1906–07, 15–20, 45–51, 276–280, 316–321; *ibid.* 9, 1910–11, 25–27, 162–165, 212–217, 284–287, 290–294, 337–342, 428–439; *ibid.* 10, 1911, 250–252; *ibid.* 11, 1912, 140–146).–Mixed descr.

—, Notizbl. Berl.-Dahlem 8 (1921) 14–20.–New *spp.* coll. Beccari in Borneo & Sumatra.

—, in Fedde, Rep. Beih. 74 (1934) 85 tab.–Fig. of Ind. & Mal. *spp.*

Smith, J. J., Bull. Inst. Bot. Btzg *no* 7 (1900) 1–5.–List mixed descr.

—, Rec. Trav. Bot. Néerl. 1 (1904) 146–159.–List mixed descr.

—, Neue Orchideen des Malaiischen Archipels (Bull. Dép. Agric. Ind. Néerl. *no* 5, 1907, 1–36).—Descr.

—, *ditto* II (*ibid. no* 15, 1908, 1–29).–Descr.

—, *ditto* III (*ibid. no* 22, 1909, 1–51).–Descr.

—, *ditto* IV (*ibid. no* 45, 1911, 13–25).–Descr.

—, *ditto* V (Bull. Jard. Bot. Btzg II, *no* 3, 1912, 53–69).–Descr.

—, *ditto* VI (*ibid.* II, *no* 8, 1912, 38–47).–Descr.

—, *ditto* VII (*ibid.* II, *no* 13, 1914, 1–52).–Descr.

— ,*ditto* VIII (*ibid.* II, *no* 25, 1917, 1–103).–Descr.

—, *ditto* IX (*ibid.* III, 2, 1920, 15–127).–Descr.
—, *ditto* X (*ibid.* III, 5, 1922, 12–102).–Descr.
—, *ditto* XI (*ibid.* III, 8, 1926, 35–70).–Descr.
—, *ditto* XII (*ibid.* III, 9, 1927, 138–195).–Descr.
—, *ditto* XIII (*ibid.* III, 10, 1928, 25–84).–Descr.
—, *ditto* XIV (*ibid.* III, 12, 1932, 105–150).–Descr.
—, *ditto* XV (in Fedde, Rep. 36, 1934, 110–119).–Descr.
—, *ditto* XVI (Bull. Jard. Bot. Btzg III, 14, 1937, 160–168).–Descr.
—, *ditto* XVII (Blumea 5, 1943, 297–315).–Descr.
—, *ditto* XVIII (*ibid.* 5, 1945, 692–699, 6 fig.).–Descr.
—, Blumea 5 (1945) 764–785.–Compl. & emend. descr.
—, Icones Orchidacearum malayensium I (Bull. Jard. Bot. Btzg III, Suppl. 2, 1930, t. 1–100).–Plates belonging to series above.
—, *ditto* II (*ibid.* Suppl. 3, 1938–1949, t. 101–176). –*Ditto.*
—, *idem* Additamenta t. 178–189 (Reinwardtia 1, 1950, 1–25).–*Ditto.*
—, Ic. Bog. 2 (1903) t. 51–75; 3 (1906) t. 204–225; 3 (1907) t. 240–243; 4 (1910) t. 301–305.–Descr. fig.
—, Bull. Jard. Bot. Btzg III, 8 (1927) 353–369.–Notes from Reichenbach's Herb. I.
—, *ibid.* 9 (1928) 482–492.–*Ditto* II.
—, *ibid.* 11 (1930) 19–27.–*Ditto* III.
—, in Fedde, Rep. 31 (1932) 76–82.–3 new *spp.*
—, Gard. Bull. Str. Settl. 9 (1935) 89–92.–1 *Oberonia*, 2 *Dendrobiums.*
Van Steenis, Trop. Natuur 23 (1934) 53–57, fig. 18–24.–Key to saprophytic Mal. Orch. mostly Javan.
Teysmann, Nat. Tijd. Ned. Ind. 5 (1853) 487–494. –Mixed diagn.
—, Ned. Kruidk. Arch. 3 (1854) 396–402. Mixed diagn. *ex* Hort. Bog.
— & Binnendijk, Nat. Tijd. Ned. Ind. 24 (1862) 305–326.–Mixed diagn.
—, *ibid.* 27 (1864) 16–22.–*Ditto.*
—, *ibid.* 29 (1867) 241–244.–*Ditto.*
De Vriese, Illustrations d'orchidées orientales néerlandaises, ou choix de plantes nouvelles ou peu connues de la famille des Orchidées. Avec texte explicatif et scientifique. La Haye (1854) 19 tab. (col.).–Descr. various *spp.*; no keys.

Local

India: Hooker, A century of Indian Orchids (Ann. R. Bot. Gard. Calc. 5, 1895, 1–68, t. 1–101).–Descr.; pl.
King & Pantling, The Orchids of the Sikkim Himalaya (Ann. R. Bot. Gard. Calc. 8, 1898, 1–342, t. 1–448).–Descr.; pl.
Lindley, J. & Proc. Linn. Soc. Lond. 1 (1857) 170–190; *ibid.* 3 (1859) 1–63.–Enum.; descr.

Indo-China: Gagnepain & Guillaumin, Fl. Gén. Indo-Chine 6 (1932–34) 142–647.

Sumatra: Ames, in Merrill, Contr. Arn. Arb. 8 (1934) 22–40.
Reichenbach, Bonplandia 5 (1857) 34–43, 53–58.–List Zollinger.
Ridley, J. Fed. Mal. Stat. Mus. 8, 4 (1917) 87–114.–Coll. Mt Kerintji; list.
—, J. Mal. Br. R. As. Soc. *no* 87 (1923) 94–98.–List E. Coast coll. Ridley.
Schlechter, Bot. Jahrb. (1911) Beibl. *no* 104, p. 1–61.–List Schlechter coll.
Smith, in Fedde, Rep. 32 (1933) 129–386.–Critical, complete list Orch. of Sumatra & adjacent islands.
—, Blumea 5 (1943) 316–323; *ibid.* 5 (1945) 700–708.–List Atjeh coll. van Steenis.

Malay Peninsula: Carr, Some Malayan orchids (Gard. Bull. Str. Settl. 5, 1929, 1–50, pl. 1–18). –List; descr.
—, *ditto* II (*ibid.* 5, 1930, 124–160, pl. 1–4).–*Ditto.*
—, *ditto* III (*ibid.* 7, 1932, 1–59, pl. 1–5).–*Ditto.*
—, *ditto* IV (J. Mal. Br. R. As. Soc. 11, 1933, 66–109, pl. 1–13).–*Ditto.*
—, *ditto* V (Gard. Bull. Str. Settl. 8, 1935, 69–129).–*Ditto.*
—, *ibid.* 7 (1932) 61–86, pl. 6–14.–Key *Taeniophyllum.*
Henderson, J. Mal. Br. R. As. Soc. 5 (1927) 268–272.–List Cameron Highlands.
—, J. Fed. Mal. Stat. Mus. 13, 4 (1927) 7–10.–List Pahang.
—, *ibid.* 223–226.–List; 2 new *spp.*
—, Gard. Bull. Str. Settl. 5 (1930) 79–80.–List P. Tioman.
Holttum, Mal. Nat. J. 2 (1947) 1–7, 2 fig.–Key & descr. *Paphiopedilum.*
—, Gard. Bull. Str. Settl. 11 (1947) 275–292, fig. 2–5.–New *spp.*
—, Mal. Nat. J. 4 (1949) 85–92, 4 fig.–Key *Arachnis.*
—, *ibid.* 13 (1951) 251–253.–New *Vanilla.*
—, Gard. Bull. Sing. 14 (1953) 4–7.–Descr. 3 new *spp.*
—, Orchids of Malaya. Revised Flora of Malaya 1 (1953) v + 753, 234 fig.–Keys; descr.
Ridley, J. Linn. Soc. Bot. 32 (1896) 213–415.–List of *spp.* from Mal. Pen.
—, Mat. Fl. Mal. Pen. (Monocot.) 1 (1907) 7–231.–Keys.

Anambas & Natuna Islands: Smith, in Fedde, Rep. 30 (1932) 327–336.–List coll. van Steenis.

Java: Backer, Bekn. Fl. Java (em. ed.) vol. 12 Orchidaceae. 3 pts, 494 pp., 2 pl. (folio-mimeogr.). Leyden (Aug.–Sept. 1952).–In Dutch; keys, *etc.*
Blume, Tabellen en platen voor de Javaansche Orchideën. Batavia (1825) text t. 1–5, fig. 1–78. –Generic key & figures.–See for a bibliogr. note on this work Mansfeld, in Fedde, Rep. 39 (1936) 318.
—, Flora Javae, nov. ser. vol. 1 (1858) 1–162, t. 1–66.–Col. plates & descr.
Breda, Genera et species Orchidearum et Asclepiadearum quas in itinere per insulam Java . . . collegerunt G. Kuhl & J. C. van Hasselt. 3 fasc. (1828–29).–15 col. pl. and descr.
Loogen, Trop. Natuur 27 (1938) 113–115, 1 fig.–*Disperis javanica.*

Reichenbach, Bonplandia 5 (1857) 34–43, 53–58.–List Zollinger.

Smith, Die Orchideen von Java. Leiden (1905) viii + 672 pp.–Rev.; keys; descr.

—, *ditto* Atlas, 6 parts, 483 fig. (1908–1912).

—, Die Orchideen von Java. Nachtrag I (Bull. Dép. Agric. Ind. Néerl. *no* 13, 1907, 1–78, 2 tab.).–Lists add.; descr.

—, *ditto* II (*ibid. no* 43, 1910, 1–77).–*Ditto.*

—, *ditto* III (Bull. Jard. Bot. Btzg II, *no* 9, 1913, 1–130).–*Ditto.*

—, *ditto* IV (*ibid.* II *no* 14, 1914, 1–56).–*Ditto.*

—, *ditto* V (*ibid.* II *no* 26, 1918, 1–135).–*Ditto* with key to *Luisia* & *Taeniophyllum.*

—, *ditto* VI (*ibid.* III, *no* 3, 1921, 227–333).–Keys to *Cryptostylis, Thrixspermum § Dendrocolla,* and to *Agrostophyllum.*

—, *ditto* VII (*ibid.* III, *no* 9, 1927, 23–66, Taf. 2–8).–List.

—, *ditto* VIII (*ibid.* III, *no* 16, 1939, 121–138).–List.

—, Trop. Natuur 5 (1916) 179–183.–Key to *Taeniophyllum,* & *Chiloschista.*

—, Tafeln Javanischer Orchideen I (Bull. Jard. Bot. Btzg III, 5, 1922, t. 18–37).

—, *ditto* II (*ibid.* III, 6, 1924, t. 1–25).

—, in Fedde, Rep. 24 (1931) 248–252.–4 *n. spp.*

Borneo: Ames, in Merrill, En. Born. (1921) 134–204.–List.

— & Schweinfurth, in Ames, Orchidaceae 6 (1920) xiv + 271 pp.–List & descr. Orchid. Mt Kinabalu; no keys.

Carr, Gard. Bull. Str. Settl. 8 (1935) 165–240.–List Clemens & Carr coll. Kinabalu part 1.

Holttum, Sarawak Mus. J. 5 (1949) 172–173.–New *Arachnis.*

—, *ibid.* 5 (1950) 389–390, pl. 20.–New *Vanda.*

Ridley, J. Linn. Soc. Lond. Bot. 31 (1896) 261–306, t. 13–15.–Complete list.

Smith, J. Str. Br. R. As. Soc. *no* 63 (1912) 63–70.–Coll. Moulton Sarawak.

—, Not. R. Bot. Gard. Edinb. 13 (1921) 188.–New *Chelonistele*; descr.

—, Rec. Trav. Bot. Néerl. 22 (1925) 262–267.–*Phalaenopsis denevei.*

—, Inst. Allg. Bot. Hamburg 7 (1927) 9–76, 10 pl.—List Hans Winkler coll.

—, Bull. Jard. Bot. Btzg III, 11 (1931) 83–160.–Coll. Endert.

—, Brittonia 1 (1931) 105–111.–List Sarawak Clemens coll.

Williams, Bot. Mus. Leafl. Harv. Univ. 6 (1938) 57–61.—3 new *spp.*

Philippines: Ames, Orchidaceae 1 (1905) 63–107.–Descr. list Orch. Philip.

—, Proc. Biol. Soc. Wash. 19 (1906) 143–154.–New *Acoridiums.*

—, Philip. J. Sc. 2 (1907) Bot. 311–337.–Orchids from Mt Halcon.

—, Orchidaceae 3 (1908) 17–257.–Mixed descr.

—, Notes on Philippine Orchids with descriptions of new species I (Philip. J. Sc. 4, 1909, Bot. 593–600).

—, *ditto* II (*ibid.* 4 (1909) Bot. 663–676).

—, *ditto* III (*ibid.* 6 (1911) Bot. 35–56).

—, *ditto* IV (*ibid.* 7 (1912) Bot. 1–27, 126–143).

—, *ditto* V (*ibid.* 7 (1912) Bot. 125–143).–*Bulbophyllum.*

—, *ditto* VI (*ibid.* 8 (1913) Bot. 407–440).

—, *ditto* VII (*ibid.* 6 (1920) 273–318).

—, in Elmer, Leafl. Philip. Bot. 5 (1912) 1549–1588.–Mixed not. & descr.

—, Orchidaceae 5 (1915) 3–271.–The genera and *spp.* of Philip. Orchids.

—, Orchidaceae 7 (1922) 141–155.–Add. Orchid. Mountain Prov. Luzon.

—, Sched. Orchidaceae 5 (1923) 1–42.–List.

—, in Merrill, En. Philip. Fl. Pl. 1 (1924) 252–458.–List.

—, Bot. Mus. Leafl. Harv. Univ. 2 (1934) 31–32, 39–40.–Mixed notes.

—, Blumea Suppl. 1 (1937) 66–77.–New *Acoridiums.*

—, Amer. Orch. Soc. Bull. 13 (1945) 320–326.–Mixed notes.

— & Quisumbing, New or noteworthy Philippine Orchids I (Philip. J. Sc. 44, 1931, 369–383).

—, *ditto* II (*ibid.* 47, 1932, 197–220, 29 pl.).

—, *ditto* III (*ibid.* 49, 1932, 483–504, 28 pl.).

—, *ditto* IV (*ibid.* 52, 1933, 443–473, 17 pl.).

—, *ditto* V (*ibid.* 56, 1935, 453–469, pl. 1–10).

—, *ditto* VI (*ibid.* 59, 1936, 1–14, 9 pl.).

Davis, Orch. Digest 11 (1947) 264–266.–Genus *Phreatia.*

—, Philip. Orch. Rev. 1, *no* 2 (1948) 10–15, 3 fig. –*Dendrobium.*

— & Steiner, Philippine Orchids. New York (1952) 278 pp. 112 fig.–Popular.

Kraenzlin, in Fedde, Rep. 7 (1910) 97–98.–2 new *spp.*

—, *ibid.* 17 (1921) 382–392.–Various diagn. coll. Loher.

Leavitt, Philip. J. Sc. 4 (1909) Bot. 201–244, fig. 1–26.–*Eria*; census; no key.

Quisumbing, Philip. J. Sc. 52 (1933) 271–279, pl. 1–3.–Difference between *Anota violacea* & *Rhynchostylis retusa.*

—, Philip. J. Sc. 72 (1940) 481–492, 8 pl.–Key to Philip. *Cymbidiums.*

—, *ibid.* 74 (1941) 175–187, 2 pl.–Studies in various *Phalaenopsis spp.*; no key.

—, *ibid.* 76 (1941) 81–98, 9 pl.–*Phalaenopsis. Non vidi.*

—, *ibid.* 77 (1947) 1–18, t. 1–5.–*Phalaenopsis*; key.

—, *ibid.* 66 (1948) 141–154, t. 1–7.–Various descr.

—, Philip. Orch. Rev. 1^{1} (1948) 4–9.–*Spathoglottis*; no key.

—, *ibid.* 1 (1948) 4–9, 1 fig.–*Spathoglottis,* descr.; no key.

—, *ibid.* 2^{1} (1949) 8–15, 4 fig.–*Vanda*; key.

—, *ibid.* 3^{2} (1950) 3–11.–*Renanthera*; key; many fig.

—, *ibid.* 3^{1} (1950) 9–11.–*Angraecum.*

—, *ibid.* 4^{1} (1951) 2–5, t. 1–2.–New *Dendrobium.*

—, *ibid.* 4^{1} (1951) 26–32.–*Grammatophyllum*; key.

—, *ibid.* 4^{2} (1951) 8–14, 2 photos, 1 fig.–*Coelogyne*; key.

—, *ibid.* 4^3 (1951) 2–10, 3 pl.–*Eulophia*; key.
—, *ibid.* 5^1 (1953) 2–6.–*Vanilla*; no key.
REICHENBACH *f.*, Bonplandia 3 (1855) 212–227. –Descr. CUMING coll.
—, Linnaea 41 (1877) 99–118.–Descr. coll. WALLIS.
RENDLE, J. Bot. 34 (1896) 357–358.–2 new *spp.*
SCHLECHTER, in PERKINS, Fragm. Fl. Philip. pt 1 (1904) 43–44.–Small list.
STEINER, Philip. Orch. Rev. 2^3 (1949) 3–8.–*Aerides*; key.
—, *ibid.* 5^3 (1953) 4–15, 2 pl.–Revision; key.
WILLIAMS, Philip. J. Sc. 65 (1938) 385–397.–Rev. *Trichoglottis*; key.
—, Bot. Mus. Leafl. Harv. Univ. 6 (1938) 46–48.–Syn. *Plocoglottis.*
—, *ibid.* 6 (1938) 53–57, tab.–Descr. *Phragmorchis n.g.*
—, *ibid.* 6 (1938) 77–95.–Rev. *Thrixspermum*; key.
—, *ibid.* 6 (1938) 96–111.–Mixed descr.
—, Philip. J. Sc. 71 (1940) 113–114.–*Epiblastus*; 1 new *sp.*
—, *ibid.* 80 (1952) 281–334.–Revision of *Dendrochilum sect. Acoridium*; key.

Celebes: ROLFE, Kew Bull. (1899) 126–133.–New *spp.* Minahasa coll. KOORDERS.
SCHLECHTER, in FEDDE, Rep. 8 (1910) 500–512.
—, *ibid.* 10 (1911) 1–40, 66–96, 177–213.–List SCHLECHTER coll.
—, *ibid.* 21 (1925) 113–212.–List.
SMITH, Nat. Tijd. Ned. Ind. 58 (1898) 358–363. –Descr. 3 *n. spp.*
—, Svensk Bot. Tidskr. 20 (1926) 470–482.–List W. KAUDERN coll.
—, Bull. Jard. Bot. Btzg III, 10 (1928) 1–24.–List BÜNNEMEIJER coll.
—, Bot. Jahrb. 65 (1933) 449–508.–List coll. KJELLBERG.
—, Blumea 5 (1945) 563–566.–List coll. MONOD DE FROIDEVILLE.

Lesser Sunda Islands: KRAENZLIN, Bot. Jahrb. 7 (1886) 435–443.–Some records of Timor.
REICHENBACH, Bonplandia 5 (1857) 34–43, 53–58.–List ZOLLINGER coll.
SMITH, Med. Rijksherb. Leiden *no* 53 (1925) 1–17.–List ELBERT coll.

Moluccas.–
Ambon: FINET, Not. Syst. 2 (1911–13) 253–255.–New *Phalaenopsis.*
SMITH, Die Orchideen von Ambon. Batavia 1905. 125 pp.–Descr.
—, Philip. J. Sc. 12 (1917) 249–262.–List ROBINSON coll.
Buru: SMITH, Bull. Jard. Bot. Btzg III, 9 (1928) 439–481.–List coll. TOXOPEUS, STRESEMANN.
Ceram: SMITH, Bull. Jard. Bot. Btzg III, 10 (1928) 85–172.–List coll. RUTTEN, STRESEMANN.
Talaud & Morotai: SMITH, Bull. Jard. Bot. Btzg III, 11 (1930) 67–81.–List coll. LAM.

New Guinea: BAILEY, Various small contributions, in Queensl. Agric. J. 3 (1898) 159.–Papua.
—, *ibid.* 4 (1899) 48.–*Dendrobium armittii.*
—, *ibid.* 5 (1899) 41.–*Ornithochilus moretonii.*
—, *ibid.* 6 (1900) 287.–Papua.
—, *ibid.* 7 (1900) 349.–Papua.
—, *ibid.* 16 (1906) 410–412.–*Dendrobium litoreum.*
—, *ibid.* 19 (1907) 273–274.–Papua (*leg.* COPLAND KING).
—, *ibid.* 2 (1914) 75.–*Eulophia papuana.*
KRAENZLIN, Bot. Jahrb. 7 (1886) 435–443.–Some new *spp.*
—, Oester. Bot. Z. 44 (1894) 161–164, 208–212, 253–257, 298–302, 333–338, 418–421, 459–462. –Descr. new *spp.*
MANSFELD, Bot. Jahrb. 62 (1929) 462–474.–KEYSSER coll. from Sarawaged.
REICHENBACH, Bot. Centralbl. 28 (1886) 343–346.–New *spp.* BECCARI coll.
RIDLEY, J. Bot. 24 (1886) 322–327.–Descr. new *spp.* FORBES coll.
—, Trans. Linn. Soc. Lond. Bot. II, 9 (1916) 159–209.–List BODEN KLOSS coll. *etc.*
ROGERS, Trans. R. Soc. South Austr. 49 (1925) 254–265.–List.
—, *ibid.* 54 (1930) 37–39.
— & WHITE, *ibid.* 44 (1920) 110–119, pl. 5–8.–Coll. C. T. WHITE.
SCHLECHTER, Die Orchidaceen von Deutsch-Neu Guinea (in FEDDE, Rep. Beih. 1, 1914, i–lxvi, 1–1079).–Descr.; no keys.
—, in FEDDE, Rep. 16 (1919) 214–219.–New *spp.* coll. KEYSSER.
—, Bot. Jahrb. 58 (1923) 50–154.–List add.
SMITH, in FEDDE, Rep. 10 (1912) 487–488.–4 *n. spp.*
—, Vorläufige Beschreibungen neuer Papuanischer Orchideen I (Bull. Dép. Agric. Ind. Néerl. *no* 19, 1908, 1–39).–Coll. VERSTEEG.
—, *ditto* II (*ibid.* 39, 1910, 1–22).–Coll. VON RÖMER.
—, *ditto* III (*ibid.* 45, 1911, 1–12).–Coll. GJELLERUP.
—, *ditto* IV (Bull. Jard. Bot. Btzg II, 2, 1911, 1–20).–Coll. A. C. DE KOCK.
—, *ditto* V (*ibid.* II, 3, 1912, 70–79).–Coll. GJELLERUP.
—, *ditto* VI (in FEDDE, Rep. 11, 1912, 130–140). –*Ditto.*
—, *ditto* VII (*ibid.* 11, 1912, 274–280).–*Ditto.*
—, *ditto* VIII (*ibid.* 11, 1913, 552–560).–*Ditto* & others.
—, *ditto* IX (*ibid.* 12, 1913, 24–34).–*Ditto.*
—, *ditto* X (*ibid.* 12, 1913, 110–123).–*Ditto.*
—, *ditto* XI (*ibid.* 12, 1913, 394–406).–*Ditto.*
—, *ditto* XII (Bull. Jard. Bot. Btzg II, 13, 1914, 53–77).–Coll. PULLE.
—, *ditto* XIII (Med. Rijksherb. *no* 23, 1915, 1–21).–Coll. JANOWSKI & others.
—, Die Orchideen von Niederländisch Neu-Guinea (Nova Guinea 8, 1909, 1–148, t. 1–46).
—, *ditto* (*ibid.* 8, 1911, 521–611, t. 75–112).
—, *ditto* (*ibid.* 12, 1913, 1–108, t. 1–28).
—, *ditto* (*ibid.* 12, 1915, 173–477, t. 55–99).
—, *ditto* (*ibid.* 14, 1929, 337–516, t. 41–87).–List.
—, *ditto* (*ibid.* 18, 1934, 9–85, t. 3–16).
—, in GIBBS, Contr. Fl. Phytog. Arfak Mts (1917) 105–127, 203–206.–List.
—, Neue Orchideen Papuasiens (Beitr. z. Fl.

v. Papuasien XX) (Bot. Jahrb. 66, 1934, 161–215).–Coll. Stein, Mayr; also some *spp.* from Japen & Waigeou Isl.

Williams, Amer. Orch. Soc. Bull. 10 (1942) 373–375.–New *Paphiopedilum.*

—, *ibid.* 11 (1943) 297–298.–2 new *Saccoglossum.*

—, Bot. Mus. Leafl. Harv. Univ. 12 (1946) 149–183, pl. 21–23.–Part Brass coll.

Solomon Islands: Carr, Kew Bull. (1934) 375–383.–Records coll. Waterhouse.

Micronesia: Schlechter, Bot. Jahrb. 56 (1920) 434–501.–Keys!

New Hebrides: Ames, J. Arn. Arb. 13 (1932) 127–144.

—, *ibid.* 14 (1933) 101–112.

Australia: Fitzgerald, R. D., Australian Orchids (1875–1895) vol. 1 (7 parts), vol. 2 (5 parts).–204 *spp.* represented on coloured plates; unfinished. *Non vidi.*

Nicholls, W. H., Orchids of Australia. Parts 1–2 (1 dated 1951), each with 24 col. pl.–Key to genera and *spp.*

Rupp, H. M. R., The Orchids of New South Wales. Sydney (1943) 1–152, fig.–Keys.

Genera

Acriopsis: Schlechter, Oester. Bot. Z. 50 (1900) 245–250, 286–290.–Revision; descr.; key.

Appendicula (*Lobogyne, Chilopogon, Cyphochilus*): Smith, Bull. Jard. Bot. Btzg II, *no* 8 (1912) 30–37.–List.

Arachnis (*Dimorphorchis*): Rolfe, Orch. Rev. 27 (1919) 149.

Smith, Nat. Tijd. Ned. Ind. 72 (1912) 71–76.–List.

Basigyne: Smith, Bull. Jard. Bot. Btzg II, *no* 25 (1924) 4–6.–Celebes, monotypic.

Bromheadia: Ridley, J. Linn. Soc. Bot. 28 (1891) 331–339.—Key.

Bulbophyllum § Cirrhopetalum: Smith, Bull. Jard. Bot. Btzg II, *no* 8 (1912) 19–29.–List *spp.*

Caladenia: Rupp, Proc. Linn. Soc. N.S.W. 71, 1946, 278–281.–Variab. *C. carnea.*

Camarotis: Smith, Nat. Tijd. Ned. Ind. 72 (1912) 96–98.–List.

Chiloschista: Diels & Mansfeld, Notizbl. Berl.-Dahlem 11 (1932) 491–498.–Rev.; key.

Chrysoglossum (*Collabium*): Smith, Bull. Jard. Bot. Btzg II, *no* 8 (1912) 1–3.–Sect. divisions.

Corybas (*Corysanthes*): Schlechter, in Fedde, Rep. 19 (1923) 18–24.–Nomencl.; census of all *spp.*

Cymbidium: Schlechter, in Fedde, Rep. 20 (1924) 96–105.–List.

Cyperorchis (*Iridorchis*): Schlechter, in Fedde, Rep. 20 (1924) 105–110.–List.

Cystorchis: Smith, in Fedde, Rep. 30 (1932) 329–331.–Key to Mal. *spp.*

Dendrobium: Finet, Bull. Mus. Hist. Nat. Paris 9 (1903) 295–303.–Key to sections; enum. *spp.* represented at Paris.

Dendrobium § Cadetia (*Cadetia*); Smith, Bull. Jard. Bot. Btzg II, *no* 8 (1912) 15–18.—List *spp.*

Dendrobium § Rhopalanthe (*partim*): Smith, Trop. Natuur 19 (1928) 23–26.

Dendrochilum (*Platyclinis*): Ames, Orchidaceae 3 (1908) 3–20.–New sect.; 4 new *spp.*; observ.; later he accepted *Acoridium* for Philip. *spp.; cf.* under Philippines.

Smith, Rec. Trav. Bot. Néerl. 1 (1904) 52–80.–Key!

Didymoplexis (*Leucolaena*): Kurz, J. Bot. 4 (1886) 40–41.–Discussion synonymy.

Schlechter, Bot. Jahrb. 45 (1911) 407–408.–Key.

Smith, Bull. Jard. Bot. Btzg III, 2 (1920) 20.

Epipogium: Schlechter, Bot. Jahrb. 45 (1911) 398–399.–Key.

Sprague & Green, Kew Bull. (1937) 475–476.

Eria § Aporodes: Smith, Blumea 5 (1945) 735–739.–List.

Eria (*Forbesina*): Smith, in Fedde, Rep. 32 (1933) 244.

Gastrochilus: Schlechter, in Fedde, Rep. 12 (1913) 313–317.–Enum. *spp.*; segregate from *Saccolabium.*

Gastrodia: Schlechter, Bot. Jahrb. 45 (1911) 409–410.–Key.

Glomera (*Giulianettia, Glossorrhyncha*): Smith, Bull. Dép. Agric. Ind. Néerl. *no* 15 (1908) 27–29.–List.

—, Bull. Jard. Bot. Btzg II, *no* 8 (1912) 7–14.–Sect. division; list *spp.*

Goodyera (*Salacistus*): Smith, Bull. Jard. Bot. Btzg III, 8 (1927) 353.

Grammatophyllum (*Grammangis*): Schlechter, Orchis 9 (1915) 99–109, 115–122.–Census; descr.; no keys.

Gynoglottis: Smith, Rec. Trav. Bot. Néerl. 1 (1904) 49–51.

Habenaria: Kraenzlin, Bot. Jahrb. 16 (1892) 52–223.–Rev.; keys!

Liparis: Ridley, J. Linn. Soc. Lond. Bot. 22 (1886) 244–297.–Monograph.

Malaxis (*Microstylis*): Ridley, J. Linn. Soc. Lond. Bot. 24 (1888) 308–351.

Nephelaphyllum: Gagnepain, Bull. Mus. Hist. Nat. Paris II, 4 (1932) 705–710.–Reduces the genus to *Tainia.*

Nervilia: Schlechter, Bot. Jahrb. 45 (1911) 399–405.–Key.

Sprague & Fischer, Kew Bull. (1927) 363–365.–Generic syn. (nomencl.).

Paphiopedilum: Hallier *f.*, Ann. Jard. Bot. Btzg 14 (1897) 34–52, t. 4.–Conspectus.

Phalaenopsis (*Doritis, Kingiella*): Reichenbach, Hamb. Gartenzeit. 16 (1860) 114–117.–Census; *clav. part.*

Rolfe, Gard. Chron. 26 (1886) 168–170, 212, 276–277.–Revision; no key.

Smith, Blumea 5 (1945) 755.–Synonymy genus.

Polystachya: Kraenzlin, in Fedde, Rep. Beih. 39 (1926) 1–136.

Pomatocalpa: Smith, Nat. Tijd. Ned. Ind. 72 (1912) 102–108.–List.

Pristiglottis (*Cystopus* Bl.): Smith, in Act. pro Fauna & Flora Univ. II Bot. 1 *no* 14 (1934) 1–6; *ibid. no* 17 (1935) 4.–List of *spp.*

Pterostylis: RUPP, Proc. Linn. Soc. N.S.W. 58 (1933) 421–428.

Rhynchostylis (*Anota*): HOLTTUM, Orchid J. 2 (1953) 123–125.–*Anota* reduced; key; references.

Robiquetia: SMITH, Nat. Tijd. Ned. Ind. 72 (1912) 112–115.–List.

Sarcanthus (*Cleisostoma*): SMITH, Nat. Tijd. Ned. Ind. 72 (1913) 79–96.–List.

Sarcochilus: RUPP, Proc. Linn. Soc. N.S.W. 76 (3–4) (1951) 49–56.–Rev. Australian *spp.*

Sarcopodium: ROLFE, Orch. Rev. 18 (1910) 237–240.–Mostly incl. as a section of *Dendrobium*; census of 21 *spp.*

Schoenorchis: SMITH, Nat. Tijd. Ned. Ind. 72 (1912) 99–101.–List.

Spiranthes: VAN STEENIS, *c.s.*, Blumea 6 (1950) 361.–Syn. *S. lancea.*

Taeniophyllum (*Geissanthera*): WILLIAMS, Bot. Mus. Leafl. Harv. Univ. 5 (1938) 164–170.–Some new comb. & descr.

Tainia (*Mitapetalum, Ascotainia, Mischobulbum*): GAGNEPAIN, Bull. Mus. Hist. Nat. Paris II, 4 (1932) 705–710.–Includes *Nephelaphyllum* in *Tainia.*

SMITH, Bull. Jard. Bot. Btzg II, *no* 8 (1912) 3–6. –Sect. division.

Thrixspermum (*Dendrocolla*): SCHLECHTER, Orchis 5 (1911) 46–48, 54–58.–Census; concise descr.; no keys.

Tropidia (*Schoenomorphus*): MANSFELD, in FEDDE, Rep. 36 (1934) 58–59.–Reduction.

Vanda (*Papilionanthe*): LINDLEY & PAXTON, Fl. Gard. 2 (1852) 20–22.

SCHLECHTER, Orchis 9⁴ (1915) 77–80.

SMITH, Teysmannia 9 (1898) 200–208.–Disc. & char. Mal. *spp.*; in Dutch.

Vandopsis: SMITH, Nat. Tijd. Ned. Ind. 72 (1912) 76–78.–List.

Vanilla: ROLFE, J. Linn. Soc. Lond. Bot. 32 (1896) 439–478.–Revision; key.

Zeuxine (*Monochilus*): AMES, Bot. Mus. Leafl. Harv. Univ. 5 (1938) 100–101.–Nomencl. transfers.

SMITH, Bull. Jard. Bot. Btzg III, 8 (1927) 353.–Generic syn.

OROBANCHACEAE

(*Aeginetiaceae*)

BECK-VON MANNAGETTA, G., Pflanzenreich Heft 96 (1930) 1–348, 24 fig.

LIVERA, E. J., Aeginetiaceae. A new natural family of flowering plants (Ann. R. Bot. Gard. Perad. 10, 1927, 145–159).—List.

Genera

Aeginetia: BAKHUIZEN VAN DEN BRINK, Trop. Natuur 10 (1921) 154–158, 164–173, 11 fig.–Key.

—, Bull. Jard. Bot. Btzg III, 13 (1933) 77–91, 5 fig.–Revision; key.

Christisonia: WORSDELL, Ann. Bot. 9 (1895) 103–136, t. 5–6.–Anat.

OXALIDACEAE

KNUTH, R., Pflanzenreich Heft 95 (1930) 1–481, fig. 1–28.

—, Pflanzenfamilien ed. 2, 19a (1931) 11–42, fig. 2–19.

Local

New Guinea: LAUTERBACH, Bot. Jahrb. 62 (1929) 482.

PULLE, Nova Guinea 8 (1910) 389.

—, *ibid.* 8 (1911) 655.

Genera

Biophytum: VAN STEENIS, Bull. Bot. Gard. Btzg III, 18 (1950) 449–455, 2 fig.–Revision; key.

—, Reinwardtia 1 (1952) 467.–Addition.

Connaropsis (*cf. sub Dapania*): RIDLEY, Kew Bull. (1930) 75–76.–New *sp.* Borneo.

Dapania: HALLIER, Beih. Bot. Centralbl. 34, ii (1916) 25–27.

KNUTH, Bot. Jahrb. 50 Suppl. (1914) 234.–*Connaropsis* is reduced to *Dapania* (*sic*!).

KORTHALS, Ned. Kruidk. Arch. 3 (1853) 381–384.–Type descr.

Oxalis: CALDER, Rec. Bot. Surv. Ind. 6 (1919) 325–341, t. 1–7.–Key Indian *spp.* native & introduced.

PETCH, Ann. R. Bot. Gard. Perad. 5 (1914) 541. –In Ceylon.

VAN STEENIS, Bull. Jard. Bot. Btzg III, 13 (1934) 235.–List native *spp.*

Sarcotheca: HALLIER *f.*, Med. Rijksherb. Leiden *no* 1 (1910) 1–2.–List.

—, Beih. Bot. Centralbl. 34, ii (1916) 27–30.–List new *spp.*

MIQUEL, Ill. Fl. Arch. Ind. (1871) 69–71.–Descr.

RIDLEY, Kew Bull. (1930) 75–76.–As *Connaropsis.*

PALMAE

BECCARI, O., Reliquiae Schefferianae (Ann. Jard. Bot. Btzg 2, 1885, 77–171, t. 1–14).–Descr.; list of *spp.* of a number of genera.

—, Nuovi studi sulle Palme Asiatiche (Malesia 3, 1886, 58–149, pl. 6–11).

—, Nuove Palme Asiatiche (Malesia 3, 1889, 169–200).–Mixed diagn.

—, Asiatic Palms. Lepidocaryae and Corypheae (Ann. R. Bot. Gard. Calc. 11–13, 1908–1931).

—, Recensio della palme del vecchio mondo appartenenti alla Tribù delle Corypheae con descrizione delle specie e varietà nuove che vi appartengono (Webbia 5, 1921, 1–70).

BLUME, C. L., Rumphia 2 (1837/8) 37–176, t. 82–137.–Descr. *Licuala, Pericycla, Saribus, Corypha, Areca, Pinanga, Kentia, Oncosperma, Cyrtostachys, Calyptrocalyx, Iguanura, Wallichia, Orania, Ptychosperma, Saguerus, Caryota, Sagus, Salacca, Ceratolobus, Korthalsia.* Extr. in Bull. Sc. Phys. Nat. Néerl. (1838) 61–67 and in Ann. Sc. Nat. II, 10 (1838) 369–377.

—, Rumphia 3 (1842/3) 1–90.–Descr. of *Daemonorops, Calamus, Nypa, Plectocomia*; notes on uses of palms.

Burret, M., Beiträge zur Kenntnis der Palmen von Malesia, Papua, and der Südsee (in Fedde, Rep. 24, 1928, 253–296).–Mixed notes, descr. & lists.

—, Palmae Gerontogeae IV (Notizbl. Berl.-Dahlem 12, 1935, 590–602).

—, Palmae Gerontogeae V (Notizbl. Berl.-Dahlem 13, 1936, 185–200).

—, Indomalayische Palmen (Notizbl. Bot. Gart. Berl.-Dahlem 15, 1940, 164–210).–New descr. of *Calamus*, *Daemonorops*, *Caryota*, and *Pinanga*, all from Sumatra except one, coll. Burret.

—, Systematische Übersicht über die Gruppen der Palmen (Mitt. Bot. Gart. & Mus. Berl.-Dahlem 1, 1953, 59–74).–Key to genera of palms (not finished).

Martelli, U., Generi, specie e varietà nuove di palme gerontogee della tribù Arecaceae lasciate inedite dal Dr. Od. Beccari (Atti Soc. Tosc. Sc. Nat. 44, 1934, 114–176).–Descr. new *spp.*; new comb. & records of many genera from various sources of Indo-Malaysia; some of Pacific. In Ital.

Martius, K. F. P. von, Historia naturalis Palmarum ... (1823–50). Three volumes in two, pp. 1–cxcviii, 1–350, t. 1–445. Volume 2 and 3 Expositio Palmarum systematica, 350 pp., 180 pl.

Miquel, F. A. W., De Palmis Archipelagi Indici observationes novae (Verh. Kon. Akad. Wet. A'dam 11^5, 1868, 1–33, t. 1).–Descr. & list new or noteworthy *spp.*

Scheffer, R. H. C. C., Sur quelques palmiers du groupe des Arécinées. I (Nat. Tijd. Ned. Ind. 32, 1873, 149–193).–Descr. and keys to *spp.* of genera of *Arecineae*.

—, *ditto* II (Ann. Jard. Bot. Btzg 1, 1876, 52–54, 103–164, pl. 1–30).–List Papuan *spp.* of palms; disc. & descr.; key to genera of *Arecineae; spp.* listed, exceptionally a key.

Local

India: Beccari & Hooker, in Hook. *f.* Fl. Br. Ind. 6 (1892) 402–448; *ibid.* (1893) 449–483.

Blatter, The palms of British India & Ceylon. London (1926) i–xxviii, 1–600. t, 1–106, fig. 1–27.–Descr.; keys to genera, a few to *spp.*

Indo-China: Beccari, Webbia 3 (1910) 191.–List Indo-Chinese palms.

—, Bull. Mus. Hist. Nat. Paris. 17 (1911) 148–160.–Concise key.

Gagnepain & Conrard, Fl. Gén. Indo-Chine 6 (1937) 946–1056.

Sumatra: Miquel, in Miquel, J. Bot. 1 (1861) 1–29. –List; some new *spp.*

Malay Peninsula: Burret, Notizbl. Bot. Gart. Berl.-Dahlem 15 (1941) 316–318.–*Symphyogyne n. g.*, 2 *spp.*, formerly *Livistona rupicola*.

Furtado, Palmae Malesicae I (in Fedde, Rep. 35, 1934, 273–283).–Mostly Mal. Pen & Bornean *Pinanga*.

—, *ditto* II (Gard. Bull. Str. Settl. 8, 1935, 159–163).–*Nenga*; nomencl., synon.

—, *ditto* III (*ibid.* 8, 1935, 241–262).–Descr. *Calamus*; also of Borneo.

—, *ditto* V (*ibid.* 8, 1935, 339–367).–*Daemonorops*; list.

—, *ditto* VI (*ibid.* 9, 1937, 152–181).–Some *spp.* of *Daemonorops § Cymbospathae.*

—, *ditto* VIII (*ibid.* 11, 1940, 31–73, 9 fig.).–*Licuala*; keys.

—, *ditto* IX (*ibid.* 11, 1941, 236–243, fig. 1–2).–2 monotypic new *gen. Liberbaileya* and *Maxburrettia* (*Coryphoideae*).

—, *ditto* X (*ibid.* 12, 1949, 378–403).–*Salacca*; key.

—, *ditto* XI (*ibid.* 13, 1951, 300–324).–*Korthalsia*; key.

—, *ditto* XII (*ibid. l. c.* 325–338).–*Plectocomiopsis*; key.

—, *ditto* XIII (*ibid. l. c.* 339–344).–*Myrialepis.*

—, *ditto* XIV (*ibid. l.c.* 345–350).–*Plectocomia.*

—, *ditto* XV (*ibid. l.c.* 351–359).–*Ceratolobus.*

—, *ditto* XVI (*ibid. l.c.* 360–365).–*Calospatha*; key.

—, *ditto* (*ibid.* 14, 1953, 49–147, 41 tab.).–Rev. *Daemonorops*; plates; key!

Ridley, Mat. Fl. Mal. Pen. (Monocot.) 2 (1907) 133–221.–Keys.

Borneo: Beccari, Nuovo Giorn. Bot. Ital. 3 (1871) 11–30.–Some new descr. & records in *Caryota*, *Eugeissona*, *Metroxylon*, and *Teysmannia.*

Merrill, Sarawak Mus. J. 3 (1928) 518.–New *Pinanga.*

Miquel, Anal. Bot. Ind. 1 (1850) 2–7; repr. Verh. Kon. Ned. Inst. 1e kl. 3e Reeks vol. 3.–Enumeration; some new *Calamus.*

Philippines: Beccari, in Perkins, Fragm. Fl. Philip. pt 1 (1904) 45–48.–List.

—, Webbia 1 (1905) 315–359.–List; descr.

—, Philip. J. Sc. 2 (1907) Bot. 219–240.–Descr. *n. spp.*

—, Philip. J. Sc. 3 (1908) Bot. 339–342.–List *spp.* of Batanes and Babuyanes Isl.

—, in Elmer, Leafl. Philip. Bot. 36 (1909) 639–650.–List.

—, Philip. J. Sc. 4 (1909) Bot. 601–637, 2 pl.–Descr. new *spp.*

—, Philip. J. Sc. 6 (1911) Bot. 229–230.–List Polillo Isl. *spp.*

—, in Elmer, Leafl. Philip. Bot. 8 (1919) 2997–3067.–Descr. of *spp.* coll. by Elmer; also key to genera.

—, Philip. J. Sc. 14 (1919) 295–363, t. 1–3.–Revision with keys!

Furtado, Gard. Bull. Str. Settl. 8 (1935) 321–338.–Verification ratans descr. by Blanco.

Moluccas: Beccari, Philip. J. Sc. 12 (1917) Bot. 81.–New *Calamus* (Ambon).

New Guinea: Beccari, Nuovo Giorn. Bot. Ital. 20 (1888) 177–180.–New *spp.*

—, Webbia 1 (1905) 281–313, fig. 1–8.–New gen. & new *spp.*; descr. only.

—, in Nova Guinea 8 (1909) 203–220, t. 50–51. –Descr. new *spp.*

—, Bot. Jahrb. 52 (1914) 19–39.–List; new *spp.*

—, in Gibbs, Contr. Fl. Phytog. Arfak Mts (1917) 91–98, 200.–List.

—, Bot. Jahrb. 58 (1924) 441–462.–List new *spp.*

Burret, J. Arn. Arb. 12 (1931) 264–269.–Descr. new *spp.*

—, Notizbl. Berl.-Dahlem 11 (1933) 704–713. –Descr. new *spp.*

—, *ibid.* 12 (1935) 309–348.–Descr. new *spp.*; records; no keys.

—, *ibid.* 13 (1936) 65–101.–Descr. new *spp.*, many of Solomon Isl.

—, *ibid.* 13 (1936) 317–332.–Descr. new *spp.*

—, *ibid.* 13 (1937) 468–475.–Descr. new *spp.*

—, J. Arn. Arb. 20 (1939) 187–212.–Records and descr. new *spp.*

Furtado, Gard. Bull. Str. Settl. 9 (1937) 182–186.–New *Calamus.*

Ridley, J. Bot. 24 (1886) 358–359.–2 new *spp.* Forbes coll.

Solomon Islands: Burret, Notizbl. Berl.-Dahlem 13 (1936) 65–101.–List new *sp. & n.g.*

Micronesia: Beccari, Bot. Jahrb. 59 (1924) 11–16. –*Gulubiopsis, Ponapea n.g.*

Genera

Actinophloeus: Burret, in Fedde, Rep. 24 (1928) 271–273.–List.

—, Notizbl. Berl.-Dahlem 11 (1930) 205–207.–2 new *spp.*

Adelonenga (*Hydriastele*): Burret, Notizbl. Berl.-Dahlem 13 (1936) 482–487.–List.

Areca (*Mischophloeus*): Burret, Notizbl. Berl.-Dahlem 13 (1935) 199–200.–New *sp.* Celebes.

Furtado, in Fedde, Rep. 33 (1933) 217–239.–Delimitation; key to infrageneric divisions; list of *spp.*

Scheffer, Nat. Tijd. Ned. Ind. 32 (1873) 149–170.–List.

Barkerwebbia: Beccari, Webbia 1 (1905) 281–289.–Monotypic.

Borassodendron: Beccari, Webbia 4 (1914) 359–373.–New genus from Malaya.

Borassus: Beccari, Webbia 4 (1914) 293–359; 373–385.–Key.

Brassiophoenix: Burret, Notizbl. Berl.-Dahlem 12 (1935) 345–348.–Monotypic; New Guinea.

Calamus: Bartlett, Pap. Mich. Acad. Sc. 25^1 (1939) 3–14, pl. 1–4.–Descr. new Sumatran *sp.*, type of new subgenus.

Beccari, Rec. Bot. Surv. Ind. 2 (1903) 197–218. –Compl. list; descr. new *spp.*

—, Ann. R. Bot. Gard. Calc. 11 (1908) 1–518, t. 1–231.–Complete revision.

—, *ibid.* (1913) Suppl., i–x, 1–142, t. 1–83.–Records & descr.

Burret, Notizbl. Berl.-Dahlem 15 (1943) 800–819.–Some descr. new *spp.*

Ceratolobus: Beccari, Ann. R. Bot. Gard. Calc. 12^2 (1918) 18.

Cocos: Beccari, Malpighia 1 (1887) 343–354, 441–454, t. 9; *ibid.* 2 (1888) 85–95, 147–156.–Segregation of *Cocos.*

—, Agric. Col. 10 (1916) 435 *seq.*, extracted in Kew Bull. (1917) 331–335.–Key to *Cocos* and allied genera; list.

—, Philip. J. Sc. 12 (1917) Bot. 27–43.–Origin and distr. of *C. nucifera.*

Coleospadix: Burret, in Fedde, Rep. 24 (1928) 285–288.–List; descr.

Corypha: Beccari, Webbia 5 (1921) 6–10.

—, Ann. R. Bot. Gard. Calc. 13 (1931) 10–32.–Key; descr.

Daemonorops: Beccari, Rec. Bot. Surv. Ind. 2 (1903) 218–230.–Compl. list; descr. new *spp.*

—, Ann. R. Bot. Gard. Calc. 12^1 (1911) 1–237, t. 1–109.

Burret, Notizbl. Berl.-Dahlem 15 (1943) 797–800.–Some new *spp.*

Eugeissona: Beccari, Webbia 4, pt 1 (1913) 190–202, fig. 8–11.–Genus transferred from the *Lepidocaryeae* to *Cocoineae.*

—, Ann. R. Bot. Gard. Calc. 12^2 (1918) 196–205.

Gronophyllum: Burret, Notizbl. Berl.-Dahlem 13 (1936) 200–205.–List.

Hydriastele: Burret, in Fedde, Rep. 24 (1928) 291–292.

—, Notizbl. Berl.-Dahlem 13 (1937) 482–487.

Iguanura: Beccari, Malesia 3 (1886) 100–107.

Kentia: Beccari, Webbia 4 (1913) 143–156.–List.

Korthalsia: Beccari, Ann. R. Bot. Gard. Calc. 12^2 (1918) 104–155.–Key; descr.

Laccospadix: Burret, in Fedde, Rep. 24 (1928) 289–291.

Licuala: Beccari, Malesia 3 (1886) 70–90.–List.

—, Webbia 5 (1921) 22–55.–Old World *spp.* key.

—, Ann. R. Bot. Gard. Calc. 13 (1931) 109–224. –Key; descr.

Burret, Notizbl. Berl.-Dahlem 15 (1941) 327–336.–List; no key.

Linospadix: Burret, Notizbl. Berl.-Dahlem 12 (1935) 330–331.–List.

Livistona: Beccari, Ann. R. Bot. Gard. Calc. 13 (1931) 43–108.–Key; descr.

Burret, Notizbl. Berl.-Dahlem 15 (1941) 319–327.–List; no key.

Metroxylon: Beccari, Ann. R. Bot. Gard. Calc. 12^2 (1918) 156–195.–Key; descr.

Nengella (*Leptophoenix*): Burret, Notizbl. Berl.-Dahlem 13 (1936) 312–317.–List.

Paralinospadix: Burret, Notizbl. Berl.-Dahlem 12 (1935) 331–336.–List.

Phoenix: Beccari, Malesia 3 (1890) 345–416, pl. 43–44.–Key.

Gamble & Fischer, Fl. Pres. Madras pt 9 (1931) 1558–1560.–Key.

Pholidocarpus: Beccari, Malesia 3 (1886) 90–92. –Key.

—, Ann. R. Bot. Gard. Calc. 13 (1931) 227–238.–Key; descr.

Pigafetta: Beccari, Ann. R. Bot. Gard. Calc. 12^2 (1918) 99–103.–Key; descr.

Pinanga: Beccari, Malesia 3 (1886) 110–147.–Key.

Burret, Notizbl. Berl.-Dahlem 13 (1935) 185–186.–New *sp.* Sumatra.

Plectocomia: Beccari, Ann. R. Bot. Gard. Calc. 12^2 (1918) 19–45.–Key; descr.

Plectocomiopsis: Beccari, Ann. R. Bot. Gard. Calc. 12^2 (1918) 46–66.–Key; descr.

Gagnepain, Not. Syst. 6 (1937) 149–160.–Discussion affinities with *Myrialepis* and a new genus from Indo-China.

Pritchardia: Beccari, Malesia 3 (1889) 281–317, t. 37–38.

—, Webbia 4 (1913) 202–240.–Key.

—, Ann. R. Bot. Gard. Calc. 13 (1931) 308–316.–Key; descr.

Pseudopinanga: BURRET, Notizbl. Berl.-Dahlem 13 (1936) 188–198.–List; segregate from *Pinanga.*

Ptychococcus: BURRET, in FEDDE, Rep. 24 (1928) 261–262.–List.

Ptychosperma: BURRET, in FEDDE, Rep. 24 (1928) 263–271.–List.

—, Notizbl. Berl.-Dahlem 12 (1935) 595–599.–List.

—, *ibid.* 13 (1936) 384–385.

Rehderophoenix: BURRET, Notizbl. Berl.-Dahlem 13 (1936) 86.

Rhopaloblaste: BURRET, in FEDDE, Rep. 24 (1928) 288–289.–Descr.

Roystonea (*Oreodoxa*)**:** BAILEY, Gentes Herb. 3 (1935) 343–387.–Key.

—, *ibid.* 8 (1949) 114–134, fig. 24–40.–New revision; key.

Sabal: BAILEY, Gentes Herb. 3 (1934) 275–337.–Key.

Salacca (*Zalacca*)**:** BECCARI, Malesia 3 (1886) 63–68.—List.

—, Ann. R. Bot. Gard. Calc. 12^{2} (1918) 67–98.–Key; descr.

Siphokentia: BURRET, Notizbl. Berl.-Dahlem 10 (1927) 198–201.–New genus; Moluccas.

Symphyogyne: BURRET, Notizbl. Berl.-Dahlem 15 (1941) 316–318.–2 *spp.*; Mal. Peninsula.

Teysmannia: BECCARI, Ann. R. Bot. Gard. Calc. 13 (1931) 238–241.

MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 89–90.–Descr.

PALM & JOCHEMS, Trop. Natuur 13 (1924) 9–12, fig. 1–4.–Descr.; in Dutch.

PANDANACEAE

KURZ, S., Revision of the Indian screwpines and their allies (J. Bot. 5, 1867, 93–106, 125–136, t. 62–65).–List; no keys; contains also the Mal. *spp.*

MARTELLI, U., Enumerazione delle 'Pandanaceae' (Webbia 3, 1910, 307–327).–*Freycinetia;* list.

—, *ditto* (*ibid.* 4, 1913, 5–105, t. 1–17).–*Pandanus*; list.

—, *ditto* (*ibid.* 4, 1914, 399–435, t. 18–43).–Descr. new *spp.* of *Pandanus.*

—, La distribuzione geographica delle Pandanaceae (Atti Soc. Toscana Sc. Nat. Pisa, Mem. 43, 1933, 190–209).–General; in Ital.

SOLMS-LAUBACH, H., Monographia Pandanacearum (Linnaea 42, 1878, 1–110).–No keys.

—, Ann. Jard. Bot. Btzg 3 (1883) 89–104, t. 16.–New *spp.*, coll. BECCARI in Celebes, Aru, Key and New Guinea; list.

WARBURG, O., Pflanzenreich Heft 3 (1900) 1–97, fig. 1–22.

Local

India: BECCARI & HOOKER *f.*, Fl. Br. Ind. 6 (1893) 483–488.

KURZ, J. As. Soc. Beng. 38, ii (1869) 145–151.–Rev. Ind. *Pandanus.*

Indo-China: MARTELLI, Fl. Gén. Indo-Chine 6 (1937) 1056–1069.

Sumatra: KANEHIRA, J. Jap. Bot. Tokyo 16 (1940) 101–105.–New *spp.*; list of Sumatran *Pandanus.*

Malay Peninsula: KANEHIRA, J. Jap. Bot. Tokyo 14 (1938) 429–438.–Some records.

RIDLEY, Mat. Fl. Mal. Pen. (Monocot.) 2 (1907) 221–235.–Keys.

Borneo: KANEHIRA, J. Jap. Bot. 14 (1938) 429–438, 10 fig.–Some records.

MARTELLI, Univ. Calif. Publ. Bot. 12 (1930) 369–370, t. 48.–New *sp.*

Java: BACKER, Handb. Fl. Java 1 (1925) 32–47.–Key; also on sterile characters & incl. some cult. *spp.*

Celebes: FAGERLIND, Svensk Bot. Tidskr. 34, (1940) 101–116.–New *sp.*

—, Bot. Notiser (1941) 173–182.–Coll. KJELLBERG.

Philippines: ELMER, Leafl. Philip. Bot. 1 (1906) 74–77, 80–82.–New *spp. Pandanus.*

—, *ibid.* 1 (1907) 212–219.–New *Freycinetia.*

—, *ibid.* 10 (1938) 3601–3610.–Descr. new *Freycinetia.*

—, *ibid.* 10 (1939) 3771–3776.–New *spp.* of *Pandanus & Freycinetia.*

—, *ibid.* 10 (1939) 3811–3818, t. 1–3.–Notes on *Pandanus utilissimus* ELM.

MARTELLI, Philip. J. Sc. 3 (1908) Bot. 59–72.–List new *spp.*; no key.

—, Webbia 3 (1910) 5–35.–Key to *Freycinetia.*

—, in ELMER, Leafl. Philip. Bot. 3 (1911) 1109–1132.–New *spp.* of *Pandanus & Freycinetia.*

MERRILL, Philip. J. Sc. 3 (1908) Bot. 307–315.–Rev. of *Freycinetia* with key.

—, *ibid.* 26 (1925) 448–451.–4 new *Pandanus* from Busuanga.

—, *ibid.* 29 (1926) 476.–New *Pandanus* from Bohol.

QUISUMBING & MERRILL, Philip. J. Sc. 37 (1928) 134–135.–2 new *Pandanus* from Luzon.

WARBURG, in PERKINS, Fragm. Fl. Philip. pt 1 (1904) 50.–New *Pandanus.*

Moluccas: FAGERLIND, Svensk Bot. Tidskr. 34 (1940) 101–116.–New *sp.* Buru.

New Guinea: KANEHIRA, Bot. Mag. Tokyo 54 (1940) 249–260, 9 fig.–Compl. list; no key.

KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 55 (1941) 251–308.–List, with new *spp.*

MARTELLI, Bot. Jahrb. 49 (1913) 60–67.–List; no key.

—, J. Arn. Arb. 10 (1929) 137–142, t. 18.–New *spp.* BRASS coll.

MERRILL & PERRY, J. Arn. Arb. 20 (1939) 139–186, t. 1–2.–Descr., list BRASS coll.; no keys.

—, *ibid.* 21 (1940) 163–175.–Many new *spp. Pandanus & Freycinetia.*

RIDLEY, J. Bot. 24 (1886) 359.–List FORBES coll.; 2 new *Freycinetia.*

WHITE, J. Arn. Arb. 10 (1929) 201–202.–List BRASS coll.

Micronesia: KANEHIRA, J. Jap. Bot. 12 (1936) 495–501, 545–554, 21 fig.–List; no keys.

—, *ibid.* 12 (1936) 783–792, 6 fig.–Figures.

—, *ibid.* 13 (1937) 322–331, fig. 7–14.–Figures.

Fiji: Martelli, Univ. Calif. Publ. Bot. 12 (1930) 325–335, t. 37–44.

Perry, J. Arn. Arb. 31 (1950) 208–213.–*Freycinetia*, revis.; key.

Queensland: Martelli, Proc. R. Soc. Queensl. 36 (1925) 129–130, t. 25.–New *sp.*

Genera

Freycinetia: Hemsley, Kew Bull. (1896) 164–167.–Descr. new *Freycinetias.*

Martelli, Webbia 3 (1910) 167–186.–New *spp.* from Borneo, Moluccas, Timor, and New Guinea.

Pandanus: Balfour, J. Linn. Soc. Lond. Bot. 17 (1878) 33–68.–Enumeration *spp.*

Fagerlind, Svensk Bot. Tidskr. 34 (1940) 101–116.–4 new *spp.* cult. Bogor.

Kurz, in Miquel, Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 52–54.–Descr.; no key.

—, J. As. Soc. Beng. 38, ii (1869) 145–151.–Rectification of sections.

Martelli, Bull. Soc. Bot. Ital. (1904) 298–304. –Brief descr. keyed out.

—, Nuovo Giorn. Bot. Ital. n.s. 36 (1929) 328–337.–Nomencl. *Pandanus tectorius* & *odoratissimus.*

Sararanga: Stapf & Hemsley, J. Linn. Soc. Lond. Bot. 32 (1896) 479–489, t. 4–7.–Revision; morphol.

PAPAVERACEAE

Fedde, F., Pflanzenreich Heft 40 (1909) 1–430, fig. 1–43.–Revision of *Hypecoideae* & *Papaveroideae;* some genera are: *Papaver*, *Argemone*, *Eschscholzia*, and *Bocconia.*

—, Pflanzenfamilien ed. 2, 17b (1936) 5–145, fig. 1–76.

Hutchinson, J., The genera of Papaveraceae (Kew Bull. 1925, 161–168).–Key to genera.

Steenis, C. G. G. J. van, Fl. Mal. I, 5 (1954) 114–117, fig. 1–2.

Local

Java: Backer, Schoolfl. Java (1911) 51–53.

—, Onkruidfl. Jav. Suiker. pt 2 (1930) 249–250.

Genera

Argemone: Prain, J. Bot. 33 (1895) 129–135. 176–178, 207–209, 307–312, 325–333, 363–371. –Revision; key!

Bocconia: Hutchinson, Kew Bull. (1920) 275–281.–Revision; key!

Chelidonium: Prain, Bull. Herb. Boiss. 3 (1895) 570–587.

Meconopsis: Taylor & Cox, An account of the genus Meconopsis. London (1934) 1–130.

PASSIFLORACEAE

Blume, C. L., Rumphia 1 (1836) 165–170.–No key.

Hallier *f.*, H., Indonesische Leidensblumen (Meded. Rijksherb. Leiden *no* 42, 1922, 1–17). –Revision; list.

Harms, H., Pflanzenfamilien ed. 2, 21 (1925) 470–507.

Killip, E. P., The American species of Passifloraceae (Field Mus. Nat. Hist. (bot. ser.) 19, 1938, 7–613).–Keys!

Masters, M. T., Contributions to the natural history of the Passifloraceae (Trans. Linn. Soc. 27, 1871, 593–645, t. 64–65, 1 fig.).–With enumeration of genera and *spp.* of tribe *Passifloreae* with synonyms.

Local

India: Chakravarty, Bull. Bot. Soc. Bengal 3 (1949) 45–71, 2 pl.–Revision Ind. *spp.*; descr.; keys.

Sumatra: Merrill, Contr. Arn. Arb. 8 (1934) 110–111.–New *Adenia.*

Borneo: Ridley, Kew Bull. (1938) 112.–List of *Adenia* records.

Java: Backer, Bekn. Fl. Java (em. ed.) 4a (1942) fam. 87.

van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 400–401.–*P. capsularis.*

New Guinea: Merrill & Perry, J. Arn. Arb. 24 (1943) 210.–Record *Hollrungia.*

—, *ibid.* 29 (1948) 160.–Record *Hollrungia.*

—, *ibid.* 30 (1949) 44.–List.

Pulle, Nova Guinea 8 (1911) 673.–Record.

White, J. Arn. Arb. 10 (1929) 244.–Record.

Genera

Hollrungia: van Steenis, Reinwardtia 1 (1952) 480–481.–Revision; E. Malaysia.

PEDALIACEAE

(*incl. Martyniaceae*)

Backer, C. A., Fl. Mal. I, 4 (1951) 216–221, fig. 1–3.

Bruce, E. A., Notes on African Pedaliaceae (Kew Bull. 1953, 417–429).–Contains notes on *Sesamum* and *Josephinia.*

PENTAPHRAGMATACEAE

Poulson, V. A., Pentaphragma ellipticum sp. nov. Et Bidrag til Kundskab om Slaegten Penta-. phragma Wall. (Vidensk. Medd. Naturh. Før. Kjøbenhavn, 1903, 319–331, t. 4–5).–Descr. new *sp.* Mal. Pen.; anatomy; considerations on affinity.

Shaw, H. K. Airy, The Pentaphragmataceae of the Oxford University Expedition to Sarawak (Kew Bull. 1941, 233–236).–Descr. family; discussion affinity.

—, Fl. Mal. I, 4 (1953) 517–528, fig. 1–3.

Local

Sumatra: Merrill, Pap. Mich. Ac. Sc. Arts & Lett. 19 (1934) 201–203.–2 new *spp.*

Ridley, J. Fed. Mal. St. Mus. 8, pt 4 (1917) 56. –New *sp.*

Borneo: Airy Shaw, Kew Bull. (1941) 235–236.–Records Richards coll.

Philippines: Philip. J. Sc. 37 (1928) 211.–New *sp.*

Moluccas: Kurz, Bot. Zeit. 30 (1872) 136.–New *sp.* from Batjan.

New Guinea: Pulle, Nova Guinea 8 (1910) 407, (1911) 691.–Records.

Genera

Pentaphragma: Airy Shaw, Kew Bull. (1953) 241–249.–Descr. new *spp.*

PENTAPHYLACACEAE

Mattfeld, J. Pflanzenfamilien ed. 2, 20b (1942) 13–21.

Tieghem, Ph. van, in Morot, J. Bot. 14 (1900) 189–193.–Morphol.

Local

Indo-China: Gagnepain, Suppl. Fl. Gén. Indo-Chine 1 (1943) 332–334.–Descr.; key.

Sumatra: van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 404.–First record.

Malay Peninsula: Ridley, Fl. Mal. Pen. 1 (1922) 205–206.

—, *ibid.* 5 (1925) 291.

PERIPTERYGIACEAE

See Icacinaceae

PHILYDRACEAE

Caruel, T., in DC. Monogr. Phan. 3 (1881) 1–6.–No key.

Pilger, R., Pflanzenfamilien ed. 2, 15a (1930) 190–191.

Skottsberg, C., Bemerkungen über die Philydraceen (Bot. Jahrb. 65, 1932, 253–274, 65 fig.).

—, The Philydraceae of Netherlands India (Bull. Jard. Bot. Btzg III, 13, 1933, 110–113).–Revision; key.

—, Fl. Mal. I, 4^1 (1948) 5–7, fig. 1.

PHYTOLACCACEAE

Backer, C. A., Fl. Mal. I, 4 (1951) 228–232, fig. 1.

Heimerl, A., Pflanzenfamilien ed. 2, 16c (1934) 135–164.

Walter, H., Pflanzenreich Heft 39 (1909) 1–154, fig. 1–42.

PINACEAE

See Coniferae

PIPERACEAE

Blume, C. L., Monographie der Oost-Indische pepersoorten (Verh. Bat. Gen. K. & W. 11, 1826, 139–245).–Descr. many new *spp.* of *Piper.*

Candolle, C. de, in DC. Prod. 16, 1 (1869) 235–471.–Descr.; partial keys.

—, Piperacearum clavis analytica (Candollea 1, 1923, 65–415).–Keys to *Piper* & *Peperomia.*

Miquel, F. A. W., Systema Piperacearum. Fasc. 1 (1843) 1–304, fasc. 2 (1844) 305–575.–Key to genera; keys or partial keys to *spp.*

—, Illustrationes Piperacearum (Nov. Act. Acad. Leop.-Carol. Nat. Cur. 21, Suppl. 1846, 1–87, t. 1–92).–Descr.; no keys.

—, Animadversiones in Piperaceas Herbarii Hookeriani (Lond. J. Bot. 4, 1845, 410–470).–Descr.

—, Mantissa Piperacearum e speciminibus Musei Vindobonensis, Regii Monacensis et Martiana (Linnaea 20, 1847, 117–182).–Enum. and descr.

—, Piperaceae Reinwardtianae (*ibid.* 21, 1848, 480—486).–Enum. and descr.

—, Ann. Mus. Bot. Lugd.-Bat. 1 (1863–64) 134–141.–List new *spp.*

Local

Malay Peninsula: de Candolle, Rec. Bot. Surv. Ind. 6 (1912) 1–29.–Descr. new *spp.*

Borneo: de Candolle, Ann. Cons. Jard. Bot. Genève 21 (1920) 279–295.–Descr.

Schwartz, Mitt. Allg. Inst. Bot. Hamburg 7 (1931) 231–234.–List; new *spp.*

Java: de Candolle, Ann. Cons. Jard. Bot. Genève 15–16 (1912) 231–235.–Enum.; descr. coll. Hochreutiner; some new *spp.*

—, Med. Rijksherb. Leiden 22 (1914) 1–7.–Enum., descr.

—, Ann. Cons. Jard. Bot. Genève 21 (1920) 271–277.

Koorders, Verh. Kon. Ak. Wet. A'dam sect. 2, 14, *no* 4 (1908) repr. 1–75.–Revision; keys.

Lesser Sunda Islands: de Candolle, Med. Rijksherb. Leiden 22 (1914) 1–7.–List, descr.

Celebes: de Candolle, Ann. Cons. Jard. Bot. Genève 21 (1920) 297–304.–Descr. new *spp.*

Philippines: de Candolle, in Perkins, Fragm. Fl. Philip. pt 1 (1905) 153–160.–Descr.

—, in Elmer, Leafl. Philip. Bot. 3 (1910) 759–789.–Descr.

—, Philip. J. Sc. 5 (1910) Bot. 405–463.–Revision; keys!

—, in Elmer, Leafl. Philip. Bot. 6 (1914) 2291–2294.–Descr. 6 new *spp.*

—, Philip. J. Sc. 11 (1916) Bot. 207–225.–New *spp.* and records of *Piper.*

Miquel *ex* Meyen in Nov. Act. Acad. Caes. Leop.-Car. 19 (1843) Suppl. 1, 483–494.–Descr.

Quisumbing, Philip. J. Sc. 43 (1936) 1–246, fig. 1–124, t. 1–24.–Revision; descr. & keys!

Moluccas: de Candolle, Philip. J. Sc. 11 (1916) Bot. 260–261.–Descr. new *spp.* Ambon.

—, Med. Rijksherb. Leiden *no* 32 (1918) 1–2. –Descr. new *spp.* Key Isl.

New Guinea: de Candolle, Nova Guinea 8 (1910) 415–422; (1914) 1005–1010.–Descr.

—, in Gibbs, Contr. Fl. Phytog. Arfak Mts (1917) 127–128, 207–208.

—, Bot. Jahrb. 55 (1918) 204–220.–Descr.; no keys.

—, Candollea 2 (1925) 216–222.–Descr. new *spp.*

Trelease, J. Arn. Arb. 9 (1928) 146–150.–Descr. new *spp.*

Fiji: Smith, J. Arn. Arb. 24 (1943) 347–361. –Crit. not. Pacific *spp.*; key to Fijian *spp.* of *Piper.*

Hawaii: Yuncker, Bern. P. Bish. Mus. Bull. 112 (1933) 1–131, fig. 1–38.–Rev. *Peperomia*; keys.

Polynesia: Yuncker, Bern. P. Bish. Mus. Bull. 143 (1937) 1–73, fig. 1–35.–Rev. *Peperomia*; keys.

PIROLACEAE

See Ericaceae

PITTOSPORACEAE

BLUME, C. L., Mus. Bot. Lugd.-Bat. 1 (1850) 158–162.–Descr.; ± key.

MIQUEL, F. A. W., Ill. Fl. Arch. Ind. (1871) 75–84, t. 34–37.–Descr.; ± key.

PRITZEL, E., Pflanzenfamilien ed. 2, 18a (1930) 265–286.

PUTTERLICK, A., Synopsis Pittosporearum (in NEES, Gen. Pl. fasc. 22–24? *Non vidi*). Separate print Vienna (1839) 30 pp.–Descr. of *spp.*; partial keys to *spp.;* no key to genera.

Local

Java: BACKER, Schoolfl. Java (1911) 73–75.
KOORDERS & VALETON, Ic. Bog. 2 (1904) t. 138, p. 1–2.–Descr.

New Guinea: MERRILL & PERRY, J. Arn. Arb. 21 (1940) 175–179.–Descr.; no key.
PRITZEL, Bot. Jahrb. 62 (1929) 338–340.–Descr.; no key.
PULLE, Nova Guinea 8 (1910) 365; (1911) 643. –Descr.

Genera

Citriobates: BOERLAGE & KOORDERS, Ic. Bog. 1 (1901) t. 77, p. 1–2.–Descr. Jav. *sp.*

Hymenosporum: BAKHUIZEN VAN DEN BRINK & VAN STEENIS, Blumea 7 (1952) 292.–Record from New Guinea.

Pittosporum: GAGNEPAIN, Bull. Soc. Bot. Fr. 55 (1908) 544–548.–Descr. SE. Asiat. *spp.*
GOWDA, J. Arn. Arb. 32 (1951) 263–343.–Rev. Sino-Indian *spp.*; keys!
SHERFF, Field. Mus. Nat. Hist. bot. ser. 22 (1942) 467–566, 574–580.–Revision Hawaiian *spp.*; keys per island!

PLANTAGINACEAE

PILGER, R., Bot. Jahrb. 50, 1. Suppl. (1914) 61–71. –Distr. & morph. of *Sect. Plantaginella* DECNE.

—, Die Arten der Plantago major-Gruppe in Ostasien (Notizbl. Berl.-Dahlem 8, 1922, 104–116).–Key!

—, Pflanzenreich Heft 102 (1937) 1–466, fig. 1–45.

Local

Java: BACKER & VAN SLOOTEN, Theeonkruiden Java (1924) 200.

New Guinea: MERRILL & PERRY, J. Arn. Arb. 30 (1949) 52–55.–Descr. new *spp.*
PILGER, Bot. Jahrb. 67 (1935) 236.–Record.

PLUMBAGINACEAE

STEENIS, C. G. G. J. VAN, Fl. Mal. I, 4 (1949) 107–112, fig. 2.

Local

New Guinea: PULLE, Nova Guinea 8 (1910) 397.

Genera

Plumbago: VAN STEENIS, Trop. Natuur 26 (1937) 12–13.–Key.

PODOCARPACEAE

See Coniferae

PODOSTEMACEAE

ENGLER, A., Pflanzenfamilien ed. 2, 18a (1930) 3–68.

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1936) 530–534.–Key.

—, Fl. Mal. I, 4 (1949) 65–68, fig.1–2; 503.

Local

New Guinea: VAN STEENIS, J. Arn. Arb. 28 (1947) 421.

Genera

Cladopus: MÖLLER, Ann. Jard. Bot. Btzg 16 (1899) 115–132, t. 12–15.–Type descr.

Lemnopsis = Halophila & Utricularia.

Torrenticola: VAN STEENIS, Proc. R. Soc. Queensl. 62 (1952) 67–68, t. 2.

POLEMONIACEAE

BACKER, C. A., Fl. Mal. I, 4 (1951) 195–196, 1 fig.

BRAND, A., Pflanzenreich Heft 27 (1907) 1–202, fig. 1–39.

Genera

Cobaea: STANDLEY, Contr. U. S. Nat. Herb. 17 (1914) 448–458, t. 26–31.–Revision; key.

Polemonium: DAVIDSON, Univ. Cal. Publ. Bot. 23 (1950) 209–282, fig. 1–23.–Revision; keys.

POLYGALACEAE

(incl. Xanthophyllaceae)

CHODAT, R., Monographia Polygalacearum (Mém. Soc. Phys. Hist. Nat. Genève Suppl. 1890 (1891) 1–143, t. 1–12; 31, 1893, 1–500, t. 13–35).

—, Polygalaceae novae vel parum cognitae V (Bull. Herb. Boiss. II, 4, 1906, 233–237).–Some new *spp.*; no keys.

HASSKARL, J. K., Polygalaceae, praesertim indicae (Ann. Mus. Bot. Lugd.-Bat. 1, 1863–64, 142–196).–Semi-monogr.; some keys.

Local

Indo-China: GAGNEPAIN, Suppl. Fl. Gén. Indo-Chine 1 (1939) 217–236; *ibid.* (1943) 237–238.–Keys.

Sumatra: CHODAT, Bull. Herb. Boiss. 4 (1896) 234.–*Polyg. sumatrana.*
MERRILL, Contr. Arn. Arb. 8 (1934) 84–85.–Crit. not. *P. pulchra.*
RIDLEY, J. Mal. Br. R. As. Soc. *no* 87 (1923) 53. –List 5 records.

Borneo: CHODAT, in MERRILL, Plant. Elm. Born. (1929) 133–137.–Rev. & new *spp.* of *Xanthophyllum*; no key.
FISCHER, Kew Bull. (1932) 176–177.–New *Xanthophyllum.*
RIDLEY, Kew Bull. (1938) 113–115.–New *Xanthophyllums.*
AIRY SHAW, Kew Bull. (1940) 252–253.–Records Oxf. Univ. Exp.

Philippines: CHODAT, Bull. Herb. Boiss. 4 (1896) 233.
ELMER, Leafl. Philip. Bot. 5 (1913) 1671–1678.–Descr. new *Securidaca* & *Xanthophyllums.*

—, *ibid.* 10 (1939) 3776–3777.–New *Xanthophyllum.*
MERRILL, Philip. J. Sc. 27 (1925) 29–30.–New *Xanthophyllum.*
New Guinea: KASSAU, in FEDDE, Rep. 35 (1934) 160.–Descr. 2 *Securidacas.*
SMITH, in FEDDE, Rep. 10 (1912) 486.
—, Nova Guinea 8 (1912) 897–898, t. 158.–Descr. *Epirixanthes papuana.*
WENT, Nova Guinea 8 (1909) 169.

Genera

Epirixanthes: PENZIG, Ann. Jard. Bot. Btzg 17 (1901) 142–170, t. 20–26.–Anat.
VAN STEENIS, Trop. Natuur 23 (1934) 51.–Key.
—, Bull. Bot. Gard. Btzg III, 17 (1948) 461. –Generic syn.
Eriandra: VAN ROYEN & VAN STEENIS, J. Arn. Arb. 33 (1952) 91–96, 1 fig.–End. new genus of New Guinea.
Semeiocardium. See *Balsaminaceae.*
Xanthophyllum: CHODAT, Bull. Herb. Boiss. 4 (1896) 254–264.–Conspectus; new *spp.*; no key.
GAGNEPAIN, in MOROT, J. de Bot. 21 (1908) 241–253.–Discuss. taxon.; key!
MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 271–277, 317–318.–Descr.

POLYGONACEAE

BRUYN, A. J. DE, in MIQUEL, Pl. Jungh. (1854) 302–311.–No key.
DANSER, B. H., Die Polygonaceen Niederländisch-Ostindiens (Bull. Jard. Bot. Btzg III, 8, 1927, 117–261, fig. 1–17).–Rev.; keys.
—, *ibid.* III, 12 (1932) 65–70, 3 fig.–Descr. some *Rumex* and *Polygonum* hybrids from Java.
HEDBERG, O., Pollen morphology in the genus Polygonum L. sens. lat. and its taxonomic significance (Svensk Bot. Tidskr. 40, 1946, 371–404, fig. 1–47).–Pollen types are typical for segregate genera; proposed segregation and key to these.
MEISSNER, C. F., in MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 55–65.–List; descr.; no key.

Local

Java: DANSER, Med. Proefst. Thee *no* 98 (1926) 16 pp., 9 fig.–Descr. & fig. *Polyg.* of tea plantations; key.
—, in BACKER, Bekn. Fl. Java (em. ed.) 4A (1942) fam. 60.
New Guinea: DANSER, Nova Guinea 14 (1927) 333–336.
—, Bull. Jard. Bot. Btzg III, 13 (1935) 429–431. –List of records; no key.
MERRILL & PERRY, J. Arn. Arb. 23 (1942) 384–385.–Records.
—, *ibid.* 29 (1948) 154.–New record *P. attenuatum.*
PULLE, Nova Guinea 8 (1910) 359; (1911) 625–626.–Records; descr. *Muehl. monticola.*

Genera

Muehlenbeckia: DANSER, Bull. Jard. Bot. Btzg 16 (1940) 324–328.–Descr. Pap. & Queensl. *spp.*
Polygonum: DANSER, Bull. Jard. Bot. Btzg III, 8 (1926) 25–31.–Syn. *Reynoutria & Truellum.*
GAGE, Rec. Bot. Surv. Ind. 2 (1903) 371–452. –Enum. of Indian *spp.*; keys!
STEWARD, Contr. Gray Herb. Harv. Univ. 88 (1930) 3–129, t. 1–4.–Revision E. Asiat. *spp.*; keys.
Rumex: RECHINGER, Beih. Bot. Centralbl. 49, ii (1932) 1–132.–Prelim. to monogr.; no keys.
—, Bot. Notiser, Suppl. 3:3 (1954) 1–114.–Monogr. African *spp.*

PONTEDERIACEAE

BACKER, C. A., Fl. Mal. I, 4 (1951) 255–261, fig. 1–3.
SCHWARTZ, O., Anatomische, morphologische und systematische Untersuchungen über die Pontederiaceen (Beih. Bot. Centralbl. 42, i, 1926, 263–320).–No taxon.
—, Zur Systematik und Geographie der Pontederiaceen (Bot. Jahrb. 61, 1927, Beibl. 139, p. 28–50).–Syst. geogr. disc.; partial key.
—, Pflanzenareale II, 2 (1928) Karten 11–17.–Geogr. maps.
—, Pflanzenfamilien ed. 2, 15a (1930) 181–188, fig. 67–71.
SOLMS-LAUBACH, H., in DC. Monogr. Phan. 4 (1883) 501–535.–Rev.; keys.

Local

Java: BACKER, Handb. Fl. Java 3 (1924) 39–42. –Key.
New Guinea: HALLIER *f.*, Nova Guinea 8 (1913) 909. –One record.
VAN STEENIS, J. Arn. Arb. 28 (1947) 419.–Record.

PORTULACACEAE

PAX, F. & K. HOFFMANN, Pflanzenfamilien ed. 2, 16c (1934) 234–262, 587.

Local

Java: BACKER, Schoolfl. Java (1911) 84–85.–Key.
New Guinea: MERRILL & PERRY, J. Arn. Arb. 23 (1942) 386.–*Montia* recorded!
PULLE, Nova Guinea 8 (1910) 357.–*P. oleracea.*

Genera

Portulaca: VON POELLNITZ, in FEDDE, Rep. 37 (1934) 240–320.–Precurs. to monogr.; keys!
Talinum: VON POELLNITZ, Ber. Deut. Bot. Ges. 51 (1933) 112–127.
—, in FEDDE, Rep. 35 (1934) 1–34.–Monogr.

POTAMOGETONACEAE

ASCHERSON. P., Nuovo Giorn. Bot. Ital. 3 (1871) 299–302.–List marine *spp.* of BECCARI coll.; em. descr. of *Halophila* with a new *sp.*
— & P. GRAEBNER, Pflanzenreich Heft 31 (1907) 1–184, fig. 1–36.
STEENIS, C. G. G. J. VAN, Trop. Natuur 22 (1933) 43–46.–Key to marine representatives.
—, Webbia 8 (1952) 435.–List records of BECCARI coll. *ditto.*

Local

Java: BACKER, Handb. Fl. Java pt 1 (1924) 47–51.

Philippines: BENNETT, Philip. J. Sc. 9 (1914) Bot. 339–344; *ibid.* 40 (1929) 183.–List; descr. new *spp.*

Australia: OSTENFELD, Dansk Bot. Ark. 2 (6) (1916) 1–44.–W. Australian seagrasses.
—, Proc. R. Soc. Victoria n.s. 42 (1929) 1–3.–List Austr. *spp.* of marine representatives.
—, *ibid.* 43 (1930) 1 pp.–Additions.

Genera

Potamogeton: BENNETT, J. Bot. 28 (1890) 297–302; *ibid.* 29 (1891) 121–122, 150–152, 154, 186.–List; nomencl.; notes on *P. javanicus.*
—, J. Bot. 65 (1927) 113–116.–Various notes; also *P. javanicus.*
HAGSTRÖM, Critical researches on the Potamogetons (Kungl. Svenska Vet.-Ak. Handl. 55⁵ (1916) 1–281, fig. 1–119).–Revision; no key!
MIQUEL, Ill. Fl. Arch. Ind. pt 1 (1870) 44–48.–List.
VAN STEENIS, Arch. Hydrobiol. Suppl. 10 (1932) 268–271, fig. 1.–List; crit. notes.

Ruppia: SETCHELL, Proc. Calif. Acad. Sc. IV, 25 (1946) 469–478, t. 47–48).–Revision.

PRIMULACEAE

PAX, F. & KNUTH, R., Pflanzenreich Heft 22 (1905) 1–386, fig. 1–75, 2 maps.

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 236–238.–List.

Local

Sumatra: MERRILL, Not. Nat. Acad. Nat. Sc. Philad. *no* 47 (1940) 6–7.–Descr. new *Primula.*
SMITH, W. W., Trans. & Proc. Bot. Soc. Edinb. 35 (1950) 181–182.–Discuss. *Primula sumatrana.*

Malay Peninsula: HENDERSON, J. Mal. Br. R. As. Soc. 17 (1939) 53.–Record of *Lysimachia peduncularis.*

Java: BACKER, Bekn. Fl. Java (em. ed.) 8 (1949) fam. 180, p. 1–4.–Keys; in Dutch.

New Guinea: MERRILL & PERRY, J. Arn. Arb. 29 (1948) 162–163.–Record.
WENT Jr, Nova Guinea 14 (1924) 113.–List.

Genera

Lysimachia (*Orescia*): HANDEL-MAZZETTI, Not. R. Bot. Gard. Edinb. 16 (1928) 51–123.–New system of genus; revision Chinese *spp.* with a key.
—, Pflanzenareale 2⁵ (1929) 39–41, Karten 44–49.–Distr.
VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 458.–Syn.

Primula: ERNST, Ann. Jard. Bot. Btzg 49 (1940) 99–161.–Flower morph. of *P. imperialis.*
PAX, Bot. Jahrb. 10 (1889) 75–241.–Concise revision; keys.
SMITH, W. W. & FLETCHER, Trans. & Proc. Bot. Soc. Edinb. 33 (1941) 122–181.–Rev. *§ Candelabra*; key.
— & FORREST, J. R. Hort. Soc. Lond. 54 (1928) 4–49, fig. 1–70.–Definition & keys to sections; synopsis of species.

PROTEACEAE

SLEUMER, H., Proteaceae Americanae (Bot. Jahrb. 76, 1954, 139–211).–Keys!

Local

Malay Peninsula: SYMINGTON, Kew Bull. (1937) 319.–Syn. *Helicia excelsa.*

Borneo: MERRILL, Plant. Elm. Born. (1929) 52–53.–Records.

Moluccas: MIQUEL, Ann. Mus. Bot. Lugd.-Bat. I (1864) 204.–Descr. *spp.* Ambon.

New Guinea: DIELS, Bot. Jahrb. 50 (1913) 328–334.–Keys!
—, *ibid.* 54 (1917) 198–206.–No keys.
—, Nova Guinea 14 (1923) 74.
LAUTERBACH, Nova Guinea 8 (1910) 285; (1912) 811.–Records.
VON MUELLER, Vict. Nat. 3 (1886) 63–64.–Descr.
SLEUMER, Bot. Jahrb. 70 (1939) 125–148.–Compl. revision; keys!
—, Bot. Jahrb. 76 (1954) 139–211.
WHITE, Proc. R. Soc. Queensl. 34 (1922) 24–27.–Records; descr.
—, J. Arn. Arb. 10 (1929) 209–210.–Records; a new *Helicia.*

Genera

Finschia: SLEUMER, Bot. Jahrb. 70 (1939) 126.–Red. to *Grevillea.*
WARBURG, Bot. Jahrb. 13 (1891) 297–298.
WHITE, Pac. Sc. 3 (1949) 187–194, 3 fig.–Revision; key.

Grevillea: SLEUMER, Bot. Jahrb. 70 (1939) 126–130.–Key.

Helicia: BLUME, Ann. Sc. Nat. II, 1 (Bot.) (1834) 211–220.–Census.

Macadamia: JOHNSON, Proc. Linn. Soc. N. S. W. 79 (1954) 15–18.–Descr. new *sp.* allied to *M. ternifolia.*
VAN STEENIS, Reinwardtia 1 (1952) 467–481, 2 fig.–New *sp.* from Celebes.

PUNICACEAE

BACKER, C. A., Fl. Mal. I, 4 (1951) 226–227, fig. 1.

Local

Java: BACKER, Bekn. Fl. Java (em. ed.) 4a (1942) fam. 74.

Genera

Punica: CAIRNS, J. Bomb. Nat. Hist. Soc. 42 (1940) 13–37.–*P. granatum.*

RAFFLESIACEAE

HARMS, H., Pflanzenfamilien ed. 2, 16b (1935) 243–281.

KOORDERS, S. H., Botanisch overzicht der Rafflesiaceae van Nederlandsch-Indië (1918) vi, 1–128, t. 1–18.–Revision; in Dutch; keys.

SOLMS-LAUBACH, H., Pflanzenreich Heft 5 (1901) 1–19, fig. 1–13.

Local

Sumatra: Suringar in Boerlage, in Veth, Midden-Sumatra 4, 2 (1884) 26–30, 2 pl.–Descr. *Rafflesia hasseltii*; discussion specific differences in the genus; in Dutch.

Java: Blume, Flora Javae fasc. 1–2 (1828) 1–26. van Steenis, Trop. Natuur 23 (1934) 47–48.–Key.

Borneo: Beccari, Atti Soc. Ital. Sc. Nat. 11 (1868) repr. 1–2.–Descr. new *Brugmansia* and *Rafflesia*.

—, Nuovo Giorn. Bot. Ital. 1 (1869) repr. 20–27, t. 5.–Descr. new *Brugmansia*.

Genera

Mitrastemon: Hayata, Ic. Plant. Formos. 3 (1913) 156, 199–213.–Syst. position of genus. *Cf.* also Bot. Jahrb. 51 (1913) 164–176.

Jochems, Rec. Trav. Bot. Néerl. 25a (1928) 203–207.–Descr. N. Sumatran new *sp.*

Matuda, Bull. Torrey Bot. Club 74 (1947) 133–141.–Key!

Palm, Medd. Göteb. Bot. Trädg. 9 (1934) 147–152, 1 fig.–Record from Sumatra; descr.

Watanabe, J. Jap. Bot. 12 (1936) 603–618.–Revision; key.

Yamamoto, Bot. Mag. Tokyo 50 (1936) 539–541.–First record from Mexico.

Rafflesia: Miquel, Analecta Bot. Ind. pt 3 (1852) 23–30, t. 2–3.–Obs. *R. rochussenii.*

Solms-Laubach, Ann. Jard. Bot. Btzg 9 (1891) 184–246, t. 25–28.–Descr.

—, Ann. Jard. Bot. Btzg Suppl. 3 (1910) 1–7.–Descr. *R. cantleyi* from the Malay Peninsula.

van Steenis, *c.s.*, Bull. Brit. Mus. (Nat. Hist.) hist. ser. 1 (1954) 56, 61, t. 13.–First collection ever made of *Rafflesia* by Deschamps.

Rhizanthes (*Brugmansia* Bl., *Mycetanthe*): Blume, in van Hall, Bijdr. Nat. Wet. 2 (1827) 422–423.

Fawcett, Trans. Linn. Soc. Lond. II, Bot. 2 (1886) 244–245, t. 36.–Descr. *B. lowii.*

Harms, in Fedde, Rep. 36 (1934) 286–287.–Nomencl.

RANUNCULACEAE

Hutchinson, J., Kew Bull. (1923) 75–89.–Key to tribes and genera.

Korthals, P. W., Ned. Kruidk. Arch. 1 (1847) 207–211.–Census Indonesian representatives.

Prantl, K., Beiträge zur Morphologie und Systematik der Ranunculaceen (Bot. Jahrb. 9, 1887, 225–273).–Contr. morphol. & taxon.; partial keys to *spp.*

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1934) 238–240.–List mountain *spp.*

Local

Sumatra: van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 403–404.–*Anemone rivularis.*

Borneo: Stapf, Trans. Linn. Soc. Lond. II, Bot. 4 (1894) 127–128.–Descr.

Java: Backer, Schoolfl. Java (1911) 5–8.–In Dutch; key.

New Guinea: Diels, Bot. Jahrb. 62 (1929) 479.–Descr.

Merrill & Perry, J. Arn. Arb. 24 (1943) 34–41.–Descr.!

—, *ibid.* 29 (1948) 154–155.–Records.

Pulle, Nova Guinea 8 (1911) 631.

Genera

Aconitum: Stapf, Ann. Roy. Bot. Gard. Calc. 10 (1905) 115–197, t. 92–116.–Revision Asiat. *spp.*; key.

Anemone: Pritzel, Linnaea 15 (1842) 561–698, t. 1–6.–Revision, no key.

Ulbrich, Bot. Jahrb. 37 (1905) 172–334, 37 fig.–Infrageneric segr.; geogr. census of species; no key.

Aquilegia: Brühl, J. As. Soc. Beng. 61, ii (1892) 270–324, t. 3–6.–Rev. Ind. *spp.*; no key.

Munz, Gentes Herb. 7 (1946) 1–150, fig. 1–38.–Monogr.; keys.

Clematis: Hallier *f.*, Ann. Jard. Bot. Btzg 14 (1897) 248–276, t. 18–20.–No key.

Kuntze, Verh. Bot. Ver. Prov. Brandenburg 26 (1885) 83–202. Nachtr. in Verh. Zool.-Bot. Ges. Wien 37 (1887) 47–50.–Monogr.; keys.

Delphinium: Huth, Bot. Jahrb. 20 (1895) 322–499, t. 6–8.–World monogr.

Thalictrum: Boivin, Rhodora 46 (1944) 337–377, 391–445, 453–487, fig. 1–114.–Revision Amer. *spp.* and their Old World allies; keys.

Lecoyer, Bull. Soc. Roy. Bot. Belg. 24 (1885) 78–325, t. 1–5.–Monogr.; key.

von Regel, Bull. Soc. Nat. Moscou 34, 1 (1861) 14–63, 3 pl.–Key to *spp.* of Russia, Siberia, and N. China.

RESEDACEAE

Mueller, J. von, Monographie de la famille des Résédacées (Neue Denkschr. Allg. Schweiz. Ges. 16 (1) (1857) 1–239, t. 1–10.–Keys!

Local

Java: Backer, Schoolfl. Java (1911) 64.–Culta.

RESTIONACEAE

Masters, M. T., in DC. Monogr. Phan. 1 (1878) 218–398, t. 1–4.–Monogr.; no keys to *spp.*

Steudel, E. G., Synopsis plantarum Glumacearum pars II. Stuttgart (1855) 246–266.–Enum. descr. in Latin.

Local

Malay Peninsula: Ridley, Fl. Mal. Pen. 5 (1925) 136.–Descr. *Leptocarpus disjunctus* Mast.

RHAMNACEAE

Suessenguth, K., Pflanzenfamilien ed. 2, 20d (1953) 7–173, fig. 1–49.

Local

Sumatra: Merrill, Contr. Arn. Arb. 8 (1934) 96–97.–Critical notes.

Malay Peninsula: Symington, Mal. Br. R. As. Soc. 14 (1936) 350.

Borneo: Ridley, Kew Bull. (1931) 493–495.–New *spp.* of *Ventilago* and *Zizyphus*; new records.

Suessenguth & Overkott, in Fedde, Rep. 50 (1941) 330–331.–New *Zizyphus.*

Java: BACKER, Schoolfl. Java (1911) 239–244.
— & BAKHUIZEN VAN DEN BRINK Jr, Blumea 5 (1945) 519–521.–List.
Philippines: MERRILL, Philip. J. Sc. 27 (1925) 35.–Record of *Sageretia hamosa* BRONGN.
—, Philip. J. Sc. 30 (1926) 408.–New *Zizyphus.*
New Guinea: LAUTERBACH, Bot. Jahrb. 57 (1922) 326–340.–Keys.
—, Bot. Jahrb. 59 (1925) 536–537.–A new doubtful *Rhamnus.*
MANSFELD, Notizbl. Berl.-Dahlem 10 (1928) 222–224, fig. 2.–New *Alphitonia.*
MERRILL & PERRY, J. Arn. Arb. 20 (1939) 337–339.–Descr.
—, J. Arn. Arb. 22 (1941) 263–264.–New *Ventilago & Colubrina.*
WENT Jr, Nova Guinea 14 (1924) 110–111.

Genera

Alphitonia: BRAID, Kew Bull. (1925) 168–186.–Revision; key!
Rhamnus: VAN STEENIS, J. Bot. 72 (1934) 6–7.–New *spp.* Borneo & Sumatra.
—, Bull. Jard. Bot. Btzg III, 13 (1934) 240.–List mountain *spp.*
Sageretia: DRUMMOND & SPRAGUE, Kew Bull. (1914) 175.–Correction on next paper.
SCHNEIDER, in SARGENT, Pl. Wils. 2 (1914) 226–231.–Revis. Asiat. *spp.*; key.
Smythea: SUMMERHAYES, Kew Bull. (1928) 389.–*S. lanceata* (TULASNE) SUMMERHAYES correct name for *S. pacifica.*
Ventilago (*Apteron*): BENTHAM, J. Linn. Soc. Bot. 5 (1861) 75–77.–Revision; no key.
MERRILL, Philip. J. Sc. 11 (1916) Bot. 287.–New *sp.* from Ambon.
RIDLEY, Fl. Mal. Pen. 5 (1925) 300.
VAN STEENIS, Blumea 7 (1954) 597.–Distr. *V. oblongifolia.*
Zizyphus: SANTAPAU, J. Bombay Nat. Hist. Soc. 51 (1953) 801–804.–Remarks on nomencl. of genus & *spp.*; distinction of 4 Deccan *spp.*; no key.
VAN STEENIS, Blumea 7 (1954) 595–596.–Syn. & distr. *Z. grewioides.*

RHIZOPHORACEAE

BENTHAM, G., Synopsis of the Legnotideae, a tribe of the Rhizophoraceae (J. Linn. Soc. Bot. 3, 1858, 65–80).–Synopsis.
BLUME, C. L., Mus. Bot. Lugd.-Bat. 1 (1849–'50) 126–145.–Census; descr.
MIQUEL, F. A. W., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 66–67.–Only subfam. *Legnotideae.* List; no key.
VALETON, TH., Bull. Jard. Bot. Btzg III, 2 (1920) 346–348.–New *Carallia*; new *var.* in *Pellacalyx.*

Local

Malay Peninsula: KING, J. As. Soc. Beng. 66, ii (1897) 311–326.–Keys.
Borneo: RIDLEY, Kew Bull. (1938) 282–283.–Descr. new *Carallias.*
Java: BACKER, Schoolfl. Java (1911) 478–486.–In Dutch; keys.
New Guinea: PULLE, Nova Guinea 8 (1910) 393–394; (1912) 679.
WHITE, Proc. R. Soc. Queensl. 34 (1922) 46.–List.

Genera

Anisophyllea: BURKILL, Gard. Bull. Str. Settl. 4 (1927) 426.–Syn. of *A. grandis.*
SANDWITH, Kew Bull. (1952) 303–306.—Record from America.
Bruguiera: MERRILL, Trans. Am. Phil. Soc. Philad. n.s. 24² (1935) 282.–Nomencl.
Combretocarpus: AIRY SHAW, in HOOK. Ic. Pl. (1937) t. 3335.—Ample discussion of ecol. and morphol.
Pellacalyx (*Craterianthus*): KORTHALS, Tijd. Nat. Gesch. & Phys. 3 (1836) 20–22.–Descr.
SCORTECHINI, Nuovo Giorn. Bot. Ital. 17 (1885) 140–144.–*P. saccardianus n. sp.*
VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 457.–Synonymy.
Rhizophora: SALVOZA, Univ. Philip. Nat. & Appl. Sc. Bull. 5 (1936) 179–237, t. 1–9.–Revision whole genus; key.

ROSACEAE

BLUME, C. L., Mélanges botaniques (Flora 41, 1858, 255–256).–Concise review of an unpublished paper of BLUME by HASSKARL.
KORTHALS, P. W., Nat. Tijd. Ned. Ind. 7 (1854) 206–212.–Latin diagn.
—, Bijdrage tot de kennis der Chrysobalaneae van Nederlandsch Oost-Indië (Ned. Kruidk. Arch. 3, 1855, 384–388).–Copy of the above; descr. 3 new genera.
MIQUEL, F. A. W., Chrysobalaneae quaedam Indicae (Ann. Mus. Bot. Lugd.-Bat. 3, 1867, 236–237).–List.
STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 240–246.–List mountain *spp.*

Local

Sumatra: MERRILL, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 155–157.–Descr. new *Photinia*, 2 new *Pygeums.*
—, Not. Nat. Acad. Nat. Sc. Philadelphia *no* 47 (1940) 3.–Record *Potentilla.*
Malay Peninsula: HENDERSON, Gard. Bull. Str. Settl. 7 (1933) 101–103.–2 new *spp.*
Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 76 (1917) 81–83.–New records in *Parinari*, new *spp.* of *Pygeum.*
—, Plant. Elm. Born. (1929) 92–94.–New *Parinaris.*
RIDLEY, Kew Bull. (1938) 280–282.–Records of *Rubus* & new *Pygeum.*
Java: BACKER, Schoolfl. Java (1911) 443–465.
DOCTERS VAN LEEUWEN, Trop. Natuur 18 (1929) 148–151, fig. 1–3.–*Rubus calycinus* in E. Java.
KOORDERS, Bull. Jard. Bot. Btzg III, 1 (1918) 84–85, t. 5.–Key to *Prunus*; one new *sp.*
VAN STEENIS, Trop. Natuur 21 (1932) 103–104, fig. 3–4.–*Potentilla mooniana.*
—, Trop. Natuur 24 (1935) 122, fig. 1.–*Rubus calycinus* in E. Java.

Lesser Sunda Islands: Focke, Med. Rijksherb. Leiden *no* 14 (1912) 39–40.–List *Rubus* coll. Elbert.
Von Malm, Notizbl. Berl.-Dahlem 11 (1932) 630.–New *Parinari* from Flores.

Philippines: Elmer, Leafl. Philip. Bot. 2 (1908) 445–462.–Revision of Philippine *Rubus*; key!
—, *ibid.* 5 (1913) 1621–1628.–Census descr. Philip. *Pygeum.*
—, *ibid.* 10 (1939) 3777–3778.–New *Rubus.*
— & Focke, *ibid.* 5 (1913) 1617–1619.–Descr. 2 new *spp. Rubus.*
Merrill, Philip. J. Sc. 29 (1926) 480.–New *Potentilla.*
—, *ibid.* 30 (1928) 395–396.–New *Pygeum.*

New Guinea: Baker, J. Bot. 61 (1923) Suppl. 13.–New *Angelesia.*
Diels, Bot. Jahrb. 62 (1929) 480–482.–Notes on *Acaena, Potentilla,* and *Rubus.*
Focke, Abh. Naturw. Ver. Bremen 13 (1894) 161–166.–Records of *Potentilla, Rubus*; some new.
—, Bot. Jahrb. 54 (1916) 69–73.–List *spp.* NE. part, some new.
Merrill & Perry, J. Arn. Arb. 21 (1940) 179–198.–New *spp.* in *Potentilla, Pygeum, Parastemon,* and *Rubus;* no key.
—, *ibid.* 22 (1941) 256.–Note on *Parastemon.*
Pulle, Nova Guinea 8 (1910) 367.
—, *ibid.* 8 (1912) 647.–New *Rubus.*
Ridley, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 35–37.–On *Rubus* & *Potentilla.*
White, J. Arn. Arb. 31 (1950) 86–88.–New *spp.* of *Parinari.*

Genera

Acaena: Bitter, Bibl. Bot. Heft 74 (1910–1911) 1–336, t. 1–37.–Revision; key.
—, in Fedde, Rep. 10 (1912) 498–501.–Suppl. notes to revision.

Alchemilla: Rothmaler, in Fedde, Rep. 38 (1935) 33–43.
—, *ibid.* 40 (1936) 208–212.–Sect. div.

Angelesia (*Trichocarya*): Boerlage & Koorders, Ic. Bog. 1 (1901) t. 96.

Eriobotrya: Cardot, Bull. Mus. Hist. Nat. Paris 25 (1919) 205–207.–Critical notes; census Paris sheets.

Geum: Bolle, in Fedde, Rep. Beih. 72 (1933) 119 pp.–Revision; with keys.

Inodaphnis = Microcos (*Tiliaceae*).

Parastemon (*Diemenia*): Boerlage & Koord., Ic. Bog. 1 (1901) t. 97.
Korthals, Nat. Tijd. Ned. Ind. 7 (1854) 212.

Parinari (*Cyclandrophora, Parinarium*): Blume, Mus. Bot. Lugd.-Bat. 2 (1852) 94–99.–Descr.
Kanehira, J. Japan. Bot. 16 (1940) 471–475, 4 fig.
Van Steenis, Bull. Bot. Gard. Btzg III, 17 (1948) 461.–Synon.

Potentilla: Wolff, Bibl. Bot. Heft 71 (1908) 1–715, 20 tab., 2 maps.–Monogr.; keys. Obsolete for Malaysia.

Prunus: Koehne, in Sargent, Pl. Wils. pt 2 (1912) 196–282.–Principally account of Chin. *spp.*; subdivision genus; keys to *spp.* in some subgen. & sect.

Pygeum: Koehne, Bot. Jahrb. 51 (1913) 177–224.–Unsatisfactory & very incomplete now; geogr. keys.
—, *ibid.* 52 (1915) 334–345.–Suppl. notes; descr. new *spp.*
Miquel, Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 212.–Descr.

Rosa: Boulenger, Bull. Jard. Bot. Brux. 13 (1935) 165–266.–Revision of some groups of *Rosa § Eglanteriae* in Asia.
—, *ibid.* 14 (1936) 115–221, (1937) 274–292.
—, *ibid.* 14 (1937) 241–273.–Introd. to taxon. of genus.

Rubus: Focke, Bot. Jahrb. 1 (1881) 87–103.–General disc. taxon.
—, Bibl. Bot. Heft 72 (1910) 1–120, fig. 53; *ibid.* (1911) 121–223, fig. 54–87; *ibid.* Heft 83 (1914) 1–274, fig. 88–155.–Revision; keys.

ROXBURGHIACEAE

See Stemonaceae

RUBIACEAE

Bakhuizen van den Brink Jr, R. C., Notes on Malaysian Rubiaceae (Blumea 7, 1953, 329–338).–Critical notes; new descr.

Haviland, G. D., A revision of the tribe Naucleae (J. Linn. Soc. Lond. Bot., 33, 1897, 1–94, t. 1–4).–Monogr. of the tribe; keys!

Korthals, P. W., Over het geslacht Nauclea en eenige verwante geslachten (in Temminck, Verhand. (Botanie), 1842, 150–174, pl. 32–35, 48.–Deals with the tribe *Naucleae.*

—, Overzigt der Rubiaceën van de Nederlandsch-Oostindische Koloniën (Ned. Kruidk. Arch. 2^2, 1851, 99–136, 145–269).–Disc. & enum. Neth. East Indian *spp.* & genera.

Miquel, F. A. W., in de Vriese, Plant. Ind. Bat. Orient. (1856) 156–160.–Descr. of some *spp.* from herb. Reinwardt, mainly from Java.

—, De quibusdam Rubiaceis, Apocyneis et Asclepiadeis (Ann. Mus. Bot. Lugd.-Bat. 4, 1869, 128–137).–Descr. of various genera & *spp.*

—, Ecloge Rubiacearum archipelagi Indici (*ibid.* 4, 1869, 179–213, 221–262).–*Ditto*; no keys.

Ridley, H. N., Notes on some Malayan Rubiaceae (Kew Bull. 1939, 493–513, *sphalm.* 593–613).–Crit. notes on various genera & *spp.*

Robijns, W., Tentamen monographiae Vangueriae generumque affinium (Bull. Jard. Bot. Brux. 11, 1928, 1–359, fig. 1–36).–Monogr. of *Vangueria* and segregates; keys.

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1934) 246–248.–List mountain *spp.*

Valeton, Th., in Ic. Bog. 2 (1903–1906) t. 141–148, 183–184.–Descr. various records and *spp.*

—, *ibid.* 3 (1906–1909) t. 221 (Backer), 247–248, 267–273, 278–299.–*Ditto.*

—, *ibid.* 4 (1913) t. 355–366.–*Ditto.*

Local

Siam: Ridley, Kew Bull. (1931) 441–448.–Descr. new *spp.* coll. Kerr.

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 156–164.–List.
—, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 194–199.–Descr. new *spp.*
—, Pap. Mich. Acad. Sc. 23 (1937) 1938, 191–202.–Descr. new *spp.*
VALETON, Ic. Bog. 4 (1914) t. 390.–New *sp.* from Billiton.

Malay Peninsula: CORNER, Gard. Bull. Str. Settl. 10 (1939) 46–55.–Critical notes.
RIDLEY, J. Bot. 66 (1932) 191–197, 219–226.–Census of *Urophyllum* in Malaya; no key.
—, *ibid.* 72 (1934) 251–257, 271–274.–Descr. of new *Ixora, Tarenna, Gardenia, Geocardia.*
SCORTECHINI, J. Bot. 22 (1884) 369–370.–Descr. *Creaghia* (= *Mussaendopsis*).

Java: BACKER, Onkruidfl. Jav. Suiker. (1931) 685–722.

Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 76 (1917) 117.–New *Uncaria.*
—, *ibid. no* 77 (1917) 238–245.–Descr. new *Timonius* from Borneo.
—, J. R. As. Soc. Mal. Br. 1 (1923) 37–44.–Descr. new *spp.*
—, Sarawak Mus. J. 3 (1928) 534–537, 553–556.
—, Mitt. Inst. Allg. Bot. Hamb. 7 (1937) 270–301.–Descr. & new records.
RIDLEY, Sarawak Mus. J. 1 (1912) 30–32.–Descr. of some new *spp.*
—, Kew Bull. (1934) 119–120.–Descr. 3 new *spp.*
STAPF, Trans. Linn. Soc. Lond. II, Bot. 4 (1894) 168–187.–List; descr. new *spp.*
VAN STEENIS, J. Bot. 72 (1934) 9.–Descr. *Coptosapelta montana.*
WERNHAM, J. Linn. Soc. Bot. 42 (1914) 87–97.–Descr. & records.

Celebes: BREMEKAMP, Blumea 5 (1945) 587–591, fig. 11–12.–Records & descr. new *spp.*
KOORDERS, Suppl. Flora N.O. Celebes 2 (1922) t. 123–127; *ibid.* 3 (1922) 58–60.–Descr. new *spp.*

Moluccas: BREMEKAMP, Blumea 5 (1942) 243–251.–List Talaud & Morotai.

Philippines: ELMER, Leafl. Philip. Bot. 1 (1906) 1–41.–Survey of fam.; keys to *spp.*
—, *ibid.* (1906) 63–73.–Addit. new *spp.*
—, *ibid.* 3 (1911) 971–1046.–New & noteworthy *spp.*
—, *ibid.* 4 (1912) 1327–1362.–New *spp.* & records from Palawan Island.
—, *ibid.* 5 (1913) 1855–1905.–New *spp.* & records from Mt Urdaneta (Mindanao).
—, *ibid.* 9 (1934) 3209–3216.–New *spp.* from Mt Pinatubo (Luzon).
—, *ibid.* 9 (1937) 3242–3272.–Various new *spp.*
—, *ibid.* 10 (1939) 3778–3781.–Two new *spp.*
MERRILL, Philip. J. Sc. 8 (1913) Bot. 31–62, t. 1.–Descr. new *spp.*, records, critical notes on synon.
—, *ibid.* 10 (1915) Bot. 99–144.–*Ditto.*
—, *ibid.* 12 (1917) Bot. 159–176.–Descr. new *spp.*
—, *ibid.* 17 (1920) 425–485.–Descr. new *spp.*
—, *ibid.* 26 (1925) 492–496.–Descr. new *spp.*
—, *ibid.* 27 (1925) 55–59.–Descr. new *spp.*
—, *ibid.* 29 (1926) 489–495.–Descr. new gen. & *spp.* from Bohol & Mindanao.
—, *ibid.* 35 (1928) 7–9.–New comb. for Philip. '*Plectronia*'.
QUISUMBING, Philip. J. Sc. 41 (1930) 360–368.–Descr. new *spp.*
— & MERRILL, Philip. J. Sc. 37 (1928) 200–211.–Descr. new *spp.*

New Guinea: DIELS, Bot. Jahrb. 62 (1929) 493–494.–New *Galium.*
MERRILL & PERRY, J. Arn. Arb. 25 (1944) 183–205; *ibid.* 26 (1945) 1–36, 1 pl., 229–266; *ibid.* 27 (1946) 193–233.–Account BRASS coll.; no keys.
—, *ibid.* 29 (1948) 164–167.–Descr. new *spp.*
MOORE, J. Bot. 65 (1927) 241–247, 265–272.–Descr. & records coll. BRASS.
—, *ibid.* 67 (1929) 49.–New *Psychotria.*
VALETON, Bull. Dép. Agr. Ind. Néerl. 10 (1907) 61–67.–List.
—, Nova Guinea 8 (1911) 437–519, (1912) 755–775.–Descr.
—, in GIBBS, Contr. Fl. Phytog. Arfak Mts (1917) 180–182, 220–221.–Descr.
—, Bot. Jahrb. 60 (1925) 1–104; 61 (1927) 32–163.–Descr.; keys!
—, Nova Guinea 14 (1926) 229–274, t. 20–29.
WERNHAM, J. Bot. 56 (1918) 68–77, 129–135.–List FORBES coll.; new records and descr. new *spp.*
WHITE, Proc. R. Soc. Queensl. 34 (1922) 52–59.–List; descr. new *spp.*
—, Proc. Linn. Soc. N.S.W. 51 (1926) 296, t. 17.–New *Plectronia.*

New Caledonia: GUILLAUMIN, in VIGUIER, Arch. Bot. 3 (1930) Mém. 5, p. 1–47.–Keys!

Genera[1]

Acranthera (*Psilobium, Gonyanera*): BREMEKAMP, J. Arn. Arb. 28 (1947) 261–308.–Revision; key.

Adina: HAVILAND, J. Linn. Soc. Lond. Bot. 33 (1897) 42–48.–Revision; key.
VERHOEF, Tectona 31 (1938) 802–814.–List.

Antherostele: BREMEKAMP, J. Arn. Arb. 21 (1940) 25–31.–Segregate of *Urophyllum*; 4 *spp.* in Philippines.

Anthocephalus: HAVILAND, J. Linn. Soc. Lond. Bot. 33 (1897) 22–24.–Revision; key.

Antirrhea: VALETON, Bull. Dép. Agr. Ind. Néerl. 26 (1909) 31–32.
WHITE, J. Arn. Arb. 27 (1946) 121–122, t. 1.–List 3 Australian *spp.*

Aphaenandra: BREMEKAMP, Blumea Suppl. 1 (1937) 116–122.
JOCHEMS, Trop. Natuur 18 (1929) 153–154.–Descr.; fig.
VAN STEENIS, Bull. Bot. Gard. Btzg III, 18 (1950) 457–458.
DE VOOGD, Trop. Natuur 18 (1929) 110–111.–Descr.; photogr.

Argostemma (*Argostemmella*): BAKHUIZEN VAN

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(1) Not all segregate genera proposed by BREMEKAMP are mentioned here separately.

DEN BRINK Jr, Blumea 7 (1953) 329–334.–Sect. div.; descr. new *spp.*; critical notes.
RIDLEY, J. Bot. 65 (1927) 25–42.–Census; no key.

Asemanthia (*Mussaenda § Asemanthia*): RIDLEY, Kew Bull. (1939) 499–500.–Segregate; Mal. Pen. & Borneo; list 4 *spp.*

Bikkia: BEUMÉE, Trop. Natuur 15 (1926) 198–200. –Distr. & descr. *B. grandiflora*.
GUILLAUMIN, Not. Syst. 1 (1909) 111–112.–Discuss. gen. syn. of New Caledon. *Bikkia*.
VALETON, Philip. J. Sc. 23 (1923) 573–574.–New *sp.* from Cebu.

Boholia: MERRILL, Philip. J. Sc. 29 (1926) 492–494.–Descr.; Bohol Isl.

Borreria: BACKER, Onkruidfl. Jav. Suiker. (1931) 714–722.–In Dutch; Jav. *spp.*; key.

Canthium (*Plectronia auct. non* L.): BURTT, Kew Bull. (1936) 463.–Recomb. in a *Canthium*.
MERRILL, Philip. J. Sc. 35 (1928) 7–9.–New comb. for Philippine '*Plectronia*'.

Carlemannia, See *Caprifoliaceae*; *cf.* Fl. Mal. I, 4 (1951) 192–194.

Cinchona: KUNTZE, O., Monographie der Gattung Cinchona. Leipzig (1878).–*Non vidi.*
MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 263–275.–Descr. *spp.* cult. in Java.

Coelospermum: GUILLAUMIN, Arch. Bot. Caen 3 (1929) Mém. V, p. 15, 41.

Coffea: CHEVALIER, Rev. Int. Bot. Appl. & Agr. Col. 26 (1946) 81–94, map.–Ecol. & geogr. distr. of the species.
—, Les Caféiers du globe fasc. 3. Systématique (Encycl. Biol. 28, 1947, 117–263).–Revision; keys!
FROEHNER, Notizbl. Berl.-Dahlem 1 (1897) 230–238.–Revision; key.
—, Bot. Jahrb. 25 (1898) 233–295.–Revision; key.
VALETON, Bull. Inst. Bot. Btzg *no* 8 (1901) 15–25. –Discussion; no key.

Coprosma: OLIVER, Bern. P. Bish. Mus. Bull. 132 (1935) 1–207, t. 1–59, 67 fig.–Monogr.; key.
—, Rec. Dominion Mus. 1 (1942) 44–47, t. 14.–Descr. 3 new *spp.*, 2 from Papua, one from Hawaii.

Coptosapelta: VALETON, Versl. Kon. Akad. Wet. A'dam (Sept. 1908) 120–126.–Discussion; census.
—, Rec. Trav. Bot. Néerl. 19 (1922) 281–292, t. 10–11.–Descr.; key!
—, Versl. Kon. Akad. Wet. A'dam 26 (1923) 423–440, fig. 1–14.–Descr.

Craterianthus = Pellacalyx (*Rhizophoraceae*); *cf.* Bull. Bot. Gard. Btzg III, 17 (1948) 457.

Dentella: AIRY SHAW, Kew Bull. (1932) 289–292.–Descr. some extra-Mal. *spp.*
—, Kew Bull. (1934) 290–301.–Australian *spp.*; keys!

Didymoecium: BREMEKAMP, Bull. Jard. Bot. Btzg III, 13 (1935) 425–428, 1 fig.–Descr.; monotypic; Sumatra.

Dolianthus: BREMEKAMP, Kew Bull. (1936) 103–105. –Formerly incl. in *Logan.* but closely allied to *Amaracarpus*. In my opinion at most a sect. of it (Ed.).

Galium: VAN STEENIS, Trop. Natuur 25 (1936) 152–155.–In Dutch; key to Mal. *spp.*

Gardenia: SPRAGUE, Kew Bull. (1929) 12–16.–Syn. of *G. jasminoides* ELLIS.

Geocardia: (*Geophila* D. DON, *non* BERGERET): STANDLEY, Contr. U.S. Nat. Herb. 17 (1914) 444–445.–Census; no key.

Guettarda: BAILLON, Adansonia 12 (1879) 316–319.–Delimitation of the genus.

Hedyotis (*Oldenlandia*, *Pleiocraterium*): BACKER, Onkruidfl. Jav. Suiker. (1931) 688–700.–Key Jav. *spp.*
BREMEKAMP, Rec. Trav. Bot. Néerl. 36 (1939) 438–445.–Rev. *Pleiocraterium*.
—, Verh. Kon. Akad. Wet. 2e reeks, 48, *no* 2 (1952) 297 pp., 13 tab.–Rev. African *spp.*; keys.
FOSBERG, Bern. P. Bish. Mus. Bull. *no* 174 (1943) 102 pp., 9 fig., t. 1–4.–Revision Hawaiian *spp.*
KANEHIRA, Trans. Nat. Hist. Soc. Formosa 25 (1925) 2–7, 35–39.–List, descr. of records and new *spp.*
MERRILL & METCALF, J. Arn. Arb. 23 (1942) 226–230, 1 pl.–Discussion generic concept and synonymy; descr.
RIDLEY, Kew Bull. (1939) 511–513.–New *spp.*; records.

Ixora: BAILLON, Adansonia 12 (1878) 213–219.–Delimitation of the genus.
BREMEKAMP, Bull. Jard. Bot. Btzg III, 14 (1937) 197–367.–Revision; keys!
—, *ibid.* 16 (1940) 276–299.–Add. & emend. to revision.
—, J. Bot. 75 (1937) 108–111, 169–175, 260–266, 295–298, 318–326; *ibid.* 76 (1938) 330–336.–Census Andaman Isl. and Burma; no key.
—, J. Arn. Arb. 20 (1939) 216–219.–New *spp.* from Solomons.
CORNER, Gard. Bull. Str. Settl. 11 (1941) 177–235.–Key & disc. Mal. Pen. *spp.*

Kajewskiella: MERRILL & PERRY, J. Arn. Arb. 28 (1947) 331–332, t. 1.–Descr.; Solomons.

Lachnastoma: VALETON, Bull. Inst. Bot. Btzg *no* 8 (1901) 25–33.–Key.

Lasianthus: WIGHT, Calcutta J. Nat. Hist. 6, p. 494–518.–*Non vidi.*

Lecariocalyx: BREMEKAMP, Kew Bull. (1940) 192–193.–Aff. *Grumilea* (*Psychotrieae*); Borneo.

Lerchea: BAKHUIZEN VAN DEN BRINK Jr, Blumea 7 (1953) 334–335.–New Jav. *sp.*

Mastixiodendron (*Dorisia*): MERRILL & PERRY, J. Arn. Arb. 23 (1942) 416; *ibid.* 25 (1944) 205; *ibid.* 26 (1945) 254–256.

Meyna: ROBIJNS, Bull. Jard. Bot. Brux. 11 (1928) 226–242.–The As.-Mal. complement of *Vangueria* and formerly included in that genus; key!

Mitragyne: HAVILAND, J. Linn. Soc. Lond. Bot. 33 (1897) 68–73.–Revision; key.

Morinda: BAILLON, Bull. Soc. Linn. Paris 1 (1879) 205–206.–Delimitation of the genus; remarks on some BECCARI *nos.*

Mussaenda: RIDLEY, Kew Bull. (1929) 497–499.–Descr. new *spp.*
SULIT, Philip. J. For. 2 (1939) 35–41, pl. 1–3.–

Descr. & key to *spp.* in Makiling National Park, Luzon.

Mussaendopsis: BREMEKAMP, Rec. Trav. Bot. Néerl. 36 (1939) 367–371.–Revision; key.
STAPF, in HOOK. Ic. Pl. 24 (1895) t. 2388.–*M. beccariana.*

Mycetia (*Adenosacme*): SPRAGUE & FISCHER, Kew Bull. (1928) 253.–Gen. nomencl.
VALETON, Ic. Bog. 3 (1908–1909) t. 270, 281–282. –Fig., descr., syn. of 3 Jav. *spp.*

Myrmeconauclea: MERRILL, Philip. J. Sc. 17 (1920) 375–376.–Monotypic; Mal.

Nauclea (*Sarcocephalus*): HAVILAND, J. Linn. Soc. Lond. Bot. 33 (1897) 24–33.–Revision; key.
MERRILL, J. Wash. Acad. Sc. 5 (1915) 530–537. –Typification; new comb. under *Nauclea.*

Neonauclea (*Nauclea auct.*): HAVILAND, J. Linn. Soc. Lond. Bot. 33 (1897) 48–68.
MERRILL, J. Wash. Acad. Sc. 5 (1915) 530–542. –Typification; new comb. under *Neonauclea.*

Pavetta: BREMEKAMP, in FEDDE, Rep. 37 (1934) 1–208.–Monogr.; keys.
—, Blumea Suppl. 1 (1937) 112–116.–Notes on synon.
—, in FEDDE, Rep. 47 (1939) 12–28, 81–98.–Emend. to monograph.

Pentas: VERDCOURT, Bull. Jard. Bot. Brux. 23 (1953) 237–371.–Revision; keys!

Perakanthus: ROBIJNS, Bull. Jard. Bot. Brux. 11 (1928) 330–331.–2 *spp.* Mal. Pen.; segregate of *Canthium.*

Pleiocarpidia: BREMEKAMP, Rec. Trav. Bot. Néerl. 37 (1940) 198–236.–Revision; key.

Polycycliska: RIDLEY, Kew Bull. (1926) 67–68.–Monotypic; Mentawai; said to be allied to *Pomazota.*

Pomazota (*Coptophyllum* KORTH. *non* GARDN.): BREMEKAMP, J. Arn. Arb. 28 (1947) 186–203.–Revision; key.

Porterandia (*Randia § Anisophyllea* HOOK. *f.*): RIDLEY, Kew Bull. (1939) 493–497.–Segregate; W. Malaysia; key.

Praravinia (*Williamsia*): BREMEKAMP, Rec. Trav. Bot. Néerl. 37 (1940) 237–278.–Revision of *spp.* from Celebes & Borneo; key.
KOORDERS, Nat. Tijd. Ned. Ind. 63 (1903) 73–75.–Descr. 2 *spp.* from Borneo & Celebes.
KORTHALS, in TEMMINCK, Verh. Nat. Gesch. Botanie (1842) 189–191.

Prismatomeris: RIDLEY, Kew Bull. (1939) 501–507. —Crit. remarks; list; records.
VALETON, Bull. Inst. Bot. Btzg *no* 8 (1901) 1–34.–Discussion.

Psilobium: KERR, in HOOK. Ic. Pl. V, 4 (1937) t. 3332.–Disc.; fig.

Psychotria (*Gouldia*): BREMEKAMP, J. Bot. 71 (1933) 271–280.–Descr. & key to the bacteriophilous species of *Psychotria.*
ERNST, Arch. J. Klaus Stift. (Zürich) 7 (1932) 241–280, 9 fig.–Heterostyly.
ST.JOHN, Bern. P. Bish. Mus. Occ. Pap. 12 *no* 7 (1936) 1–4, t. 1.–Reduction of *Gouldia.*

Randia (*Anomanthodia, Canthopsis, Gynopachys*): BAILLON, Bull. Soc. Linn. Paris 1 (1879) 206.–Reduction of *Canthopsis.*
FAGERLIND, Arkiv Bot. 30A, *no* 7 (1942) 1–57, 10 fig. –Survey of morphol.; precursory for a future revison & segregation.
GAMBLE, Kew Bull. (1921) 312–313.–Critical notes on some *spp.* from India.
VALETON, Not. Syst. 3 (1914) 54–55.–New *sp.* from Rawak Isl.

Rennellia: RIDLEY, Kew Bull. (1929) 507–509.–Key.

Rhadinopus: MOORE, J. Arn. Arb. 11 (1930) 129–131, fig. 1.–Monotopic; New Guinea; aff. *Gardenia.*

Siderobombyx: BREMEKAMP, J. Arn. Arb. 28 (1947) 204–206.–Monotypic; aff. *Pomazota.*

Spermacoce: RENDLE, J. Bot. 72 (1934) 329–333.–Exam. Linnean specimens.

Steenisia (*Neurocalyx p.p.*): BAKHUIZEN VAN DEN BRINK Jr, Webbia 8 (1952) 381–382.–Census of the genus.
AIRY SHAW, Kew Bull. (1937) 281–291, t. 9.
VALETON, in FEDDE, Rep. 12 (1913) 513–514.

Stichianthus: VALETON, Bull. Jard. Bot. Btzg III, 2 (1920) 349–350, t. 10.–Descr.
WINKLER, HANS, Planta 13 (1931) 85–101, 5 fig. –Morph. inflor.

Streblosa: BREMEKAMP, J. Arn. Arb. 28 (1947) 145–185.–Revision; key!

Sulitia: MERRILL, Philip. J. Sc. 29 (1926) 494–495. –Descr.; Mindanao.

Timonius: MERRILL, J. Arn. Arb. 18 (1937) 130–132.–Some new comb.
—, *ibid.* 26 (1945) 235–254.–Numerous Pap. new *spp.*
VALETON, Bull. Dép. Agr. Ind. Néerl. *no* 26 (1909) 1–61.–Descr.; key.

Uncaria: HAVILAND, J. Linn. Soc. Lond. Bot. 33 (1897) 73–92.–Revision; key.

Urophyllum: BREMEKAMP, J. Arn. Arb. 21 (1940) 32–47.–Revisions *Pleiocarpidia, Praravinia,* and *Urophyllum*; keys.
—, Rec. Trav. Bot. Néerl. 37 (1940) 171–197.–*Urophyllum* split into a number of segregate genera.

Wendlandia: COWAN, Not. Roy. Bot. Gard. Edinb. 16 (1932) 233–316, t. 232–235; *ibid.* 18 (1934) 183–188.–Revision; keys.
—, Bull. Jard. Bot. Btzg III, 14 (1936) 8–46, fig. 1–26.–Rev. Mal. *spp.*; key.

Xanthophytum: BAKHUIZEN VAN DEN BRINK Jr, Blumea 7 (1953) 335–337.–Descr. new *spp.* from Borneo.

Zeuxanthe: (*Morinda § Dibrachya*): RIDLEY, Kew Bull. (1939) 509–511.–Borneo; 3 *spp.*; key.

RUTACEAE[1]

ENGLER, A., Über die geographische Verbreitung der Rutaceen im Verhältnis zu ihrer systematischen Gliederung (Abh. K. Preuss. Akad. Wiss. Phys. Abh. 1896 i, 1–27, 3 maps).

—, Pflanzenfamilien ed. 2, 19a (1931) 187–359, fig. 89–165.

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(1) There are various opinions on generic delimitation in this family. Many data in this bibliography should be handled with great caution.

Guillaumin, A., Espèces ou localités nouvelles pour les Rutacées d'Extrême-Orient (Not. Syst. 1, 1909, 207–223; 1911, 327–328).–List of records and notes, also several from Malaysia.

Miquel, F. A. W., Aurantiaceae novae (Ann. Mus. Bot. Lugd.-Bat. 1, 1864, 211).–Diagn. 5 new species.

—, Rutacearum quarundam illustratio (Ann. Mus. Bot. Lugd.-Bat. 3, 1867, 242–246).–New diagn. in *Evodia, Acronychia,* and *Zanthoxylum.*

Oliver, D., The natural order Aurantiaceae, with a synopsis of the Indian species (J. Linn. Soc. Lond. Bot. 5, 1861, Suppl. 2, 1–44).–Synopsis; delimitation of genera; no keys!

Shaw, H. K. Airy, Notes on the nomenclature of certain Rutaceae-Aurantioideae (Kew Bull. 1939, 290–293).–Straightening out nomencl. of *Limonia-Atalantia-Feronia.*

Swingle, W. T., A new taxonomic arrangement of the orange subfamily, Aurantioideae (J. Wash. Acad. Sc. 28, 1938, 530–533).–Concise concept of a new classification; some new comb.

—, New varieties and new combinations in the genera Clausena, Oxanthera, and Triphasia of the orange subfamily, Aurantioideae (J. Wash. Acad. Sc. 30, 1940, 79–83, 2 fig.).–New comb., mostly of varieties.

—, The Botany of Citrus and the wild relatives of the orange subfamily (in The Citrus Industry 1, 1943, 127–474).–*Non vidi.*

Tanaka, T., Revisio Aurantiacearum I (Bull. Soc. Bot. Fr. 75, 1928, 708–715).–Various notes, new comb. and descr. new *spp.*

—, Notes on the Dutch Indian species of Rutaceae-Aurantieae (Med. Rijksherb. Leiden *no* 69, 1931, 1–13).–List of records; some new *spp.* in *Clausena, Glycosmis, Lavanga.*

—, The taxonomy and nomenclature of Rutaceae-Aurantioideae (Blumea 2, 1936, 101–110).–Considerations in general and on *Citrus* in particular.

Local

SE. Asia: Guillaumin, Not. Syst. 1 (1910) 207–224; (1911) 327–328.–List of records and notes.

Tanaka, Bull. Mus. Hist. Nat. II, 2 (1930) 157–164.–Compendium with several new *spp.* and comb.

—, Enumeration of Indian species of Rutaceae-Aurantioideae (J. Bot. 68, 1930, 225–236).–List; syn.; some new *spp.*

—, J. Ind. Bot. Soc. 16 (1937) 227–240.–List of records with new *spp.* and comb.

Malay Peninsula: Burkill, Gard. Bull. Str. Settl. 5 (1931) 212–223.–List of *Atalantia, Citrus,* and *Paramignya* in the Peninsula.

Sumatra: Merrill, Pap. Mich. Acad. Sc. 23 (1938) 180–183.–New *spp.* of *Evodia & Clausena.*

Borneo: Merrill, J. Str. Br. R. As. Soc. *no* 86 (1922) 315.–New *Evodia.*

Ridley, Kew Bull. (1930) 77–80.–Records and descr. of new *spp.*

Java: Backer, Schoolfl. Java (1911) 174–189.–In Dutch; keys!

Bakhuizen van den Brink Jr, Blumea 6 (1950) 365–367.–List; some new *spp.* & new names.

Philippines: Elmer, Leafl. Philip. Bot. 9 (1934) 3216–3217.–A new *Evodia.*

—, *ibid.* 10 (1939) 3781–3783.–A new *Clausena* and *Lunasia.*

Merrill, Philip. J. Sc. 26 (1925) 458–459.–New *spp.* in *Clausena* and *Triphasia.*

—, *ibid.* 27 (1925) 26.–New *spp.* in *Micromelum* and *Clausena.*

—, *ibid.* 29 (1926) 481.–New *Lunasia.*

—, *ibid.* 30 (1926) 399–400.–Syn. of *Merope* Roem.; new *Glycosmis.*

Quisumbing & Merrill, Philip. J. Sc. 37 (1928) 154.–New *Clausena.*

New Guinea: Bailey, Ann. Rep. Br. New Guinea (1901–02) app. p. 1, pl. (1902).–2 new *Citrus.*

Francis, Kew Bull. (1931) 188–195.–Synon. of an *Evodia* and an *Acronychia.*

Kurata, Bull. Tokyo Univ. For. *no* 36 (1948) 124–129, 2 fig.–2 new *Evodias* & other records.

Lauterbach, Nova Guinea 8 (1910) 291–293.–Records & descr. new *spp.*

—, *ibid.* 8 (1912) 823–825.–*Ditto.*

—, *ibid.* 14 (1924) 139–147.–*Ditto.*

—, Bot. Jahrb. 55 (1918) 221–265.–Revision; keys.

—, *ibid.* 59 (1925) 535–536.–New *Terminthodia.*

—, *ibid.* 61 (1927) 30–31.–New *Evodia.*

Merrill & Perry, J. Arn. Arb. 20 (1939) 330–333.–List; 2 new *Flindersias.*

—, *ibid.* 22 (1941) 32–59.–List; many new *spp.*

Ridley, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 24–25.–Descr. some new *spp.*

Swingle, J. Wash. Acad. Sc. 30 (1940) 79–83.

Tanaka, J. Arn. Arb. 9 (1928) 137–141.–Descr. of *Monanthocitrus, Echinocitrus*; new comb. in *Atalantia, Wenzelia & Clausena.*

Valeton, Bull. Dép. Agr. Ind. Néerl. *no* 10 (1907) 23–24.–Records and a new *Melicope.*

White, Proc. R. Soc. Queensl. 34 (1922) 37–38.–List of records.

—, J. Arn. Arb. 7 (1926) 231–233.–New *Paramignya*; on *spp.* of *Citrus* and *Lunasia.*

— & Francis, Proc. R. Soc. Queensl. 38 (1927) 232–234.–New *Flindersia.*

Melanesia: Burtt, Kew Bull. (1935) 300–301.–New *Fagara* and *Melicope* from the Solomons.

New Caledonia: Guillaumin, Bull. Soc. Bot. Fr. 85 (1938) 294–305.–Keys.

Genera

Acronychia (*Terme*): Hallier *f.*, Rec. Trav. Bot. Néerl. 15 (1918) 65–67.–Generic syn.

Atalantia: Guillaumin, Not. Syst. 1 (1910) 175–184.–List and key for Asiat. *spp.*

Airy Shaw, Kew Bull. (1939) 290–293.–Exact syn. of some *spp.*

Swingle, Not. Syst. 2 (1911) 158–163.–Addit. notes to Guillaumin's paper and reduction of one *sp.* to *Glycosmis.*

Bouchardatia: Ridley, Trans. Linn. Soc. II, Bot. 9 (1916) 25.–*B. cyanosperma n.sp.* from New Guinea.

Burkillianthus: Swingle, J. Arn. Arb. 20 (1939) 255–258, t. 2–3.–Segregate from *Citrus*; monotypic; Mal. Pen.

Citrus: Alston, in Trimen, Handb. Fl. Ceyl. Suppl. (1931) 39.–Key for *Citrus*; new comb. for some other *Rutaceae*.

Bonavia, J. Linn. Soc. Lond. Bot. 22 (1887) 213–218.–Discussion on the probable wild source.

—, The cultivated oranges and lemons of India and Ceylon. 2 vols. London (1890) i–xix, 1–384, Atlas t. 1–158 with letterpress.–No keys.

Guillaumin, Bibl. Agric. Col. Paris (1917) 1–80.–Repr. from Agric. Pratique des Pays Chauds.–Revision; no keys.

Lushington, Ind. Forester 36 (1910) 323–353. –Key.

Marcovitch, Landbouw 2 (1926) 1–25, 1 pl.–Key; both in Dutch & English, translated from Russian.

Swingle, in The Citrus Industry (ed. by H. J. Webber and L. D. Bachelor) 1 (1943) 129–474, fig.–Taxon. of *Citrus* and its wild relatives. *Non vidi.*

Tanaka, Bull. Miyazaki College Agric. & For. *no* 1 (1929) 109–114.–Notes on origin & delimitation of *spp.*; key to *spp.* of the loose-skin oranges (*C. nobilis* auct.).

De Vries, Trop. Natuur 17, 1928, 157–158.–Key for some cult. *spp.* in Java; in Dutch.

Clymenia: Swingle, J. Arn. Arb. 20 (1939) 251–254, t. 1.–Bismarck Arch.; segreg. from *Citrus*; monotypic.

Echinocitrus: Tanaka, J. Arn. Arb. 9 (1928) 137–138.–Monotypic; New Guinea.

Fagara: Reeder & Cheo, J. Arn. Arb. 32 (1951) 67–71, t. 1–2.–Critical notes on *Xanthoxylum* and *Fagara* in China.

Feroniella: Koorders & Valeton, Ic. Bog. 2 (1904) t. 149.–Descr. *Feronia lucida* Scheff.

Swingle, Bull. Soc. Bot. Fr. 59 (1912) 774–781 (1913).

Flindersia: Francis, Queensl. Agric. J. 50 (1938) 456–458.–Notes; key to Australian rain-forest *spp.*

White, Proc. Linn. Soc. N.S.W. 46 (1921) 324–329.–List of *spp.* with critical notes; no key.

Fortunella: Swingle, J. Wash. Ac. Sc. 5 (1915) 167–175.

Tanaka, Bull. Soc. Bot. Fr. 75 (1928) 714.–New *sp.* from the Mal. Pen.

Geyera: White, Queensl. Agric. J. (1925) 146–148, t. 27–28.–Descr. & pl. of *G. salicifolia*.

Glycosmis: Kurz, J. Bot. 14 (1876) 33–40, t. 174–175.–Discussion of some allied *spp.*; key.

Narayanaswami, Rec. Bot. Surv. Ind. 14 (1941) 1–72, fig. 1–30.–Revision Indian *spp.*; keys.

Swingle, Not. Syst. 2 (1911) 158–163.–Some notes.

Hunsteinia = Rapanea (*Myrsinaceae*).

Lamiofrutex = Vavaea (*Meliaceae*).

Lavanga (*Luvunga*): Kurz, J. As. Soc. Beng. 39, ii (1870) 69.–Syn. of *L. sarmentosa*.

Limnocitrus: Swingle, J. Arn. Arb. 21 (1940) 2–6, t. 1.–Monotypic, formerly in other genera. *Cf.* Valeton, Ic. Bog. 4 (1912) t. 348.

Limonia (*Feronia*): Koorders & Valeton, Ic. Bog. 2 (1904) t. 149.–Descr. & pl. of *F. lucida* Scheff.

Airy Shaw, Kew Bull. (1939) 293.–*F. elephantum* = *L. acidissima.*

Swingle, J. Wash. Acad. Sc. 4 (1914) 325–328.

Lunasia (*Androcephalium, Mytilicoccus*): Miquel, Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 89.–Census.

White, Proc. R. Soc. Queensl. 34 (1922) 38.–Syn.

Merope: Swingle, J. Wash. Acad. Sc. 5 (1915) 420–425.–Syn. & distr. of *M. angulata*.

Microcitrus: Swingle, J. Wash. Acad. Sc. 5 (1915) 569–578.–A genus of Queensland; key!

Monanthocitrus: Tanaka, J. Arn. Arb. 9 (1928) 138–139.–*Spp.* 3; New Guinea.

Murraya (*Chalcas*): Tanaka, J. Soc. Trop. Agric. Formosa 1 (1929) 23–42.–List of *spp.*; key (under *Chalcas*).

Paramignya: Valeton, Ic. Bog. 4 (1912) t. 148.–*P. angulata.*

Pleiospermium: Swingle, J. Wash. Acad. Sc. 6 (1916) 426–431.–Descr.; 2 *spp.*; key!

—, J. Arn. Arb. 20 (1939) 258–263, t. 3–6.–Descr. new *spp.* from Sumatra and Borneo.

Skimmia: Gamble, Kew Bull. (1917) 301–303.–Note on delimitation of some Sino-Himalayan *spp.*

Masumune, Bull. Soc. Bot. Fr. 84 (1937) 91.–Descr. *S. philippinensis n. sp.*

Swinglea (*Chaetospermum* Swingle *non* Saccardo): Merrill, J. Arn. Arb. 8 (1927) 131–132.

Swingle, J. Wash. Acad. Sc. 3 (1913) 99–102.–Descr.; Philip. genus.

Tetractomia (*Terminthodia*): Merrill & Perry, J. Arn. Arb. 22 (1941) 53–55.–Reduction; census; no key.

Toddalia: Verdoorn, Kew Bull. (1926) 400–401.–Account in Africa.

Xanthoxylum: Reeder & Cheo, J. Arn. Arb. 32 (1951) 67–71, t. 1–2.–Critical notes on Chin. *spp.*

Wenzelia: Swingle, J. Arn. Arb. 26 (1940) 6–17, t. 2–3.

Tanaka, J. Arn. Arb. 9 (1928) 139–141.–Some new comb. Papuan *spp.*

SABIACEAE

Miquel, F. A. W., Revue des Sabiacées de l'Archipel Indien (Miq. Ill. Fl. Arch. Ind. 1870, 71–75).–Descr.; no keys.

Renard, A. le, Recherches anatomiques sur la tige et la feuille des Sabiacées (in Morot, J. de Bot. 21, 1908, 290–332).–Key to *Sabia* on anat. characters; descr. anat. *Sabia* & *Meliosma spp.*

Local

Sumatra: Merrill, Contr. Arn. Arb. 8 (1934) 94–95.–Syn. some *Meliosmas*.

Malay Peninsula: Henderson, Gard. Bull. Str. Settl. 7 (1933) 96–97, t. 18.–New *Meliosma*.

Java: Backer, Schoolfl. van Java (1911) 272–275. –Key, descr.; in Dutch.

Borneo: Merrill, Plant. Elm. Born. (1929) 176–177.–A new *Meliosma.*
Ridley, Kew Bull. (1933) 193.–New *sp.* and new name in *Meliosma.*

Philippines: Elmer, Leafl. Philip. Bot. 10 (1939) 3784–3788.–Descr. 3 new *Meliosmas.*

New Guinea: Merrill & Perry, J. Arn. Arb. 22 (1941) 262–263.–New *Meliosma.*

Genera

Meliosma (*Heteropithmos*): Blume, Rumphia 3 (1847) 196–204, t. 168–169.–Descr.
Cufodontis, Oester. Bot. Z. 88 (1939) 246–268. –Revision Chin. *spp.*; descr.; key!
Fedtschenko, Svensk Bot. Tidskr. 19 (1926) 493–494.
Merrill & Perry, J. Arn. Arb. 20 (1939) 356–360.–Records & descr. of a number of Mal. *spp.*
Urban, Ber. Deut. Bot. Ges. 13 (1895) 211–222, t. 19.–Morphol.

Sabia: Blume, Mus. Bot. Lugd.-Bat. 1 (1851) 368–370, t. 44.–Diagn.
Chen, Sargentia 3 (1943) 1–75.–Monogr.; key.

SALICACEAE

Andersson, N. J., Monographia Salicum (Kongl. Svenska Vet.-Ak. Handl. n.s. 6, 1, 1865, 1–181, t. 1–9).–Monogr.; no keys.

—, in DC. Prod. 16, 2 (1868) 190–331.–Census; descr.; no keys.

Jacobs, M., Fl. Mal. I, 5 (1954) 107–110, fig. 1–3.

Miquel, F. A. W., Salicinées (Ill. Fl. Arch. Ind. 1870, 11–14).–Synopsis.

Local

Sumatra: Jochems, Trop. Natuur 15 (1926) 200–203, fig. 1.
Merrill, Contr. Arn. Arb. 8 (1934) 41–42.–Record.

Genera

Salix: Schneider, Oester. Bot. Z. 62 (1915) 273–278.–Generic subdiv.

SALVADORACEAE

Backer, C. A., Fl. Mal. I, 4 (1951) 224–225, fig. 1.

Candolle, A. de, Prod. 17 (1873) 27–31.–Synopsis; in Latin.

Sleumer, H., Pflanzenfamilien ed. 2, 20b (1942) 232–239.

SAMYDACEAE

See Flacourtiaceae

SANTALACEAE

Blume, C. L., Mus. Bot. Lugd.-Bat. 1 (1850) 180–182, 242–245.–Descr. in Latin.

Danser, B. H., On some genera of Santalaceae Osyrideae from the Malay Archipelago, mainly from New Guinea (Nova Guinea n.s. 4, 1940, 133–149, t. 14).–Descr. of new genera and *spp.*

—, Supplementary notes on the Santalaceous genera *Dendromyza* and *Cladomyza* (Nova Guinea n.s. 6, 1955, 23 pp., 9 tab., *inedit.*).–For both genera keys and descr. of *spp.*; many new *spp.*

Pilger, R., Pflanzenfamilien ed. 2, 16b (1935) 52–91.

Planchon, J. E., Sur les affinités des genres Henslowia, Wall. (Crypteronia? Blume. Quilamum? Blanco), Raleighia, Gardn. et Alzatea, Ruiz. & Pav. (Hook. Lond. J. Bot. 4, 1845, 474–478, t. 16B–D).–Discussion; list of some old and new *spp.* of *Henslowia* from Malaya and the Philippines.

Sprague, T. A. & V. S. Summerhayes, Santalum, Eucarya, and Mida (Kew Bull. 1927, 193–202, 1 map).–Splitting of *Santalum* into 3 genera.

Local

Java: van Steenis, Trop. Natuur 22 (1933) 97–99, 1 fig.–Distinction 2 *spp.*

Moluccas: Merrill, Philip. J. Sc. 11 (1916) Bot. 267–268.–New *spp.* from Ambon.

New Guinea: Lauterbach, Nova Guinea 8 (1910) 287.–Record.
—, *ibid.* 8 (1912) 813.–New *Henslowia.*
Pilger, Bot. Jahrb. 59 (1924) 118–128.–Keys.
Summerhayes, Kew Bull. (1929) 125.–Descr. *Santalum papuanum.*

Genera

Calyptrosepalum: Bailey, & Smith, J. Arn. Arb. 34 (1953) 52–64, t. 1–2.–2nd *sp.* from Fiji.
Moore, J. Bot. (1925) Suppl. 90–92, 1 fig.–Descr. typ.

Phacellaria: Danser, Blumea 3 (1939) 212–235, t. 3–12.–Monogr.; key.

Santalum: Fischer, Kew Bull. (1927) 193–202.
—, J. Bomb. Nat. Hist. Soc. 40 (1938) 458–466. –*S. album* introd. in contin. Asia.
Skottsberg, Act. Hort. Gothob. 5 (1929) 135–145.–Disc. geogr. distr. & alliances Pacific *spp.*

SAPINDACEAE

Blume, C. L., De quibusdam Sapindaceis maxima parte Indiae orientali propriis (Rumphia 3, ?1849, 91–192, t. 166–167.)–Descr.

Herzog, Th., Pflanzenareale Reihe 4, Heft 4 (1936) 35–42, Karte 31–37b.–Distr. tribes and genera, based on Radlkofer's monogr.

Miquel, F. A. W., Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 88–89.

Radlkofer, L., Ueber die Sapindaceen Holländisch Indiens (Act. Congr. Intern. Amsterdam 1877 (1879), 70–133).–Precursory; descr. new *spp.* and genera; discussions; no keys.

—, Nachträge *ibid.* 216–254.–*Ditto.* The reprint of these 2 papers is paged 1–63, 65–103.
—, Ueber Capania und damit verwandte Pflanzen (Sitz.-Ber. Math.-Phys. Kl. Akad. Wiss. München 9, 1879, 457–678).–Survey of trib. *Cupanieae*; key to the genera of this tribe; list of all names used in the tribe; additions to *Arytera* with new *spp.*; *ditto* of *Cupania*; key & new *spp.* of *Cupaniopsis*; *ditto* of *Elattostachys*, *Guioa*, *Rhysotoechia* and some other small genera.

—, Ueber die Gliederung der Sapindaceen

(Sitz.-Ber. Math.-Phys. Kl. Bayer. Akad. Wiss. München 20, 1890, 105–379).–Delimitation of *Sapind.* against other families with special use of the anatomical method; conspectus of tribes and genera of the family (*non vidi*); from extract in Bot. Jahrb. 12 (1890) Lit.-Ber. p. 78–80.

—, Sapindaceae novae Indicae et Malaicae ex herbario Calcuttensi (Rec. Bot. Surv. Ind. 3, 1907, 341–355).–Descr.

—, Pflanzenreich Heft 98 (1931–34) 1–1539, fig. 1–46.

Local

Indo-China: RADLKOFER, Not. Syst. 1 (1910) 298–306.–Descr. new *spp.*

Sumatra: MERRILL, Pap. Mich. Acad. Sc. 23 (1937) 183–184 (1938).–New *Allophylus.*

Malay Peninsula: CORNER, Gard. Bull. Str. Settl. 10 (1939) 38–45, 263.–Disc. on specific delimitation in *Allophylus* and nomencl. in *Mischocarpus.*

Borneo: RIDLEY, Kew Bull. (1932) 178–179.–Record; one new *Otophora.*

—, *ibid.* (1933) 190–193.–New records and *spp.*

Java: ADELBERT, Blumea 6 (1948) 322–325.–Critical notes; no key.

BACKER, Schoolfl. Java (1911) 256–272.–Keys; in Dutch.

RADLKOFER, Flora 118–119 (1925) 399–401.–Descr. 3 new *spp.*

VALETON, Bull. Inst. Bot. Btzg *no* 15 (1902) 1–12.–Some critical notes.

Celebes: KOORDERS, Suppl. Flora N. O. Celebes 2 (1922) t. 52–54; *ibid.* Suppl. 3 (1922) 26–27.–Descr. & pl. of two *spp.*

Lesser Sunda Islands: RADLKOFER, Med. Rijksherb. Leiden *no* 22 (1914) 10–20.–List records coll. ELBERT.

Philippines: MERRILL, Philip. J. Sc. 26 (1925) 468–470.–Descr. of a new *Allophylus.*

QUISUMBING, Philip. J. Sc. 76 (1944) 44–45.–New *Allophylus* from Palawan.

— & MERRILL, Philip. J. Sc. 37 (1928) 163.–New *Otophora* from Mindanao.

RADLKOFER, in PERKINS, Fragm. Fl. Philip. (1904) 56–66.–New records and *spp.*

—, in ELMER, Leafl. Philip. Bot. 1 (1907) 208–211.–Descr. new *spp.*

—, *ibid.* 5 (1913) 1601–1616.–*Ditto.*

—, Philip. J. Sc. 6 (1911) Bot. 181–183.–Descr. 4 new *spp.* from Polillo Isl.

—, *ibid.* 8 (1913) Bot. 443–473.–List; descr. new *spp.*

—, *ibid.* 20 (1922) 657–662.–Descr. new *spp.*

Moluccas: RADLKOFER, Philip. J. Sc. 12 (1917) 83. –A new *Guioa* from Ambon.

New Guinea: KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 57 (1943) 74–83.–New records and several new *spp.*

KOORDERS, Nova Guinea 8 (1909) 171–172.–Some records.

MELCHIOR, J. Arn. Arb. 14 (1933) 63–65.–Suppl. records of BRASS coll.

MERRILL & PERRY, J. Arn. Arb. 21 (1940) 511–527.–Descr. new *spp.* coll. BRASS.

RADLKOFER, Nova Guinea 8 (1911) 617–618.–Some records and a new *Harpullia.*

—, Bot. Jahrb. 50 (1913) 73–80.–List records coll. SCHLECHTER.

—, *ibid.* 56 (1920) 251–316.–Revision; keys.

—, in FEDDE, Rep. 20 (1924) 33–42.–Descr. some new *spp.*

—, Nova Guinea 14 (1926) 181–185.–Some records.

WHITE, Proc. R. Soc. Queensl. 34 (1922) 42.–Some records.

— & FRANCIS, *ibid.* 38 (1927) 238.–Some records coll. LANE-POOLE.

Melanesia: MELCHIOR, Notizbl. Berl.-Dahlem 10 (1930) 227–281.—New *Aphania* and *Harpullia* from New Britain.

Genera

Allophylus: CORNER, Gard. Bull. Str. Settl. 10 (1939) 38–45.–Severe critic on RADLKOFER's species concept in this genus; in Mal. only one species with some varieties.

RADLKOFER, Sitz.-Ber. Math.-Phys. Kl. Kgl. Bayer. Akad. Wiss. München 38 (1909) 201–240.–Keys to all *spp.* of the genus.

Cardiospermum: ALSTON, Handb. Fl. Ceyl. 6 Suppl. (1931) 54.–Key to 3 *spp.*

Dodonaea: SHERFF, Field Mus. Nat. Hist. Publ. Bot. 23 (1947) 269–317.–Descr.

Mischocarpus: CORNER, Gard. Bull. Str. Settl. 10 (1939) 263.–Disputes MERRILL's recombinations based on doubtful LOUREIRO descriptions.

Napaeodendron = Walsura (*Meliaceae*), *cf.* Kew Bull. (1937) 319.

Paranephelium (*Mildea*): MIQUEL, Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 88–89.–Recombination.

SAPOTACEAE

(excl. Boerlagellaceae and *Sarcospermataceae)*

BAEHNI, CH., Mémoires sur les Sapotacées. I. Système de classification (Candollea 7, 1938, 394–508).–Crit. notes on morph.; system of the family; critical notes on the genera; key to the genera.

BOERLAGE, J. G., Sapotacées (Bull. Inst. Bot. Btzg *no* 5, 1900, 20–27).–List caoutchouc furnishing *spp.* coll. VAN ROMBURGH.

BURCK, W., Sur les Sapotacées des Indes néerlandaises et les origines botaniques de la gutta-percha (Ann. Jard. Bot. Btzg 5, 1886, 1–85, t. 1–10).–Descr.; no key.

DUBARD, M., Les Sapotacées du groupe des Isonandrées (Rev. Gén. Bot. 21, 1909, 392–398, fig. 1–3).–General discussion; struct. of genera; no descr. of *spp.*; no keys.

—, *ditto* des Sideroxylinées (Ann. Mus. Col. Marseille (II, 10) 20, 1912, 1–90).–Key to genera; enum. *spp.*

—, *ditto* des Sideroxylinées – Mimusopées (*ibid.* (III, 3) 23, 1915, 1–62, fig. 1–27).–Census; no keys.

ENGLER, A., Beiträge zur Kenntnis der Sapotaceen (Bot. Jahrb. 12, 1890, 496–525).–Discussion delimitation genera.

HASSKARL, J. K., Ueber einige neue Gattungen

der Sapotaceae welche Getah-pertjah liefern (Flora 38, 1855, 577–579).–Descr. 2 new gen. and a new *sp.*

Lam, H. J., The Sapotaceae, Sarcospermaceae, and Boerlagellaceae of the Dutch East Indies and surrounding countries (Bull. Jard. Bot. Btzg III, 7, 1925, 1–289).–Revision; keys.

—, Further studies on Malayan Sapotaceae I (*ibid.* III, 8, 1927, 381–493).–Addition to the revision; no keys.

—, On the system of the Sapotaceae, with some remarks on taxonomical methods (Rec. Trav. Bot. Néerl. 36, 1939, 509–525).–Discussion of Baehni's work; scheme of a new system of the family.

—, Note on the Sapotaceae-Mimusopoideae in general and the Far-Eastern Manilkara-allies in particular (Blumea 4, 1941, 323–358).–*Mimusops p. p.* and *Northia auct.* reduced to *Manilkara*; key to Far-Eastern *spp.* of *Manilkara.*

— & B. J. D. Meeuse, Monograph of the genus Nesoluma (Sapotaceae). A primitive Polynesian endemic of supposed Antarctic origin (Occas. Pap. Bern. P. Bish. Mus. 14, 1938, 127–165, t. 1–5).–Contains new system of the family; a key to *Planchonellidae* of the Pacific; monograph of *Nesoluma* (Pac.).

Pierre, L., Notes botaniques, Sapotacées (1890–91) 1–68 (not finished).–Critical notes on genera and their circumscription.

Valeton, Th., Bull. Inst. Bot. Btzg *no* 15 (1902) 13–16, 2 fig.–New *Payena.*

Vriese, W. H. de, Plant. Ind. Batav. Orient. (1856) 57–63.–List of misc. records and descr.

Local

Malay Peninsula: Gamble, Kew Bull. (1907) 109–121.–Discussion on getah-pertja trees.
Lam, Gard. Bull. Str. Settl. 9 (1935) 105–106, t. 7.–*Madhuca ridleyi n. sp.*

Borneo: Lam, Kew Bull. (1936) 17–19; *ibid.* (1938) 306–307.–Descr. new *Palaquium* and some records.
—, in Hook. Ic. Pl. 34 (1938) t. 3360, 2 pp.–Descr. new *Aulandra.*
Pierre, Arch. Néerl. Sc. Nat. 19 (1884) 104–106, t. 4.–Descr. *Diploknema sebifera n.g. n.sp.*
Ridley, Kew Bull. (1934) 121.–Descr. new *Madhuca.*

Celebes: Koorders, Suppl. Fl. N.O. Celebes 2 (1922) t. 104; *ibid.* 3 (1922) 51.–*Sideroxylon koordersii* Pierre.

Philippines: Dubard, Bull. Mus. Hist. Nat. Paris 15 (1909) 379–385.–Records & descr. of new *spp.* of *Palaquium.*
Elmer, Leafl. Philip. Bot. 3 (1910) 867–874.–Records & new *spp.* from Sibuyan Isl.
—, *ibid.* 10 (1939) 3788–3790.–2 new *Palaquiums* from Sorsogon Isl.
Merrill, Philip. J. Sc. 27 (1925) 46–48.–2 new *Palaquiums* from Luzon.

Moluccas: Holthuis & Lam, Blumea 5 (1942) 226–228.–List records Talaud & Morotai.

New Guinea: Burck, Nova Guinea 8 (1910) 435. –Unimportant record.
Krause, Bot. Jahrb. 58 (1924) 463–487.–Revision; keys!
Lam, Nova Guinea 14 (1931) 549–570, t. 94–129.–Enum; keys!
—, Boissiera 7 (1943) 91–99, 6 fig.–3 new *spp.* of *Planchonella*; new comb. in *Krausella.*
White & Francis, Proc. R. Soc. Queensl. 38 (1927) 252–255, fig. 15–16.–Descr. new *spp.* in *Sideroxylon* and *Achradotypus.*

Pacific: Lam, Proc. 6th Pac. Sc. Congr. 4 (1940) 673–683, 4 maps.–Geogr. distr. *Sapot.* in Pacific; some new comb. in Philip. *Planchonella.*
—, Blumea 5 (1942) 1–46.–Revision Melanesian-Polynesian *spp.*; keys; New Caledonia excluded.

Genera

Aulandra: Lam, in Hook. Ic. Pl. 34 (1938) t. 3360, pp. 1–2.–Second *sp.* from Borneo quite distinct from the other one.

Burckella: Lam & van Royen, Blumea 6 (1952) 580–593, 3 fig.–Revision; key.

Ganua: van den Assem, Blumea 7 (1953) 364–400. –Revision; key.
—, Blumea 7 (1954) 481–483.–Additional note.

Isonandra: Jeuken, Blumea 6 (1952) 547–579, 4 fig.

Manilkara (*Northiopsis, Achras*): Lam, Blumea 4 (1941) 323–343.–Key to Mal.–Pac. *spp.*
Van Royen, Blumea 7 (1953) 401–412.–Revision; key.

Mimusops: van Royen, Blumea 6 (1952) 594–595. –Only *M. elengi.*

Palaquium: Dubard, Mémoire 16, Soc. Bot. France (Déc. 1909) 1–24.–Revision; species listed; several Bornean *spp.* distinguished by Pierre.

Planchonella: Dubard, C. R. Acad. Sc. Paris 152 (1911) 392–393.–Delimitation of the genus.

Pouteria: Baehni, Candollea 9 (1942) 147–476.–Revision; some recombinations of *Planchonellas.*
Lam, Blumea 5 (1943) 336–338.–Some transfers from *Planchonella.*

SARCOSPERMATACEAE

Lam, H. J., Bull. Jard. Bot. Btzg III, 7 (1925) 248–250.–One Mal. *sp.*

—, Concise revision of the Sarcospermaceae (Bull. Jard. Bot. Btzg III, 8, 1926, 18–24, 2 fig.). –Key to all *spp.*

—, Fl. Mal. I, 4 (1948) 32–34, fig. 1.

— & P. van Royen, Concise revision of the Sarcospermataceae (Blumea 7, 1952, 148–153, map).–Key to all *spp.*

— & W. W. Varossieau, Revision of the Sarcospermataceae (Blumea 3, 1938, 183–200).–Key to all *spp.*

—, Additional notes on Sarcosperma (Blumea 3, 1939, 261–262).–Notes & records.

Local

Indo-China: Merrill, J. Arn. Arb. 20 (1939) 351.–Syn. & disc. of *S. kachinense.*

Philippines: Lam, Philip. J. Sc. 19 (1932) 143–146. –Reduction of *Apoia* to *Sarcosperma.*

New Guinea: Lam, Blumea 4 (1941) 322.–Record.

SAURAUIACEAE

See Actinidiaceae

SAURURACEAE

GROFF, G. W., in Piperales of Kwantung China (Lingn. Sc. J. 11, 1932, 81–86).–Key to *Saururus* and *Houttuynia*; descr. of species.

P'EI, CHIEN, The Saururaceae and Chloranthaceae of Eastern China (Bot. Bull. Acad. Sinica 1, *no* 2, 1947, 111–117).– Keys to genera and species.

STEENIS, C. G. G. J. VAN, Blumea 6 (1948) 244–245.–Key to genera.

—, Fl. Mal. I, 4 (1949) 47–48, fig. 1.

Local

Java: VAN STEENIS, Blumea Suppl. 1 (1937) 137–139.–Note on *Houttuynia*.

SAXIFRAGACEAE

ENGLER, A., Pflanzenfamilien ed. 2, 18a (1930) 74–226, fig. 64–132.

HUTCHINSON, J., The genera of Hydrangeaceae and J. E. DANDY *ditto* of Saxifragaceae (Kew Bull. 1927, 101–118, 6 maps).–Keys!

MAXIMOWICZ, C. J., Revision Hydrangeearum Asiae Orientalis (Mém. Acad. Imp. Sc. St.-Pétersb. VII, 10¹⁶, 1867, 1–48, t. 1–3).–Incl. also key to *spp.* of *Hydrangea* and *Deutzia*.

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 13 (1934) 249–250.–List *spp.* of mountain genera.

Local

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 66–67.–Small list; one new *Polyosma*.

—, Pap. Mich. Acad. Sc. Arts & Lett. 20 (1935) 97–98.–Records of some *Polyosma*.

—, Not. Nat. Acad. Nat. Sc. Philad. *no* 47 (1940) 2.–Record of *Parnassia*.

Malay Peninsula: KING, J. As. Soc. Beng. 66, ii (1897) 297–305.–Keys!

Borneo: MERRILL, Sarawak Mus. J. 3 (1928) 523–524.–New *Polyosma*.

Java: BACKER, Schoolfl. Java (1911) 466–472.–Key; in Dutch.

Philippines: ELMER, Leafl. Philip. Bot. 2 (1908) 527–529.–Key of 2 Philip. *spp.*

—, *ibid.* 5 (1913) 1633–1639.–Records & new *spp.* of *Polyosma*.

MERRILL, En. Philip. Fl. Pl. 2 (1923) 218–221.–List.

Moluccas: MERRILL, Philip. J. Sc. 11 (1916) Bot. 273–274.–New *Polyosma*.

New Guinea: KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 56 (1942) 304–308.–New *Polyosmas*.

LAUTERBACH, Nova Guinea 8 (1912) 821.–New *Polyosma*.

MATTFELD, Bot. Jahrb. 69 (1938) 273–275.–Two new *Polyosmas*.

—, *ibid.* 70 (1940) 469–470.–New *Quintinia*.

REEDER, J. Arn. Arb. 27 (1946) 275–288.–New *spp.* in *Quintinia*, *Carpodetus*, and *Polyosma*.

SCHLECHTER, Nova Guinea 12 (1912) 487–490.–Descr. new *spp.* in *Astilbe*, *Dichroa*, *Quintinia*, and *Carpodetus*.

—, Bot. Jahrb. 52 (1914) 118–138.–Important; keys!

New Caledonia: GUILLAUMIN, Bull. Soc. Bot. Fr. 86 (1939) 275–278.–Keys.

Genera

Astilbe: HENRY, Gard. Chron. III, 32 (1902) 95, 154–156, 171.–Revision; species listed; new Philip. *sp.*

KNOLL, Sitz.-Ber. Math.-Nat. Kl. Akad. Wiss. Wien 118, Abt. 1 (1909) 45–88, 11 fig., t. 1–4.–Key & descr.; nomencl. antedated.

Deutzia: LEMOINE, J. Soc. Nat. Hort. Fr. IV, 3 (1902) 298–314, fig. 8–9.–Hortic. monograph; no keys.

AIRY SHAW, Kew Bull. (1934) 177–182.–Key to the *spp.* of the Asiat. *§ Mesodeutzia*.

Dichroa: HALLIER *f.*, Meded. Rijksherb. Leiden *no* 37 (1918) 11–12.–Small note.

WU, Bot. Jahrb. 71 (1941) 180.–Key to Chinese *spp.*

Heuchera: ROSENDAHL, BUTTERS & LAKELA, Minnesota Stud. Pl. Sc. 2 (1936) 1–180, 5 fig.–Monogr. with descr. & keys.

Itea: WU, Bot. Jahrb. 71 (1941) 178.–Key to Chinese *spp.*

YAMAMOTO, Acta Phytotax. & Geobot. 6 (1937) 245–250, fig. 1–3.–Key & descr. Formosan *spp.*

Parnassia: FRANCHET, Bull. Soc. Bot. Fr. 44 (1897) 244–263.–Synopsis with partial key!

HANDEL-MAZZETTI, Oester. Bot. Z. 90 (1941) 127–136.–Key to Chinese *spp.*

KERR, J. Siam Soc., Nat. Hist. Suppl. 9 (1934) 327–328, 1 fig.–Occurrence in Siam.

MERRILL, Not. Nat. Ac. Nat. Sc. Philad. *no* 47 (1940) 2.–Record from Sumatra.

Polyosma: BLUME, Mus. Bot. Lugd.-Bat. 1 (1850) 258–261.–List; descr.

Saxifraga: ENGLER & IRMSCHER, Pflanzenreich Heft 67 (1916) 1–448; Heft 69 (1919) 449–709, pars generalis 1–47, fig. 101–124.

SCHEUCHZERIACEAE

See Juncaginaceae

SCHISANDRACEAE

BLUME, C. L., Flora Javae fasc. 33 (1830) 18 pp., 5 tab.

SMITH, A. C., The families Illiciaceae and Schisandraceae (Sargentia 7, 1947, 79–224).–Monograph; keys! Comprises *Kadsura* and *Schizandra*.

SCROPHULARIACEAE

BENTHAM, G.; Scrophularineae Indicae. A synopsis of the East Indian Scrophularineae (1835) 1–57.–No key to genera; short descr.; partial keys to *spp.*

—, Synopsis of the Buchnereae, a tribe of the Scrophulariaceae (in HOOK. Comp. Bot. Mag. 1, 1836, 356–384).–Conspectus incl. *Striga* and *Buchnera*.

—, Synopsis of the Gerardieae, a tribe of Scrophulariaceae (in Hook. Comp. Bot. Mag. 1, 1836, 192–212, t. 11).–Synopsis; no key.

—, in DC. Prod. 10 (1846) 186–586, 589–598.

Pennell, F. W., The Scrophulariaceae of the Southeastern United States (Proc. Ac. Nat. Sc. Philad. 71, 1920, 224–291).–Revision; keys.

—, Scrophulariaceae of Cuba (*ibid.* 75, 1923, 1–21).

—, Genotypes of the Scrophulariaceae in the first edition of Linné's 'Species Plantarum' (Proc. Acad. Nat. Sc. Philad. 82 (1931) 9–26).–Typification.

—, The Scrophulariaceae of Eastern temperate North America (Acad. Nat. Sc. Philad. Monogr. 1, 1935, 1–650).–Revision; keys to tribes, genera and *spp.*

—, The Scrophulariaceae of the Western Himalayas (Acad. Nat. Sc. Philad. Monogr. 5, 1943, i–vii, 1–163, t. 1–25).

Prain, D., Some additional Scrophulariaceae (J. As. Soc. Beng. 72, 1904, 11–23).–A number of additions to Fl. Br. Ind. incl. Malay Peninsula; critical notes on synon.; no keys.

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1934) 250–253.–List of *spp.* of mountain genera in Mal.

Local

East Asia: Yamazaki, J. Jap. Bot. 25 (1950) 20[illegible]–217, 3 fig.; *ibid.* 27 (1952) 61–68.–Misc. notes; some new *spp.* and comb.

India: Santapau, J. Bomb. Nat. Hist. Soc. 49 (1950) 25–49.–Keys, synonymy, and notes on Bombay *spp.*, based on Pennell's work.

Indo-China: Bonati, Not. Syst. 1 (1911) 331–339. –Descr. new *spp.*

—, Bull. Soc. Bot. Fr. 71 (1924) 1091–1100.–Descr. new *spp.* No key.

Formosa: Li, Quart. J. Taiwan Mus. 3 (1950) 55–80.–Critical review; no key.

Sumatra: Merrill, Pap. Mich. Acad. Sc. 23 (1937) (1938) 189–191.–Records.

Borneo: Merrill, Sarawak Mus. J. 3 (1928) 549.–Record of a *Lindernia.*

Java: Backer, Onkruidfl. Jav. Suiker. (1931) 598–629.–In Dutch; key.

Philippines: Quisumbing, Philip. J. Sc. 41 (1930) 345.–Record of *Veronica javanica* in Luzon.

— & Merrill, Philip. J. Sc. 37 (1928) 198–199.–New record of a *Torenia* from Luzon.

Du Rietz, Svensk Bot. Tidskr. 25 (1931) 500–542, 11 fig.–Descr. 2 new Philip. *Euphrasias* and their plant-geogr. significance.

Moluccas: Merrill, Philip. J. Sc. 11 (1916) Bot. 312.–Ambon records; 2 new comb.

New Guinea: Diels, Bot. Jahrb. 62 (1929) 490–492.–Records and *Detzneria n.g.*

— & Lanjouw, Nova Guinea 14 (1928) 534–539.–List; one new *Euphrasia.*

Pennell, Brittonia 2 (1936) 177–188.–Enum. Pap. *spp.* coll. Brass.

—, J. Arn. Arb. 24 (1943) 243–275, t. 1–5.–Second revision; keys!

Du Rietz, Svensk Bot. Tidskr. 25 (1931) 526–539.–Some new names (*nom. nud.*) of proposed New Guinean *Euphrasias* are mentioned in a discussion on plant geography.

Schlechter, Bot. Jahrb. 59 (1924) 99–117.–Rev. Pap. *spp.*; keys!

Genera

Alectra: Handel-Mazzetti, Symb. Sin. 7 (1936) 843. *Cf.* Yamazaki, J. Jap. Bot. 25 (1950) 213.–*A. arvensis* reduced to *Melasma arvense.*

Melchior, Notizbl. Berl.-Dahlem 15 (1941) 423–447.–Revision of the genus; keys.

Bacopa (*Herpestis*): Pennell, Proc. Acad. Nat. Sc. Philad. 98 (1946) 83–98.–Redefinition of the genus; complete revision; keys!

Brookea: Hallier *f.*, Bull. Herb. Boiss. II, 3 (1903) 194, 206.–H. assumes this genus to belong to the *Gesneriaceae.*

Calceolaria: Kraenzlin, Pflanzenreich Heft 28 (1907) 21–128.–Monograph; keys.

Centranthera (*Razumovia* Spr. 1807, *non* Spr. 1805): Merrill, Bull. Torr. Bot. Club 64 (1937) 589–598.–*Spp.* under *Razumovia*; key!

—, 150th Anniv. vol. Ann. R. Bot. Gard. Calcutta (1942) 53–58.–Revision; key.

Yamazaki, J. Jap. Bot. 25 (1950) 209.–New comb. for *C. tranquebarica.*

Ellisiophyllum: Baillon, Bull. Soc. Linn. Paris 103 (1890) 817–818.–Transfers the genus from *Hydrophyllaceae* to *Scrophulariaceae.*

Makino, Tokyo Bot. Mag. 20 (1906) 91–92, t. 5.–Syn.; new comb.

Yamazaki, J. Jap. Bot. 27 (1952) 61, fig. 1.–Descr. new variety from Japan.

Euphrasia: Li, Not. Nat. Ac. Sc. Philad. *no* 254 (1953) 1–6.–Key to Chinese *spp.*

Von Wettstein, Oester. Bot. Z. 43 (1893) 77–83, 126–133, 193–202, 238–241, 305–310, t. 6; *ibid.* 44 (1894) 5–11, 53–60, 92–97, 132–138, 169–173, 244–249, 288–294, 328–333, 374–381, 405–410, 448–455; *ibid.* 45 (1895) 14–17, 111–112, t. 3.–Revision; descr. *spp.*; key to Austrian *spp.* (1895).

—, Monographie der Gattung Euphrasia. Leipzig (1896) 316 pp., 18 Taf.–Key to *spp.*; no Mal. *spp.* included.

Hemiphragma: Yamazaki, J. Jap. Bot. 25 (1950) 212.–Philip. sheets represent a variety.

Limnophila: Airy Shaw, Kew Bull. (1951) (1952) 370.–*L. viscosa* Ridl. appears to be *Staurogyne glauca.*

Lindernia (*Ilysanthes*): Hara, J. Jap. Bot. 19 (1943) 203–209.–*Spp.* of Japan; several new comb. of Mal. *spp.* and their syn.

Mukerjee, J. Ind. Bot. Soc. 24 (1945) 127–134. –Revision Indo-Burmese *Lindernias*; key to 28 *spp.*

Urban, Ber. Deut. Bot. Ges. 2 (1884) 429–442. –Discussion of alliance *Ilysanthes*, *Bonnaya*, *Lindernia*, *Vandellia.* Survey of *Ilysanthes spp.*

Mazus: Bonati, Bull. Herb. Boiss. II, 8 (1908) 525–539.–Revision; key.

Li, Brittonia 8 (1954) 29–38.–Revision; key.

Mimulus: Grant, Ann. Missouri Bot. Gard. 11 (1924) 99–388, t. 3–10, fig. 1–3.–Monogr.; keys!

VAN STEENIS, Reinwardtia 1 (1952) 472–474.–First record from Sumatra.

Pentstemon: KRAUTTER, Contr. Bot. Lab. Univ. Philad. 3 (1908) 93–206.–Monogr.; key.

Picria (*Curanga*): MERRILL, Trans. Am. Phil. Soc. n. s. 24 (2) (1935) 353.–Nomencl.

Russelia: BOR & RAIZADA, J. Bomb. Nat. Hist. Soc. 46 (1946) 411–413, t. 26, 1–4.–Key to 2 cult. *spp.*

HOLTTUM, M. A. H. A. Mag. 11 (1941) 73–75, 1 fig.–*Spp.* in Malaya.

ROBINSON, Proc. Amer. Ac. Arts & Sc. 35 (1900) 319–321 (repr. in Contr. Gray Herb. new ser. 18).–Revision; key.

STANDLEY, Contr. U. S. Nat. Herb. 23 (1924) 1308–1310.–Key Mexic. *spp.*

Scoparia: CHODAT, Bull. Herb. Boiss. II, 8 (1908) 1–16.–Revision; key!

FRIES, Arkiv Bot. 6 (*no* 9) (1907) 1–31, t. 1–8.–Revision; key.

—, Bull. Herb. Boiss. II, 8 (1908) 934–940.–Some remarks on CHODAT's revision.

Striga: BARNES, J. Ind. Bot. Soc. 15 (1936) 125–130, t. 11.–Key to 4 *spp.*

BURNS, *ibid.* 1 (1920) 212–216, 4 fig.–Variation in flower colour of Bombay *spp.*

Veronica: LEHMANN, Ann. Jard. Bot. Btzg 25 (1912) 189–201.–Precurs. study on syn. & distr. of *V. javanica.*

RIEK, in FEDDE, Rep. Beih. 79 (1935) 1–68.–Syst. notes on *§ Chamaedrys*; no keys!

RÖMPP, in FEDDE, Rep. Beih. 50 (1928) 1–172.–Precursory to monograph; keys!

Wightia: HALLIER *f.*, Bull. Herb. Boiss. II, 3 (1903) 194–196, 206.–H. assumes this genus to belong to the *Bignoniaceae.*

VAN STEENIS, Bull. Bot. Gard. Btzg III, 18 (1949) 213–227.–Revision; key.

SCYPHOSTEGIACEAE

BAEHNI, CH., L'inflorescence mâle du Scyphostegia borneensis (C. R. Sc. Soc. Phys. Hist. Nat. Genève 54, 1937, 91–92).–Extract of next paper.

—, Note sur les inflorescences mâles et femelles du Scyphostegia borneensis Stapf (Bull. Soc. Bot. Suisse 48, 1938, 22–28, 3 fig.).–Descr. of ♂ flowers & discussion of taxon. position.

STAPF, O., Trans. Linn. Soc. Lond. II, Bot. 4 (1893) 217–219, t. 17.

SIMAROUBACEAE

(*incl. Irvingiaceae*)

BOAS, F., Beiträge zur Anatomie und Systematik der Simarubaceae (Beih. Bot. Centralbl. 29, ii (1913) 303–356, fig. 1–7).–*Non vidi.*

CRONQUIST, A., Studies in the Simaroubaceae IV. Resumé of the American genera (Brittonia 5, 1944, 128–147).–Keys to genera & *spp.*; descr.

—, Additional notes on the Simaroubaceae (Brittonia 5, 1945, 469–470).–Revised key to the genera.

ENGLER, A., Pflanzenfamilien ed. 2, 19a (1931) 359–405, fig. 166–190.

JADIN, F., Contribution à l'étude des Simarubacées (Ann. Sc. Nat. Bot. VIII, 13, 1901, 201–304).–Morph. & anat. of genera.

PLANCHON, J. E., Revue de la famille des Simaroubacées (HOOK. Lond. J. Bot. 5, 1846, 560–584).–List of genera and *spp.*

TIEGHEM, PH. VON, Sur les Irvingiacées (Ann. Sc. Nat. IX, 1, 1905, 247–320).–Treatment of *Irvingia* and *Irvingella* as belonging to a separate family.

Local

Indo-China & China: LECOMTE, Not. Syst. 1 (1909) 101–105.–List.

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 80–81.–2 records.

Borneo: MERRILL, Philip. J. Sc. 30 (1926) 82.–First record of *Harrisonia.*

Java: BACKER, Schoolfl. Java (1911) 189–194.–Keys; in Dutch.

Philippines: RADLKOFER, Philip. J. Sc. 6 (1911) Bot. 365–367.–Descr. *Hebonga n.g.* with 2 new *spp.*

New Guinea: LAUTERBACH, Bot. Jahrb. 56 (1921) 341–344.–Census.

WHITE, J. Arn. Arb. 31 (1950) 91.–Records of *Ailanthus.*

Melanesia: MELCHIOR, Notizbl. Berl.-Dahlem 10 (1930) 893–896.–New *Ailanthus* from Bismarck Arch.

New Caledonia: GUILLAUMIN, Bull. Soc. Bot. Fr. 85 (1938) 19–20.–Genera *Suriana* and *Soulamea*; with keys.

SIPHONODONTACEAE

See Celastraceae

SOLANACEAE

BAEHNI, CH., L'ouverture du bouton chez les Solanées (Candollea 10, 1946, 399–492).–New classification of tribes and genera based on the opening of the bud.

BITTER, G., Weitere Untersuchungen über das Vorkommen von Steinzellkonkretionen im Fruchtfleisch beerentragender Solanaceen (Abh. Naturw. Ver. Bremen 23, 1915, 114–163).–Anat.

DUNAL, F., in DC. Prod. 13, 1 (1852) 1–690.

MORTON, C. V., in Studies of tropical American plants (Contr. U. S. Nat. Herb. 29, 1944, 54–55).–Reduces *Lycianthes* to a section of *Solanum.*

Local

India: NEES VON ESENBECK, Trans. Linn. Soc. 17 (1837) 37–82.–Monogr. East Indian *Solaneae*; no keys.

SANTAPAU, J. Bombay Nat. Hist. Soc. 47 (1948) 652–662.–Revision *spp.* Bombay Pres.; keys.

Sumatra: WITASEK, Oester. Bot. Z. 80 (1931) 162–167.–Enum. coll. SCHIFFNER.

Java: ADELBERT, Blumea 6 (1948) 327–333.–Critical notes; one new *sp.*

WITASEK, Oester. Bot. Z. 80 (1931) 162–167.–List coll. SCHIFFNER.

Philippines: ELMER, Leafl. Philip. Bot. 2 (1910) 729–734.–Account of *Solanums* from Mt Apo; some new *spp.*

New Guinea: Bitter, Bot. Jahrb. 55 (1917) 59–113.–*Solanum spp.*; key!
Merrill & Perry, J. Arn. Arb. 30 (1949) 45–52. –New *spp.* and records.
White, Proc. R. Soc. Queensl. 34 (1922) 51–52. –Some records.

Genera

Brugmansia (*Pseudodatura*): Lagerheim, Bot. Jahrb. 20 (1895) 655–668, t. 11.–Monogr. Ecuador *spp.*; key.
Safford, J. Wash. Acad. Sc. 11 (1921) 182–189. –Treated as *Datura §* ; key!
Van Steenis, Bull. Jard. Bot. Btzg III, 11 (1930) 15–18.–Syn. Mal. *spp.*
—, Trop. Natuur 30 (1941) 33–37, fig. 1–2.–Key 2 Mal. *spp.*; in Dutch.
Van Zijp, Nat. Tijd. Ned. Ind. 80 (1920) 24–28.

Capsicum: Bitter, in Fedde, Rep. 15 (1917) 96–98.–Crit. notes on a Philip. *sp.*
Irish, 9th Ann. Rep. Missouri Bot. Gard. (1898) 53–110, t. 8–28.–Key! With special regard to garden varieties.
Paul, Trop. Agric. Ceylon 94 (1940) 10–18, 198–213, 332–354.–With keys to the varieties of the *spp.*

Cestrum: Francey, Candollea 6 (1935) 46–398; *ibid.* 7 (1936) 1–132, 5 pl.–Monograph; key!
Pittier, J. Wash. Acad. Sc. 22 (1932) 25–37.–Venezuelan *spp.*, several new; key!

Cyphomandra: Sendtner, Flora 28 (1845) 161–176, t. 1–9.–Monograph Brazilian *spp.*; key; differences with other genera.

Datura: Safford, J. Wash. Acad. Sc. 11 (1921) 173–189, fig. 1–3.–Revision; key! Includes *Brugmansia.*
Van Steenis, Trop. Natuur 30 (1941) 35–38.–Key 2 Mal. *spp.*; in Dutch.

Lycianthes: Amshoff, Act. Bot. Neerl. 3 (1954) 419–420.–Suggests that *Parascopolia* is the oldest name for this segregate.
Bitter, Abh. Naturw. Ges. Bremen 24 (1919) 292–520.–Precursory revision; no key; segregate of *Solanum.*
—, in Fedde, Rep. 18 (1922) 314–321.–Addition to the above.

Lycium: Hitchcock, Ann. Missouri Bot. Gard. 19 (1932) 179–374.–Monograph of New World *spp.*

Nicandra: Bitter, Beibl. Bot. Centralbl. 14 (1903) 145–176, Taf. 9–14.–Races of *N. physaloides.*

Nicotiana: Comes, Atti Reale Istituto d'Incorrag. Napoli V, 1 (1899) 1–80, t. 1–7 (fig. 1–14).–Monogr.; infrageneric subdivis.; enum. *spp.*; no keys.
—, Monographie du genre Nicotiana, *etc.* Naples (1899), 1–80, t. 1–7.–French translation of the above. *Non vidi.*
Goodspeed, Univ. Cal. Publ. Bot. 18 (1945) 345–368, 7 fig.–Sect. div.; no keys.
Wheeler, Univ. Calif. Publ. Bot. 18 (1935) 45–68.–Revision of Australasian *spp.*; key!

Petunia: Fries, Kungl. Svenska Vet.-Ak. Handl. 46, *no* 5 (1911) 1–72, t. 1–5.–Monograph; key.

Salpichroa: Benoist, Bull. Soc. Bot. Fr. 85 (1938) 408–410.–S. American; some new *spp.*; provisional key!

Solanum: Bitter, in Fedde, Rep. 10 (1912) 529–565; *ibid.* 11 (1912) 1–18, 202–237, 241–260, 349–394, 431–473, 481–491, 561–562; *ibid.* 12 (1913) 1–10, 49–90, 136–162, 433–467, 542–555; *ibid.* 13 (1914) 88–103, 169–173; *ibid.* 15 (1917) 93–98; *ibid.* 16 (1919) 10–15, 79–103; (1920) 389–409.–Descr. and notes on new and noteworthy *spp.* all over the world, mostly the New World.
—, Bot. Jahrb. 49 (1913) 560–569; *ibid.* 54 (1917) 416–506; *ibid.* 57 (1921) 248–286.–Revision, keys; descr., and notes on new and noteworthy *spp.* from Africa.
—, in Fedde, Rep. Beih. 16 (1923) 1–320.–*Ditto.*
Correll, U. S. Dep. Agric., Agr. Monogr. *no* 11 (1952) 1–243, fig. 1–168.–Revision *sect. Tuberarium* of N. & Central America; keys.
Van Steenis, Bull. Jard. Bot. Btzg III, 13 (1934) 253.–Some records of mountain *spp.*

SONNERATIACEAE

Backer, C. A. & C. G. G. J. van Steenis, Fl. Mal. I, 4 (1951) 280–289, fig. 1–6.–Complete revisions of the genera *Sonneratia* and *Duabanga.*

Local

New Guinea: Merrill & Perry, J. Arn. Arb. 22 (1941) 269.–2 Records.
Pulle, Nova Guinea 8 (1911) 677.–One record.
White, Proc. R. Soc. Queensl. 34 (1922) 45–46. –Records.

Genera

Sonneratia: Backer, Bull. Jard. Bot. Btzg III, 2 (1920) 329–330.–Excellent key to 3 *spp.*; one new.
Parker, Ind. For. 51 (1925) 505–510.–Revision.

SPARGANIACEAE

Backer, C. A., Fl. Mal. I, 4 (1951) 233–234, fig. 1.
Graebner, P., Pflanzenreich Heft 2^2 (1900) 1–26.

SPHENOCLEACEAE

Shaw, H. K. Airy, Fl. Mal. I, 4 (1948) 27–28, fig. 1.

STACKHOUSIACEAE

Brouwer, F. I., Fl. Mal. I, 4 (1948) 35–36, fig. 1–2.

Mattfeld, J., Pflanzenfamilien ed. 2, 20b (1942) 240–254.

Pampanini, R. & G. Bargagli-Petrucci, Monografia della famiglia delle Stackhousiacee (Bull. Herb. Boiss. II, 5, 1905, 901–916, 1045–1060, 1145–1160, t. 10–15; *ibid.* 6, 1906, 39–44).

Local

New Guinea: van Steenis, Nova Guinea 14 (1927) 307.–New variety.
—, J. Arn. Arb. 28 (1947) 422.–Record.

Genera

Stackhousia: Brouwer, Blumea 3 (1938) 174–178. –Revision.

STAPHYLEACEAE

Krause, J., Pflanzenfamilien ed. 2, 20b (1942) 255–321.

Local

Philippines: ELMER, Leafl. Philip. Bot. 9 (1934) 3217–3218.–Descr. new *Turpinia*.
MERRILL, Philip. J. Sc. 27 (1925) 33–35.–Descr. 2 new Philip. *spp.*, one 1-foliolate.

Genera

Turpinia: MERRILL & PERRY, J. Arn. Arb. 22 (1941) 543–555.

STEMONACEAE

(*Roxburghiaceae*)

KRAUSE, K., Pflanzenfamilien ed. 2, 15a (1930) 224–227.

PRAIN, D., Notes on the Roxburghiaceae, *etc.* (J. As. Soc. Beng. 73, 1904, 39–44).–Key to *spp.*

Local

Indo-China: GAGNEPAIN, Bull. Soc. Bot. Fr. 81 (1934) 146–148.–Descr. 5 new *spp.* from Siam & Indo-China.

Java: BACKER, Handb. Fl. Java 3 (1924) 44–45.–One *sp.*

New Guinea: SCHLECHTER, Bot. Jahrb. 59 (1924) 541–543.–Descr. 2 new *spp.*; key!
SMITH, Nova Guinea 8 (1909) 198.–Record.
—, *ibid.* 14 (1926) 208–209.–Descr.

Genera

Stemona: KRAUSE, Notizbl. Berl.-Dahlem 10 (1928) 289–290.–Notes on synon. & distr. of some *spp.*
PRAIN, J. As. Soc. Beng. 73 (1904) 39–43.–Key!
SCHLECHTER, Notizbl. Berl.-Dahlem 9 (1924) 190–196, fig. 7.–Infrageneric division; key to sections; enumeration of all *spp.*; descr. 2 new Chin. *spp.*
SMITH, Ic. Bog. 3 (1907) 244–246.–Discussion *St. javanica* and *St. moluccana*.
—, Bull. Jard. Bot. Btzg III, 6 (1924) 73–78.–Descr. new *spp.*
WRIGHT, J. Linn. Soc. Bot. 32 (1896) 490–496.–Revision; key!

STERCULIACEAE

BENTHAM, G., Notes on Malvaceae and Sterculiaceae (J. & Proc. Linn. Soc. Lond. 6, 1862, 110–122).–Generic distinction.

HOCHREUTINER, B. P. G., Ann. Jard. Bot. Btzg Suppl. 3 (1910) 821–831.–Descr. *spp.* cult. in Hort. Bog.

KORTHALS, P. W., Overzigt der Sterculiaceae en Buttneriaceae van de Nederlandsche Oost-Indische Bezittingen (Ned. Kruidk. Arch. 1, 1848, 301–313).–In Dutch; list of Neth.-Ind. *spp.*, incl. also *Bombacaceae* and *Tiliaceae*; descr. *Covilhamia* and *Schoutenia*.

Local

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 103–104.–Records; synon.
—, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 169–171.–3 new *spp.* of *Sterculia*.

Malay Peninsula: BURKILL, Kew Bull. (1935) 317.–New comb. in *Firmiana*.
CORNER, Gard. Bull. Str. Settl. 10 (1939) 262.–Record of *Pterospermum acerifolium*.
SYMINGTON, Kew Bull. (1937) 319.–*Peniculifera* reduced to *Trigonopleura*.

Borneo: MERRILL, Philip. J. Sc. 21 (1922) 524–529.–Descr. 5 new *Sterculias*.
—, *ibid.* 29 (1926) 394–395.–Descr. 2 *Sterculias*.
—, *ibid.* 30 (1926) 84.–Record of a *Pterospermum*.
RIDLEY, Kew Bull. (1938) 222–226.–List; descr. new *spp.* in *Sterculia*, *Tarrietia* and *Buettneria*.
AIRY SHAW, Kew Bull. (1949) 160–162.–List Oxford Exp.; one new *Sterculia*.
WARBURG, in FEDDE, Rep. 18 (1922) 330.–Descr. new *Buettneria*.

Java: ADELBERT, Blumea 5 (1945) 505–507.–Critical notes; a new *Melhania* and *Sterculia*.
BACKER, Schoolfl. Java (1911) 133–146.–Keys! In Dutch.

Celebes: KOORDERS, Suppl. Flora N. O. Celebes 2 (1922) t. 66–68; *ibid.* 3 (1922) 32–34.–Pl. of 3 *spp.*

Philippines: ELMER, Leafl. Philip. Bot. 5 (1913) 1641–1644.–List Philip. *Trichospermums*; descr. 2 new *spp.*
MERRILL, Philip. J. Sc. 30 (1926) 409–411.–Descr. new *Sterculia*.

New Guinea: KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 55 (1941) 389.–Some records.
MERRILL & PERRY, J. Arn. Arb. 30 (1949) 40–44.–Additions; some new *spp.* of *Sterculia*.
MILDBRAED, Bot. Jahrb. 62 (1929) 347–367.–Revision; keys!
VON MUELLER, Vict. Nat. 3 (1886) 45–52.–Some new *Pterygota*, *Sterculias*, and *Brachychiton*.
PULLE, Nova Guinea 8 (1911) 665–666.–Some records.
WHITE, J. Arn. Arb. 10 (1929) 239–240.–Misc. records.

Melanesia: MILDBRAED, Notizbl. Berl.-Dahlem 10 (1930) 281–282.–Descr. new *Sterculia*.
VON MUELLER, Australas. J. Pharm. 2 (1887) 43–45.–Descr. 2 new *spp.* New Britain.

Genera

Abroma: MIQUEL, Ill. Fl. Arch. Ind. (1871) 105.–Notes.

Buettneria: MIQUEL, Ill. Fl. Arch. Ind. (1870) 90–92.–List; descr.

Commersonia: GAGNEPAIN, Not. Syst. 1 (1909) 96–97.–Varieties of *C. echinata*.

Covilhamia = Stixis (*Capparidaceae*).

Erythropsis: BURKILL, Gard. Bull. Str. Settl. 5 (1932) 231.–Discussion; one new comb.
RIDLEY, Kew Bull. (1934) 215–216.–List of Mal. *spp.*; one new *sp.* from India.

Firmiana: RIDLEY, Kew Bull. (1934) 214–215.–List of *spp.*

Hildegardia: KOSTERMANS, J. Sc. Res. Indon. 2 (1953) 11.–Revision; one new *sp.* in Mal.

Melochia (*Aleurodendron*): GARCKE, Bot. Jahrb. 12 (1890) Beibl. *no* 27, 29–32.–Discussion synon. and confusion with *Waltheria* and other genera.

Leptonychia: Burret, Notizbl. Berl.-Dahlem 9 (1926) 727–731.–Several *spp.* of *Grewia* appear to belong to *L.*

Peniculifera = Trigonopleura (*Euphorbiaceae*), *cf.* Symington, Kew Bull. (1937) 319.

Pterocymbium: Kostermans, Reinwardtia 1 (1950) 41–50.–Revision Mal. *spp.*; key!; descr.; one new comb. in *Sterculia.*

—, *ibid.* 2 (1953) 363–365, fig. 3.–New sp.; revised key.

Pterospermum: Miquel, Ill. Fl. Arch. Ind. (1870) 84–89.–List; descr.

Pterygota: Kostermans, Reinwardtia 2 (1953) 365–366, fig. 4.–New comb.; *Tetradia* incorporated in *Pterygota.*

Reevesia: Anthony, Not. R. Bot. Gard. Edinb. 15 (1926) 121–129, 2 fig.–Revision of the genus; enum. and key!

—, *ibid.* 15 (1927) 237–238.–Revision of specimens from Java.

Scaphium: Kostermans, J. Sc. Res. Indon. 2 (1953) 2–11, fig. 1–6, tab.–Revision Mal. *spp.;* key; remarks on other genera.

Sterculia: Schumann, Bot. Jahrb. 24 (1898) Beibl. 58, 14–21.–Beccari collection.

Tarrietia: Sprague, Kew Bull. (1916) 85–86.–Some critical notes concerning distinction *Heritiera, Tarrietia, & Argyrodendron.*

Theobroma: Bernoulli, Neue Denkschr. Allg. Schweiz. Ges. Naturwiss. Zürich 24 (1871) 1–15, t. 1–7.–Revision; no key.

Chevalier, Rev. Bot. Appl. & Agric. Trop. 26 (1946) 265–285, t. 5–6.–Revision; key; based on the coll. of the Paris Herbarium.

Triumfetta: Sprague & Hutchinson, J. Linn. Soc. Bot. 39 (1909) 231–276, t. 17.–Revision African *spp.*; key!

STYLIDIACEAE

Good, R. D., New Phytol. 24 (1925) 225–240, 3 maps.–Discuss. of geogr. distr.

Mildbraed, J., Pflanzenreich Heft 35 (1908) 1–98, fig. 1–26.

Slooten, D. F. van, Bull. Jard. Bot. Btzg III, 6 (1924) 65–67.–Revision; key!

—, *ibid.* III, 14 (1937) 169–174.–New revision; key!

—, Fl. Mal. I, 4 (1954) 529–532, fig. 1–5.

Local

New Guinea: Van Slooten, Nova Guinea 14 (1926) 195.–Record.

STYRACACEAE

Perkins, J., Pflanzenreich Heft 30 (1907) 1–111, fig. 1–18.

—, Uebersicht über die Gattungen der Styracaceae, *etc.* Leipzig (1928) 1–36, fig. 1–19.–Separately published account of the genera intended for 2nd ed. of the Pflanzenfamilien.

Steenis, C. G. G. J. van, Bull. Jard. Bot Btzg III, 12 (1932) 212–272.–Revision; keys!

—, Fl. Mal. I, 4 (1949) 49–56, fig. 1–12.

Local

Sumatra: Smith, J. J., Tectona 10 (1917) 204–206; Bull. Jard. Bot. Btzg III, 4 (1922) 238–240, t. 10.–Descr. new *sp.*

De Vriese, Pl. Nov. Ind. Bat. Orient. (1845) 9–10, t. 3.–Descr. new *spp.*

Philippines: Merrill & Quisumbing, Philip. J. Sc. 56 (1935) 313–317, t. 1. –Descr. new *sp.*

New Guinea: van Steenis, J. Arn. Arb. 28 (1947) 422–423.–Ident. Pap. specim.

Melanesia: van Steenis, J. Arn. Arb. 20 (1939) 220–221.–Record of *Styrax* in the Solomons.

SYMPHOREMACEAE

See Verbenaceae

SYMPLOCACEAE

Brand, A., Pflanzenreich Heft 6 (1901) 1–100, fig. 1–9.

—, Ueber einige Symplocaceen des Herbier Delessert (Ann. Cons. Jard. Bot. Genève 7–8, 1904, 277–287).–Addit. to monogr.; list; no keys.

—, Additamenta nova, *etc.* (Bull. Herb. Boiss. II, 6, 1906, 747–750).–Some new *spp.* and comb. from W. Malaysia.

—, Decas specierum novarum (in Fedde, Rep. 14, 1916, 323–326).–Some new *spp.* from the Philippines, one from Malaya.

Local

China: Handel-Mazzetti & Peter-Stibal, Beih. Bot. Centralbl. 62 B (1943) 1–42.–Revision; key!

Indo-China: Guillaumin, Bull. Soc. Bot. Fr. 71 (1924) 273–288.–Descr.; key!

Merrill, Univ. Calif. Publ. Bot. 13 (1926) 140–141. – Descr. new. *sp.*

Sumatra & Java: Ridley, J. Fed. Mal. St. Mus. 8, part 4 (1917) 60–61.–New *sp.* from Mt Kerintji.

De Vriese, Pl. Nov. Ind. Bat. Or. (1845) 11–12. –Descr. 3 new *spp.* from Sumatra and Java.

Borneo: Merrill, Sarawak Mus. J. 3 (1928) 545–546.–Descr. 2 new *spp.*

—, Pl. Elm. Born. (1929) 248–249.–New records.

Airy Shaw, Kew Bull. (1939) 508–509.–2 records.

Stapf, Trans. Linn. Soc. II, Bot. 4 (1894) 204–206.–Descr. 5 good new *spp.*

Philippines: Brand, in Perkins, Fragm. Fl. Philip. (1904) 36.–Records; descr. new *sp.*

—, Philip. J. Sc. 3 (1908) Bot. 1–10.–Revision; key!

—, *ibid.* 4 (1909) 107–110.–Descr. new *spp.*; key!

—, *ibid.* 7 (1912) 29–36.–Addit. new *spp.*; new key!

Elmer, Leafl. Philip. Bot. 2 (1908) 508–511.–Descr. 3 new *spp.*

—, *ibid.* 7 (1914) 2319–2324.–Descr. 4 new *spp.*

—, *ibid.* 10 (1939) 3792–3794.–Descr. 2 new *spp.*

Merrill, Philip. J. Sc. 35 (1928) 7.–Nomencl. note; nom. nov.

Perkins, Fragm. Fl. Philip. (1904) 37.–Syn. *S. polyandra.*

New Guinea: BRAND, Bot. Jahrb. 54 (1916) 212–225.–Descr. new *spp.*; key!
—, Nova Guinea 14 (1924) 186–189.–Descr. 9 new *spp.*
—, in FEDDE, Rep. 26 (1929) 172.–*S. oranjeensis n. sp.*
KANEHIRA & HATUSIMA, Bot. Mag. Tokyo 56 (1942) 485–489.–Descr. some new *spp.*
LAUTERBACH, Nova Guinea 8 (1912) 857.–Record.
WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 256–257, fig. 17.–Descr. new *sp.*

Fiji: TURRILL, J. Linn. Soc. Bot. 43 (1915) 30–31.–Descr. new *sp.*

New Caledonia: GUILLAUMIN, Bull. Soc. Bot. Fr. 71 (1924) 939–946.–Census; key!

Genera

Symplocos: BRAND, Bull. Herb. Boiss. II, 6 (1906) 750.–Revision sect. *Cordyloblaste.*
VAN STEENIS, Bull. Bot. Gard. Btzg III, 17 (1948) 429–446, 2 fig. –*Ditto.*

TACCACEAE

LIMPRICHT, W., Beitrag zur Kenntnis der Taccaceae. Inaug. Diss. Bot. Gart. Univ. Breslau (1902) 1–59.–Monogr.; keys.

—, Pflanzenreich Heft 92 (1928) 1–32, fig. 1–5. –Practically a copy of the thesis.

PAX, F., Pflanzenfamilien ed. 2, 15a (1930) 434–437, fig. 192–193.

Local

Malay Peninsula: RIDLEY, Mat. Fl. Mal. Pen. (Monocot.) 2 (1907) 75–78.–Key.

Borneo: MERRILL, Philip. J. Sc. 29 (1926) 356–357.–Descr. new *sp.*

Java: BACKER, Handb. Fl. Java pt 3 (1924) 106–108.–Key; in Dutch.

Celebes: SMITH, Bull. Jard. Bot. Btzg III, 6 (1924) 79–80.–Descr. new *sp.*

Philippines: ELMER, Leafl. Philip. Bot. 10 (1939) 3794–3796.–Descr. new *sp.*
KRAUSE, in ELMER, Leafl. Philip. Bot. 6 (1914) 2283–2284.–Descr. new *sp.*
QUISUMBING & MERRILL, Philip. J. Sc. 37 (1928) 137–138.–Crit. notes; synon.

Genera

Tacca: MERRILL, J. Arn. Arb. 26 (1945) 85–92, 2 pl.–Syn. *T. leontopetaloides*; morph. rhizome.

TAMARICACEAE

NIEDENZU, FR., Pflanzenfamilien ed. 2, 21 (1925) 282–289.

TAXACEAE

See Coniferae

THEACEAE

(*Ternstroemiaceae, incl. Tetrameristaceae*)
(*excl. Pentaphylacaceae*)

CHOISY, J., Mémoire sur les familles des Ternstroemiacées et Camelliacées (Mém. Soc. Phys. Hist. Nat. Genève 14, 1854, 91–186, t. 1–3). –Generic descr. and delimitation.

KORTHALS, P. W., Bijdrage tot de kennis der Ternstroemiaceae (in TEMMINCK, Verh. Nat. Gesch. Bot. 1841–42, 93–149, t. 25–31).–Descr. in Latin of *spp.* and genera.

MELCHIOR, H., Pflanzenfamilien ed. 2, 21 (1925) 109–154, fig. 59–67.

—, Ueber die systematische Gliederung und Phylogenie der Theaceen (in FEDDE, Rep. Beih. 56, 1929, 232–235).–Validation of morphology for the system.

—, Notizbl. Berl.-Dahlem 11 (1934) 1093–1100. –Survey of the few Afr. representatives.

MIQUEL, F. A. W., Adnotationes de Ternstroemiaceis (Ann. Mus. Bot. Lugd.-Bat. 4, 1869, 103–105, 112–114).–Various notes; list; many new *spp.*

SHAW, H. K. AIRY, The classification of the Camellioideae (Kew Bull. 1936, 498–499).–Modified version of MELCHIOR's treatment excluding several genera which are assigned to other families.

Local

Formosa: KENG, Taiwania 1 (1950) 223–268.–Revision; key.

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 106–107.–List misc. records.

Borneo: MERRILL, J. Str. Br. R. As. Soc. *no* 86 (1922) 331.–New *sp.* & new comb. in *Gordonia.*
RIDLEY, Kew Bull. (1938) 173–175.–List; new records in *Ternstroemia*; new *sp.* of *Adinandra* & *Ternstroemia.*
AIRY SHAW, in HOOK. Ic. Pl. (1936) t. 3309.–New *Schima.*
—, Kew Bull. (1939) 404–408 (*sphalm.* 504–508). –List RICHARDS coll.; new records and *spp.* of *Adinandra* & *Ternstroemia.*
—, in HOOK. Ic. Pl. V, 5 (1940) t. 3408.–Descr. & pl. of *Ternstroemia magnifica.*
WARBURG, in FEDDE, Rep. 18 (1922) 329.–New *Schima.*

Java: BACKER, Schoolfl. Java (1911) 95–105.–Key; in Dutch.

Philippines: BURKILL, Philip. J. Sc. 15 (1919) 475–478.–Revision; key!; descr.

New Guinea: DIELS, Bot. Jahrb. 57 (1923) 431–435.–Keys.
—, *ibid.* 62 (1929) 483.–Descr. new *Eurya.*
HATUSIMA, J. Jap. Bot. 26 (1951) 371.–New comb. in *Eurya.*
KOBUSKI, J. Arn. Arb. 21 (1940) 134–162.–Census; no key; descr. new *spp.*
—, Bot. Mag. Tokyo 55 (1941) 504–507, fig. 2. –Records; one new *Ternstroemia.*
KURATA, Bull. Tokyo Univ. For. *no* 36 (1948) 132–133, 1 fig.–Descr. new *Ternstroemia.*
WHITE, J. Arn. Arb. 10 (1929) 241.–Record of a Philippine *Ternstroemia.*

Genera

Adinandra: KOBUSKI, J. Arn. Arb. 28 (1947) 1–98. –Revision; keys (geogr.)!
—, J. Arn. Arb. 34 (1953) 125–134.–Descr. misc. new *spp.*

Anneslea: KOBUSKI, J. Arn. Arb. 33 (1952) 79–90. –Revision; key.

Camellia (*Thea*): Cohen Stuart, Bull. Jard. Bot. Btzg III, 1 (1919) 193–320, 3 maps, pl. 21–31.–Monogr.; key.
Kochs, Bot. Jahrb. 27 (1900) 577–635, t. 8.–Monograph; key; varieties of cult. *spp.*; anat.
Rehder, J. Arn. Arb. 5 (1924) 238–239.–R. accepts *Thea* as the correct name on page priority basis which is, according to the Rules, nomenclaturally inadmissable.
Sealy, Kew Bull. (1949) 215–222.–Descr. new *spp.* & new comb. of SE. Asia, precursory to a revision of the genus.
Seemann, Trans. Linn. Soc. Lond. 22 (1859) 337–352, t. 60–61.–*Camellia* & *Thea* kept distinct; synopsis of *spp.*; no keys.

Cleyera: Kobuski, J. Arn. Arb. 18 (1937) 118–129.–Asia & Japan.
—, *ibid.* 28 (1947) 34, 44.–New var. from Luzon, originally descr. in *Adinandra.*

Eurya: Kobuski, Ann. Missouri Bot. Gard. 25 (1938) 299–359.–Revision of subg. *Euryodes* and *Pentaneurya*; keys!
—, J. Arn. Arb. 20 (1939) 361–374.–Misc. notes and descr. new *spp.*
Vesque, Bull. Soc. Bot. Fr. 42 (1895) 151–161.–Revision; key.
De Wit, Bull. Bot. Gard. Btzg III, 17 (1947) 329–375, 5 fig.–Revision; keys!; *spp.* of the Philippines and the Malay Peninsula are not treated.

Gordonia: Burkill, J. Str. Br. R. As. Soc. *no* 76 (1917) 133–159, fig. 1–15.–Enum. of *spp.*

Laplacea: Sprague, J. Bot. 61 (1923) 17–19, 83–85.–Proposed to be conserved against *Lindleya*; nomencl.

Pentaphylax. See *Pentaphylacaceae.*

Ploiarium (*Archytaea auct.*): Hallier *f.*, Beih. Bot. Centralbl. 34, ii (1916) 34, note 1.–Short note on the genus.
Kobuski, J. Arn. Arb. 31 (1950) 201–207.–Revision; key.

Schima: Bloembergen, Reinwardtia 2 (1952) 133–183, fig. A–J.–The genus is reduced to one *sp.* with a number of *subsp.*; key!
Airy Shaw, Kew Bull. (1936) 496–497.–Various critical notes.

Ternstroemia (*Cyclandra*): Hatusima, Bot. Mag. Tokyo 65 (1952) 109–111.–*Cyclandra* (formerly *Guttiferae*) is reduced to *Ternstroemia*; 1 new comb.

Tetramerista: Hallier *f.*, Beih. Bot. Centralbl. 34, ii (1916) 35–40.–Revision.

Trematanthera = Saurauia (*Actinidiaceae*).

THEOPHRASTACEAE

See Myrsinaceae

THYMELAEACEAE

(*incl. also Gonystylaceae*)

Baillon, H., Nouvelles observations sur les Aquilariées (Adansonia 11, 1875, 313–322).–General discussion.

—, Sur les Aquilariées des herbiers de la Hollande et sur une affinité peu connue de ce groupe (Adansonia 11, 1875, 326–329).–General discussion.

Decaisne, J., Description des genres Drymispermum, Pseudaïs et Gyrinopsis du groupe des Aquilariées (Ann. Sc. Nat. II, 19, 1843, 35–42, t. 1).– Descr. *n. g.* & *n. spp.*; list of *Phaleria* (under *Drymispermum*), *Pseudaïs* and *Gyrinopsis.*

Domke, W., Zur Kenntnis einiger Thymelaeaceae (Notizbl. Berl.-Dahlem 11, 1932, 348–362).–For Malaysia only new *Aquilaria*, new *sp.* & comb. in *Gyrinops.*

—, Untersuchungen über die systematische und geographische Gliederung der Thymelaeaceen nebst einer Neubeschreibung ihrer Gattungen (Bibl. Bot. Heft 111, 1934, 1–151, 1 fig., t. 1–7, 5 maps).–Subdiv. of fam.; keys to and descr. of genera.

Hallier *f.*, H., Beiträge zur Kenntnis der Thymelaeaceen und ihrer natürlichen Umgrenzung (Med. Rijksherb. Leiden *no* 44, 1922, 1–31).–Discussion on affinities within the family. List of Malayan representatives with critical syn.; descr. new *spp.*; no keys.

Meisner, K. F., Ueber die Ostindischen Thymeläen (Denkschr. Bot. Ges. Regensb. 3, 1841, 271–294, t. 6–7).–Taxonomy, tribes; mostly Asiatic *spp.*

Miquel, F. A. W., Thymelaeacearum genera nova (Ann. Mus. Bot. Lugd.-Bat. 1, 1863, 132–133, t. 4).–Descr. *Lachnolepis* and *Gonystylus.*

Quisumbing, E., A critical study of Philippine species of the tribe Aquilarieae (J. Arn. Arb. 27, 1946, 401–407).–Various new comb. of Mal. *spp.* in this tribe.

Shaw, H. K. Airy, Thymelaeaceae-Gonystyloideae (Fl. Mal. I, 4, 1953, 349–365, 6 fig.).

Steenis, C. G. G. J. van, Bull. Jard. Bot. Btzg III, 13 (1934) 254.–List of *Daphne* and *Kelleria* & *Drapetes* records.

Local

Sumatra: Merrill, Contr. Arn. Arb. 8 (1934) 111.–Syn. of *Eriosolena.*

Borneo: Domke & van Steenis, Notizbl. Berl.-Dahlem 12 (1934) 233–235.–Descr. new *Gonystylus.*
Airy Shaw, Kew Bull. (1940) 261–262.–Some records.
—, in Hook. Ic. Pl. V, 5 (1947) t. 3474–3475.

Java: Backer, Bekn. Fl. Java (em. ed.) 4A (1942) fam. 77, p. 1–5.
—, Blumea 5 (1945) 494–495.–New *Phaleria* and a new name in *Wikstroemia.*

Celebes: Koorders, Suppl. Flora N. O. Celebes 2 (1922) t. 98; *ibid.* 3, p. 48.–*Phaleria urens.*

Philippines: Elmer, Leafl. Philip. Bot. 5 (1913) 1629–1632.–Survey of *Gyrinopsis*; 3 new *spp.*
Quisumbing, J. Arn. Arb. 27 (1946) 401–407.–Crit. study of *Aquilarieae*; various new comb. and new *spp.*
Warburg, in Perkins, Fragm. Fl. Philip. (1905) 171–172.–New *Wikstroemia.*

Moluccas: Merrill, Philip. J. Sc. 11 (1916) Bot. 294–295.–New *Phaleria* from Ambon.
—, J. Arn. Arb. 31 (1950) 283.–New comb. in *Aquilaria.*

New Guinea: Domke, Bot. Jahrb. 62 (1929) 484–485.–New *Kelleria* (*Drapetes*).
Gilg, Nova Guinea 8 (1910) 411–412.–New *Phaleria* and *Brachythalamus*.
Merrill & Perry, J. Arn. Arb. 22 (1941) 264–267.–New *spp.* and records in *Phaleria*, *Wikstroemia*, and *Kelleria*.
Van Steenis, Nova Guinea 14 (1927) 306.–Record *Gonystylus*.

Genera

Aetoxylon: Airy Shaw, Kew Bull. (1950) 145.
—, Fl. Mal. I, 4 (1952) 364–365, fig. 6.
Amyxa: Airy Shaw, in Hook. Ic. Pl. V, 5 (1947) t. 3475.
—, Fl. Mal. I, 4 (1952) 362–363, fig. 5.
Aquilaria: Gilg, Bot. Jahrb. 28 (1901) 145–146.–Enum. *spp.*; key!; new *sp.* from New Guinea.
Gonystylus: Airy Shaw, Kew Bull. (1947) 9–17.–Key; 3 sections; some new *spp.*
—, in Hook. Ic. Pl. V, 5 (1947) t. 3474.– *§ Auxanthus*; descr. *G. augescens*.
—, Kew Bull. (1950) 138–147.–New or noteworthy *spp.* of *Gonystylus* and allied genera.
—, Fl. Mal. I, 4 (1952) 350–361.
Gyrinops (*Brachythalamus*): Domke, Notizbl. Berl.-Dahlem 11 (1932) 349–350.
Gilg, Bot. Jahrb. 28 (1901) 146–147.–Descr. 2 Papuan *spp.*
Phaleria: Valeton, Ic. Bog. 4 (1913) t. 368–371.–Critical notes & fig. of several *spp.*
Pimelea: Engler, Bot. Jahrb. 7 (1886) 459–460.–Nomencl. Timor *sp.*
Fawcett, in Forbes, Wanderings ed. 2 (1885) 516.–Descr. new *sp.* from Timor.

TILIACEAE

Bentham, G., Notes on Tiliaceae (J. Proc. Linn. Soc. 2nd Suppl. to vol. 5, 1861, 52–62).–Census of the family with keys to gen. & *spp.*; many new *spp.*
Burret, M., Beiträge zur Kenntnis der Tiliaceen (Notizbl. Bot. Gart. Berl.-Dahlem 9, 1926, 592–880).–Important precursory to a revision; subdivision of the family; see also under genera.
—, *ditto* II (*ibid.* 1927, 1161–1174).–Additions to paper above.
—, *ditto* III (*ibid.* 12, 1934, 160–167).–*Ditto*.
—, *ditto* IV (*ibid.* 12, 1935, 602–605).–*Ditto*.
—, *ditto* V (*ibid.* 13, 1936, 252–255).–Descr. new *Brownlowia* (Borneo), *Grewia* and *Trichospermum* (Celebes).
Hochreutiner, B. P. G., Notes sur les Tiliacées (Ann. Cons. Jard. Bot. Genève 18/19, 1914, 68–128).–New subdiv. of family; descr. of *spp.*, practically none Malaysian.

Local

Sumatra: Ridley, Kew Bull. (1924) 262.–New *Grewia* from Mal. Pen. & Sumatra.
Borneo: Merrill, Philip. J. Sc. 30 (1926) 82–83.–Record of and new *Pentace*.
—, Pl. Elm. Born. (1929) 184–188.–Records; new *spp.* in *Pentace*, *Brownlowia* and *Microcos*.
Ridley, Kew Bull. (1938) 226–229.–List records; new *spp.* of *Brownlowia*, *Pentace* and *Microcos*.
Airy Shaw, Kew Bull. (1949) 159–160.–Record and new *spp.* of *Microcos*.
Warburg, in Fedde, Rep. 18 (1922) 330.–New *spp.* of *Pentace*.
Java: Adelbert, Blumea 5 (1945) 503–505.–Critical notes on delimitation.
Backer, Schoolfl. Java (1911) 147–157.–Keys!; in Dutch.
—, Bekn. Fl. Java (em. ed.) 4B (1944) fam. 105, p. 1–25.–Keys!
Philippines: Elmer, Leafl. Philip. Bot. 2 (1909) 631–632.–New *Grewia* from Negros.
—, *ibid.* 5 (1913) 1641–1644.–List of Philip. *Trichospermum*; 2 new *spp.*; no key.
Quisumbing & Merrill, Philip. J. Sc. 37 (1928) 167–170.–Verif. Philip. nomencl. with Burret's work.
New Guinea: Burret, Notizbl. Berl.-Dahlem 11 (1932) 511–512.–2 new *spp.* of *Trichospermum*.
Merrill & Perry, J. Arn. Arb. 20 (1939) 339–345.–New *spp.* in *Berrya*, *Trichospermum*, *Microcos*, and *Colona*.
Pulle, Nova Guinea 8 (1911) 663–664.–Misc. records; new *Grewia*.
White, Proc. R. Soc. Queensl. 34 (1922) 43.–Misc. records.
—, J. Arn. Arb. 10 (1929) 238.–Records Brass coll.
—, Proc. R. Soc. Queensl. 47 (1936) 54.–Record of a Pap. *Grewia* in Queensland.
— & Francis, Proc. R. Soc. Queensl. 38 (1927) 240–241.–Descr. new *Columbia*.

Genera

Althoffia: Burret, Notizbl. Berl.-Dahlem 9 (1926) 857–861.–Revision; key.
White, Proc. R. Soc. Queensl. 34 (1922) 43.–Crit. note on 2 Pap. *spp.* of *Althoffia*.
Berrya: Burret, Notizbl. Berl.-Dahlem 9 (1926) 605–607.–Revision; key!
Koorders & Valeton, Ic. Bog. 1 (1897) 19–20, t. 5.–New *Berrya* from Java.
Brownlowia: Burret, Notizbl. Berl.-Dahlem 9 (1926) 613–619, 869.–Revision; key!
—, *ibid.* 9 (1927) 1163–1165.–New comb.; additions.
—, *ibid.* 12 (1934) 160–161.–Correction; identical with 9 (1927) 1163–1164 (*sic*).
Colona (*Diplophractum*): Burret, Notizbl. Berl.-Dahlem 9 (1926) 796.–Revision; key!
—, *ibid.* 12 (1934) 161–162.–Some notes; new *sp.* from Celebes.
Diplodiscus: Burret, Notizbl. Berl.-Dahlem 9 (1926) 618–619.–Enum.
—, *ibid.* 12 (1934) 162.–New comb. from Borneo.
Eleutherostylis: Burret, Notizbl. Berl.-Dahlem 9 (1926) 629–632.–Monotypic; New Guinea!
Grewia: Burret, Notizbl. Berl.-Dahlem 9 (1926) 632–736; *ibid.* (1927) 1165–1171.–Key to sections; *Microcos* split off as separate genus; revision & key to non-African *spp.*!
—, *ibid.* 12 (1935) 604–605.–New Papuan *spp.*
Corner, Gard. Bull. Str. Settl. 10 (1939) 262.–

Criticism on generic distinction of *Grewia* & *Microcos*; new name in *Grewia*.
DRUMMOND, J. Bot. 49 (1911) 329–337, 357–363. –Critical notes on ROXBURGH'S *spp.*
GAGNEPAIN, Not. Syst. 1 (1909) 119–132.–Revision; enum. & key of *spp.*
GARCKE, Bonplandia 5 (1857) 257–258.–Critical notes on 2 wrongly placed Philip. *Grewias* by WALPERS.
—, Bot. Zeit. 22 (1864) 337–339, 345–347.–Miscell. notes on *Grewia.*
NARAYANASWAMI & RAO, J. Ind. Bot. Soc. 29 (1950) 177–190.–Notes Indo-Burm. *spp.*

Microcos (*Omphacarpus, Inodaphnis*): BURRET, Notizbl. Berl.-Dahlem 9 (1926) 728–736, 756–795.–Revision & key to Malaysian *spp.*!; not all *spp.* are keyed out.
—, *ibid.* (1927) 1171–1173.–Some additions.
—, *ibid.* 12 (1934) 162–165.–New *spp.* from Borneo and New Guinea.
—, *ibid.* 12 (1935) 602–604.–2 new *spp.* from Borneo & New Guinea.
KORTHALS, Kruidkunde in TEMMINCK, Verh. Nat. Gesch. (1842) 192–194, t. 42.–Descr. 2 new *spp.*
KURZ, Flora 55 (1872) 397–398.–Reduction.

Pentace: BURRET, Notizbl. Berl.-Dahlem 9 (1926) 619–621, 814.–Notes; new comb.

Schoutenia (*Actinophora, Chartacalyx*): BURRET, Notizbl. Berl.-Dahlem 9 (1926) 625–628.–Revision; key!
KORTHALS, Ned. Kruidk. Arch. 1 (1846) 312–313.–Type descr.

Trichospermum (*Bixagrewia*): BURRET, Notizbl. Berl.-Dahlem 9 (1926) 846–855.–Revision; key!
—, *ibid.* 11 (1932) 511–512.–2 new Pap. *spp.*
KURZ, J. Bot. 13 (1875) 325, 373.
MERRILL, Philip. J. Sc. 11 (1916) Bot. 288–290. –New *sp.* from Ambon.

Triumfetta: BACKER, Trop. Natuur 8 (1919) 6–7, fig. 12.–Distinction *T. repens* and *procumbens.*
GAGNEPAIN, Not. Syst. 1 (1910) 170–174.–Crit. notes on 3 *spp.* allied to *T. procumbens*; key to these *spp.*
HEMSLEY, J. Bot. 28 (1890) 1–2, t. 293.–Critical note on *T. procumbens.*
LAY, Ann. Missouri Bot. Gard. 37 (1950) 315–395.–Revision Amer. *spp.*; keys!

TRAPACEAE

See Hydrocaryaceae

TRIGONIACEAE

MIQUEL, F. A. W., Fl. Ind. Bat. Suppl. 1 (1860) 394–395.–Descr. *Trigoniastrum.*
STEENIS, C. G. G. J. VAN, Fl. Mal. I, 4 (1949) 58–60, 1 fig.

Local

Borneo: AIRY SHAW, Kew Bull. (1940) 253–254. –Record; 2 new varieties.

TRIURIDACEAE

BECCARI, O., Le Triuridaceae della Malesia (Malesia 3, 1890, 318–344, t. 39–42).–Revision; key!
GIESEN, H., Pflanzenreich Heft 104 (1938) 1–84, fig. 1–18, 3 maps.

Local

Java: BACKER, Handb. Fl. Java 1 (1925) 64–66.–Key!; in Dutch.

Moluccas: SMITH, Bull. Jard. Bot. Btzg III, 16 (1939) 111–112, fig. 1.–Descr. new *sp.* from Buru.

New Guinea: SCHLECHTER, Bot. Jahrb. 49 (1913) 70–89, 3 fig.–Descr. new gen. & *spp.*; no key.
SMITH, Nova Guinea 14 (1927) 323–327, t. 35–36.–Records & descr. new *spp.*
WENT Sr, Nova Guinea 8 (1909) 165–167, t. 47. –*Ditto.*

Micronesia: TUYAMA, Bot. Mag. Tokyo 52 (1938) 61–65, fig. 1–4.–New *Andruris*; key to *Andruris.*

TROPAEOLACEAE

BUCHENAU, F., Pflanzenreich Heft 10 (1902) 1–36, fig. 1–14.
FARENHOLTZ, H., Pflanzenfamilien ed. 2, 19a (1931) 67–82, fig. 35–42.

Genera

Tropaeolum: BUCHENAU, Bot. Jahrb. 15 (1893) 180–259.–Revision; key!
—, *ibid.* 22 (1895) 157–183.–Additions.

TURNERACEAE

BACKER, C. A., Fl. Mal. I, 4 (1951) 235–238, fig. 1–2.
GILG, E., Pflanzenfamilien ed. 2, 21 (1925) 459–466.
URBAN, I., Monographie der Familie der Turneraceen (Jahrb. Bot. Gart. Berlin 2, 1883, 1–152, t. 1–11).–Monograph with keys!

Genera

Turnera: VAN STEENIS, Trop. Natuur 20 (1931) 227–231, fig. 1–3.–Distinction Mal. *spp.*

TYPHACEAE

BACKER, C. A., Fl. Mal. I, 4 (1951) 242–244, fig. 1.
GRAEBNER, P., Pflanzenreich Heft 2, pt 1 (1900) 1–18, fig. 1–4.

Local

Java: BACKER, Handb. Fl. Java 1 (1925) 31.–In Dutch.

New Guinea: HALLIER *f.*, Nova Guinea 8 (1913) 911–914.–New revision of the genus!

Genera

Typha: GÈZE, Bull. Soc. Bot. Fr. 58 (1911) 457–461.–Critical remarks on the syn. of some *spp.*
—, Études botaniques et agronomiques sur les Typha, *etc.* Villefranche-de-Bouergue (1912) 1–174, t. 1–7.–Monograph; keys!
KRONFELD, Verh. K. K. Zool.-Bot. Ges. Wien 39 (1889) 89–192, t. 4–5.–Monograph; key!

ULMACEAE

BERNARD, CH., Sur la distribution géographique des Ulmacées (Bull. Herb. Boiss. II, 5, 1905, 1098–1112; *ibid.* II, 6, 1906, 23–38, pl. 1–7).–Geogr. distr. of the family.

Planchon, J. E., Sur les Ulmacées (Ulmacées et Celtidées de quelques auteurs) considérées comme tribu de la famille des Urticées (Ann. Sc. Nat. Bot. III, 10, 1848, 244–341).–Census; no keys!

Local

East Asia: P'ei, Bot. Bull. Acad. Sin. 1 (1947) 283–297.–Revision; keys!

Sumatra: Merrill, Contr. Arn. Arb. 8 (1934) 44. –Record of *Ulmus*!

Java: Smith, in Koord. & Val. Bijdr. Booms. Java 13 (1910) 638–671.

Philippines: Elmer, Leafl. Philip. Bot. 9 (1934) 3218–3219.–New *Trema*.
—, *ibid.* 10 (1939) 3796–3797.–New *Celtis*.
Warburg, in Perkins, Fragm. Fl. Philip. (1905) 164–165.–Descr. new *Celtis*.

New Guinea: Lauterbach, Bot. Jahrb. 50 (1913) 308–327.–Keys!
Merrill & Perry, J. Arn. Arb. 20 (1939) 324–327.–New *Parasponia* and *Gironnieras*.
—, *ibid.* 22 (1941) 253–256.–2 new *Celtis* and 2 new *Parasponias*.
Smith, Nova Guinea 8 (1912) 891–892, t. 158. –New *Parasponia*, and new var. in *Gironniera*.

Genera

Aphananthe: Leroy, Bull. Mus. Hist. Nat. Paris 18 (1946) 118–123, 180–184.–Discussion; no key; 4 *spp.* distinguished.

Gironniera: Kurz, Flora 55 (1872) 446–448.–Subdivision of the *Celtideae*; some notes on *spp.*

Trema: Lauterbach, Bot. Jahrb. 50 (1913) 312–325.–Revision Indo-Mal. *spp.*
De Wit, Bull. Bot. Gard. Btzg III, 18 (1949) 184–192.–Revision Mal. *spp.*; key.

Ulmus: Schneider, Oester. Bot. Z. 66 (1916) 21–34, 65–82.–Revision of genera & *spp.*; keys!; 2nd part treats nomencl. of Europ. *spp.*

UMBELLIFERAE

Buwalda, P., The Umbelliferae of the Netherlands Indies (Blumea 2, 1936, 119–220, 6 fig.).–Revision; key.

— (& Steenis, C. G. G. J. van): Fl. Mal. 4 (1949) 113–140, fig. 1–11; *ibid.* (1954) 595–597, fig. 5a.

Miquel, F. A. W., Ombellifères, in Ill. Fl. Arch. Ind. (1870) 36–43.–Census; no key.

Molkenboer, J. H., in Miquel, Plant. Jungh. (1851) 89–98.–List; descr. new *spp.*

Wolff, H., Pflanzenreich Heft 43 (1910) 1–214, fig. 1–24.–*Apioideae-Ammineae heteroclitae*. Genus *Bupleurum, etc.*

—, *ibid.* Heft 61 (1913) 1–305, fig. 1–42.–*Saniculoideae*. Genera *Sanicula, Eryngium*.

—, *ibid.* Heft 90 (1927) 1–398, fig. 1–26.–*Apioideae-Ammineae-Carinae, etc.* Genera *Apium, Cryptotaenia, Cuminum, Petroselinum, Pimpinella, Trachyspermum, etc.*

Local

Java: van Steenis, Trop. Natuur 19 (1930) 78. –Reduction of *Pimpinella leeuwenii*.
Wolff, in Fedde, Rep. 20 (1924) 159–160.–Descr. new *Pimpinella* from Java.

Borneo: Merrill, Amer. J. Bot. 5 (1918) 514–515, t. 36.–Descr. new *Oreomyrrhis*.

Lesser Sunda Islands: Norman, J. Bot. 69 (1931) 287.–New *Trachymene* from Timor.

Celebes: Hemsley, Kew Bull. (1896) 37–38.–New *Trachymene*.
Wolff, in Fedde, Rep. 17 (1921) 439–440.–Two new *Didiscus* from Celebes.

Philippines: Elmer, Leafl. Philip. Bot. 2 (1909) 627–629.–Key!; 2 new *spp.*
Merrill, Philip. J. Sc. 29 (1926) 482–483.–Descr. new *Pimpinella* from Luzon.
—, *ibid.* 30 (1926) 418–419.–Record of *Peucedanum* from Batan Isl.
— & Quisumbing, *ibid.* 82 (1953) 332.–Record of *Apium leptophyllum*.

Moluccas: van Steenis, Fl. Mal. I, 4 (1954) 595–597, fig. 5a.–*Eryngium* from Ceram.

New Guinea: Buwalda, J. Arn. Arb. 32 (1951) 59–66, 1 fig.–List Brass records; descr. new *spp.*
Danser, Brittonia 2 (1936) 135–136, t. 2.–New *Trachymene*.
Hemsley, in Hook. Ic. Pl. 26 (1899) t. 2590.–Descr. & pl. of *Oreomyrrhis linearis*.

Genera

Centella: Domin, Bot. Jahrb. 41 (1908) 148–169. –Monograph; no key.

Petroselinum: Airy Shaw, Kew Bull. (1938) 256–258.–Nomencl. *P. crispum = vulgare*.

Sanicula: Shan & Constance, Univ. Calif. Publ. Bot. 25 (1951) 1–78.–World revision; keys!

Trachymene (*Didiscus*); Burtt, J. Bot. 79 (1941) 44–46.–New comb.
Domin, Bull. Acad. Intern. Géogr. Bot. 18 (1908) 481–494.–Revision *Trachymene sens. str.*; key; Australian *spp.*
—, Sitz.-Ber. Kön. Böhm. Ges. Wiss. Prag. II. Classe (1908) *no* 10, p. 1–77, t. 1–4.–Monogr.; key!
Norman, J. Bot. 69 (1931) 287–288.–Notes on congenericy of *Trachymene* and *Didiscus*.

URTICACEAE

Bigalke, H., Die Blattspodogramme der Urticaceae und ihre Verwendbarkeit für die Systematik (in Cohn's Beitr. z. Biol. der Pfl. 21, 1933, 1–58, t. 1–5).–Anat. of the cystoliths examined in all genera found useful for taxon. aims. Keys to the *spp.* on the basis of the crystal configuration which represents a constant specific character.

Blume, C. L., Mus. Bot. Lugd.-Bat. 2 (1852) 43–57; *ibid.* (1855) 137–160; *ibid.* (1856) 161–170, 193–256, fig. 12–24, 48–49, 54–58.–List gen. & *spp.* in Herb. Lugd.

Miquel, F. A. W., Plantae Junghuhnianae (1851) 18–41.–List.

—, Observationes de Urticeis quibusdam et de Fatoua (Ann. Mus. Lugd.-Bat. 4, 1869, 301–307).–Enum.

Unruh, M., Anisophyllie und Wechselbeziehungen des Wachstums und Spross bei Urticaceen (Ber. Deut. Bot. Ges. 58, 1940, 484–488). –Morph.

Vriese, W. H. de, Pl. Ind. Bat. Or. (1856) 143–148.–List; records copied from Weddell.

Weddell, H. A., Revue de la famille des Urticées (Ann. Sc. Nat. Bot. IV, 1, 1854, 173–212).–Preliminary census; no keys!

—, Monographie de la famille des Urticées (Arch. Mus. Hist. Nat. Paris 9, 1856–57, 1–592, t. 1–20).–Monograph! With keys to tribes and genera.

—, Considérations générales sur la famille des Urticées suivie de la description des tribus et des genres (Ann. Sc. Nat. IV, 7, 1857, 307–396).–Extr. from monogr. above.

—, in DC. Prod. 16, 1 (1869) 32–235.[64]–Conspectus tribes, genera, and species; partial keys.

Local

Sumatra: Merrill, Contr. Arn. Arb. 8 (1934) 52–53.–Some misc. records.
—, Pap. Mich. Acad. Sc. 23 (1937) (1938) 177.–New comb. in *Pseudopipturus.*

Borneo: Hallier *f.*, Ann. Jard. Bot. Btzg 13 (1896) 300–316, t. 25–27.–Descr. some new *spp.*; many recomb. under *Elatostema.*
—, Bull. Herb. Boiss. 6 (1898) 352–356.–Descr. new *Elatostemas.*
—, Meded. Rijksherb. Leiden *no* 26 (1915) 1–4.–Records and descr. new *spp.*
Robinson, Philip. J. Sc. 6 (1911) Bot. 291–314.–Misc. records coll. Sarawak Mus.
Schröter & Hub. Winkler, Mitt. Inst. Allg. Bot. Hamburg 7 (1937) 263–268.–*Elatostemas* coll. Hans Winkler; some new *spp.*

Java: Amshoff, Blumea 5 (1945) 515–517.–Critical notes & records.
Bakhuizen van den Brink *f.*, Blumea 6 (1950) 363–365.–Addit. critical notes & records.
Smith, in Koord. & Val. Bijdr. Booms. Java 12 (1910) 672–753.–Only arboreous *spp.*; excellent treatment; keys!
Van Steenis, Trop. Natuur 30 (1941) 154–155.–Distinction 2 *Pileas: peploides & microphylla.*
—, Bull. Bot. Gard. Btzg III, 17 (1948) 400.–Record of *Parietaria.*

Celebes: Amshoff, Blumea 5 (1945) 593–594.–Record of a *Chamabainia* and an *Elatostema.*

Philippines: Elmer, Leafl. Philip. Bot. 3 (1910) 875–901.–List *spp.* from Mt Apo, Mindanao; many new *spp.*
—, Leafl. Philip. Bot. 9 (1934) 3219–3222, 3227–3241.–New *Elatostemas* and a *Pipturus.*
Merrill, Philip. J. Sc. 27 (1925) 23.–New *Pilea* from Luzon.
Quisumbing, Philip. J. Sc. 41 (1930) 317–322, fig. 1–3.–Descr. new *Laportea* and 2 *Elatostemas.*
—, in Fedde, Rep. 36 (1934) 284–285, t. 178.–New *Elatostema.*
— & Merrill, Philip. J. Sc. 37 (1928) 142–143.–Descr. new *Elatostema* from Bohol.
Robinson, Philip. J. Sc. 5 (1910) Bot. 465–543; *ibid.* 6 (1911) Bot. 1–31, t. 1–3.–Revision; keys!
—, *ibid.* 6 (1911) Bot. 299–314.–Additions to revision; new *spp.*
Warburg, in Perkins, Fragm. Fl. Philip. (1905) 168.–3 records of *Laportea.*

Moluccas: van Steenis, Bull. Bot. Gard. Btzg III, 18 (1950) 458.–Record of *Poikilospermum.*

New Guinea: Diels, J. Arn. Arb. 10 (1929) 75–76.–New *Elatostema* and *Cypholophus.*
Gibbs (& Rendle), in Gibbs, Contr. Fl. Phytog. Arfak Mts (1917) 128–132, 209–210, fig. 8.–List records and descr. new gen. & *spp.*
Perry, J. Arn. Arb. 32 (1951) 369–389.–List records and new *spp.* coll. Brass.
Winkler, Hub., in Fedde, Rep. 15 (1919) 418–419.–3 new *Pileas.*
—, *ibid.* 16 (1919) 175–176.–3 new *Pipturus.*
—, *ibid.* 18 (1922) 238.–New *Elatostema.*
—, Bot. Jahrb. 57 (1922) 501–608, fig. 1–15.–Revision; keys!
—, Nova Guinea 14 (1924) 119–134.–Records and descr. new *spp.*

Genera

Boehmeria: Warburg, Notizbl. Berl.-Dahlem 7, *no* 68 (1920) 345–351 (*sphalm.* 1–7).–Discussion on various names of fibre yielding *spp.*

Elatostema (*Pellionia, Weddellia, Elatostemoides*): Schröter & Hub. Winkler, in Fedde, Rep. Beih. 83^1 (1935) 1–56; *ibid.* 83^2 (1936) 1–174, t. 9–40.–Monogr.; keys!

Fatoua: Miquel, Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 306–307.–List; no key.

Leucosyke: Unruh, Bot. Jahrb. 73 (1943) 191–258.–Monograph; key!

Oreocnide (*Villebrunea*): Sprague, Kew Bull. (1928) 395–397.–Generic nomencl.

Pipturus: Skottsberg, Medd. Göteb. Bot. Trädg. 7 (1932) 43–63, 49 fig.–Differential studies between *P. argenteus* and *P. incanus.*
—, *ibid.* 8 (1933) 111–117, 13 fig.–On the complex *P. albidus; Pseudopipturus n.g.* proposed.
—, Bull. Bern. P. Bish. Mus. *no* 117 (1934) 38–77, fig. 13–32, t. 16–38.–Revision Hawaiian *spp.*; key!

Procris: Schröter, in Fedde, Rep. 45 (1938) 179–192, 257–300.–Monograph; key!

Pseudopipturus. See under *Pipturus.*

VACCINIACEAE

See Ericaceae

VALERIANACEAE

Backer, C. A., Fl. Mal. I, 4 (1951) 253–254, 1 fig.

Graebner, P., Die Gattungen der natürlichen Familie der Valerianaceae (Bot. Jahrb. 37, 1906, 464–480).–Genera of the family.

Höck, F., Beiträge zur Morphologie, Gruppierung und geographischen Verbreitung der Valerianaceen (Bot. Jahrb. 3, 1882, 1–73).–Comparative morphology; geogr. distr.

VERBENACEAE

(*incl. Avicenniaceae & Symphoremaceae*)

Hallier *f.*, H., Verbenaceae (Med. Rijksherb. Leiden *no* 37, 1918, 17–91).–Properly a paper on Elbert's Lesser Sunda Islands coll., but with numerous other data on the family; descr. new *spp.* and critical notes.

JUNELL, S., Zur Gynäceummorphologie und Systematik der Verbenaceen und Labiaten, *etc.* (Symb. Bot. Uppsala 1, *no* 4, 1934, 1–219, fig. 1–257).–Delimitation of the families on the basis of ♀ morph.; result very deviating from current usage.

LAM, H. J., The Verbenaceae of the Malayan Archipelago, *etc.* Thesis Utrecht. Groningen (1919) 1–371, t. 1–3.–Revision of Mal. *spp.* based on materials at Leyden, Utrecht, and Berlin; keys!

—& BAKHUIZEN VAN DEN BRINK, R. C., Revision of Verbenaceae of the Dutch East-Indies and surrounding countries (Bull. Jard. Bot. Btzg III, 3, 1921, 1–116, iii).–New revision; only descr. of new taxa; keys!

MOLDENKE, H. N., An alphabetic list of invalid and incorrect scientific names proposed in the Verbenaceae and Avicenniaceae (New York, 1942, 59 pp.).

—, *ditto.* Suppl. 1 (New York, 1947, 30 pp.).

—, The known geographic distribution of the members of the Verbenaceae and Avicenniaceae (New York, 1942, 104 pp.).–List of names arranged by countries.

—, *ditto.* Suppl. 1 (New York, 1943, 4 pp.).

—, *ditto.* Suppl. 2 (Bot. Gaz. 106, 1944, 158–164).

—, *ditto.* Suppl. 3 (Castanea 10, 1945, 35–46).

—, *ditto.* Suppl. 4 (Amer. J. Bot. 32, 1945, 609–612).

—, Many other Supplements in Phytologia.–*Non vidi.*

—, The known geographic distribution of the members of the Verbenaceae, Avicenniaceae, Stilbaceae, Symphoremaceae, and Eriocaulaceae (New York, 1949, 215 pp.).

—, Phytologia 4 (1953) 173–184, 285–295.–Some transfers and new var. of Mal. Verb.

Local

China: P'EI, Mem. Sc. Soc. China 1, *no* 3 (1932) 1–193, t. 1–33.–Revision Chin. Verben.; keys!

Siam: FLETCHER, Kew Bull. (1938) 199–209.–Descr. new *spp.*

—, Kew Bull. (1938) 401–445.–Important revision with syn., distr. and full keys!

Malaysia (general): KING & GAMBLE, Kew Bull. (1908) 105–114.–Descr. various new *spp.*

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 146–148.–Records; crit. syn. of some *spp.*

MOLDENKE, Phytologia 4 (1953) 286–287, 294. –New *Callicarpa* and *Vitex.*

Malay Peninsula: HENDERSON, J. Mal. Br. Roy. As. Soc. 5 (1927) 262–263.–New *Vitex.*

—, Gard. Bull. Str. Settl. 7 (1933) 118–119, t. 29.–New *Clerodendron.*

Java: BACKER, Trop. Natuur 5 (1916) 87–94.–Key to *spp.* in Java; in Dutch.

MEEUSE, Blumea 5 (1942) 66–80.–Critical notes.

—, in BACKER, Bekn. Fl. Java (em. ed.) 9 (1949) fam. 200, p. 1–45.–Keys; in Dutch.

Borneo: MOLDENKE, Phytologia 4 (1953) 285–286, 368.–New *Callicarpa* and *Sphenodesme.*

RIDLEY, Kew Bull. (1929) 260–262.–New *spp.*

Lesser Sunda Islands: HALLIER *f.*, Med. Rijksherb. Leiden *no* 37 (1918) 17–91.–List ELBERT coll.

Philippines: ELMER, Leafl. Philip. Bot. 3 (1910) 861–866.–*Callicarpas* of Mt Apo, Mindanao.

—, *ibid.* 9 (1934) 3222–3225.–New *Callicarpa* and *Clerodendron.*

—, *ibid.* 10 (1939) 3797–3799.–New *Vitex* and *Callicarpa.*

MERRILL, Philip. J. Sc. 30 (1926) 424–426.–Descr. new *Clerodendron* and *Callicarpa* from Sulu Arch.

—, Phytologia 2 (1941) 5–6.–New *Premna. Non vidi.*

PERKINS, Fragm. Fl. Philip. (1904) 1–3.–Syn. of *Symphorema.*

QUISUMBING, Philip. J. Sc. 41 (1930) 343–345, fig. 15.–Descr. new *Clerodendron.*

— & MERRILL, Philip. J. Sc. 37 (1928) 195–198. –Descr. 2 new *Callicarpas* and a *Clerodendron.*

Moluccas: MOLDENKE, Amer. J. Bot. 32 (1945) 612.–New comb. in *Geunsia*, new *Clerodendron* from Manipa Isl.

New Guinea: BAKHUIZEN VAN DEN BRINK, J. Arn. Arb. 10 (1929) 69–75, t. 16, 17.–List BRASS coll. East N. Guinea; one new *Gmelina.*

— & LAM, Nova Guinea 14 (1924) 167–172. –List; no key.

BEER & LAM, Blumea 2 (1936) 221–228, 3 fig.–List BRASS coll.; some new *spp.* in *Premna* and *Clerodendron.*

KURATA, Bull. Tokyo Univ. For. *no* 35, art. 17 (1947) 201–207, 1 fig.–List coll. INOKUMA & HARA; one new *Teysmanniodendron.*

LAM, Bot. Jahrb. 59 (1924) 87–98.–List records.

—, Blumea 7 (1954) 553–556, fig. 1–2.–New *Premna.*

PULLE, Nova Guinea 8 (1910) 401–403; 8 (1911) 685–687.–Lists.

WHITE, Proc. R. Soc. Queensl. 34 (1922) 50.–Small list.

— & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 257–259, fig. 18.–One new *Gmelina* and some records coll. LANE-POOLE.

Solomon Isl.: BAKHUIZEN VAN DEN BRINK, J. Arn. Arb. 16 (1935) 70–75, t. 120–122.–List records some new comb. and varieties; one new *Gmelina.*

Micronesia: LAM, Bot. Jahrb. 59 (1924) 24–29.–List of records.

Genera

Archboldia: BEER & LAM, Blumea 2 (1936) 31–33, 1 fig.–Monotypic; New Guinea.

Avicennia: BAKHUIZEN VAN DEN BRINK, Bull. Jard. Bot. Btzg III, 3 (1921) 199–226, t. 14–22.–Revision; key!

BISWAS, Notes R. Bot. Gard. Edinb. 18 (1934) 159–166, t. 243–246.–Revision; key to Indian *spp.*

WYATT-SMITH, Mal. For. 16 (1953) 156–161, fig. 1–5.–Key to 5 *spp.* of the Mal. Pen.

Callicarpa: MERRILL, Frans. Am. Phil. Soc. n.s. 24^2 (1935) 332–333.–Synon. of a *Callicarpa.*

MOLDENKE, in FEDDE, Rep. 39 (1936) 288–317; *ibid.* 40 (1936) 38–131.–Monogr. of cultivated and American *spp.*; keys.

Faradaya: Lam & Meeuse, Blumea 3 (1938) 201.–*F. chrysoclada* is a *Bignon.*
Seemann, J. Bot. 3 (1865) 256–258.–Revision; no key.

Garrettia: Fletcher, Kew Bull. (1937) 70–74, fig. 1.–Type descr.; Siam.
Lam & Meeuse, Blumea 3 (1939) 248–254, fig. 1.–The *Vitex* described proved later to be a *Garrettia*, *cf.* next reference.
Meeuse, Blumea 5 (1942) 67–68.–A second *sp.* occurs in Mal.

Lantana: Backer, Trop. Natuur 2 (1913) 27–31, 33–36, 4 fig.–Key.

Petraea: Moldenke, in Fedde, Rep. 43 (1938) 1–48, 161–221.–Monograph; key!

Phyla (*Lippia*): Greene, Pittonia 4 (1899) 45–48. –*Lippia* versus *Phyla.*

Premna (*Pygmaeopremna, Tatea*): Dop, Bull. Soc. Bot. Fr. 70 (1923) 437–446, 829–836.–Descr. & records from Indo-China.
Fletcher, Not. R. Bot. Gard. Edinb. 19 (1936) 177–178.–*P. integrifolia = P. corymbosa.*
Meeuse, Blumea 5 (1942) 71.
Merrill, J. Arn. Arb. 32 (1951) 73–78.–Reduction of *Tatea* and *Pygmaeopremna* to *Premna.*

Priva: Kobuski, Ann. Missouri Bot. Gard. 13 (1926) 1–34, t. 1–5.–Revision; key!
Moldenke, in Fedde, Rep. 41 (1936) 1–76.–Revision; key!

Stachytarpheta: Danser, Ann. Jard. Bot. Btzg 40 (1929) 1–43, t. 1–10.–Revision Mal. *spp.*; key!; hybrids!

Teysmanniodendron (*Xerocarpa*): Koorders, Ann. J. Bot. Btzg 19 (1904) 19–31, t. 2–3.–Orig. descr.
Kostermans, Reinwardtia 1 (1951) 75–106.–Monograph; key!

Vitex: Lam, Bull. Jard. Bot. Btzg III, 5 (1922) 175–178.–Additions and records; one new *sp.*

VIOLACEAE

Burgersdijk, L. A. J., in Miquel, Plant. Jungh. (1852) 118–122.–List records; several new *spp.* in Java & Sumatra.

Korthals, P. W., Aanteekeningen op de familie der Violarieae van den Indischen Archipel (Ned. Kruidk. Arch. 1, 1848, 356–363, t. 1).–Survey of the family; no keys; 2 new *Rinoreas.*

Melchior, H. & W. Becker, Pflanzenfamilien ed. 2, 21 (1925) 329–377, fig. 148–162.

Miquel, F. A. W., Violacearum quarundam recensio (Ann. Mus. Bot. Lugd.-Bat. 4, 1869, 214–218).–Survey of fam. in Mal.

Oudemans, C. A. J. A., in Miquel, Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 67–78.–Revision; keys!

Local

Sumatra: Merrill, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 171–174.–New records and *spp.* of *Rinorea.*

Borneo: Merrill, Philip. J. Sc. 29 (1926) 400.–Some records in *Rinorea.*

Celebes: Melchior, Notizbl. Berl.-Dahlem 12 (1934) 205–207.–Records Kjellberg coll.; one new *sp.*
Van Ooststroom, Blumea 5 (1945) 594–595.–Misc. records of *Viola.*

Philippines: Becker, Philip. J. Sc. 19 (1921) 707–722.–Revision; key!
Merrill, Philip. J. Sc. 30 (1926) 413.–Records of a Bornean *sp.* in Sulu.

Moluccas: Merrill, Philip. J. Sc. 11 (1916) Bot. 292–293.–New *Rinorea* from Ambon.

New Guinea: Kanehira & Hatusima, Bot. Mag. Tokyo 55 (1941) 390–391.–Some records.
Melchior, Bot. Jahrb. 62 (1929) 368–375.–Revision; keys!
Merrill & Perry, J. Arn. Arb. 24 (1943) 208–210.–Descr. & records; new *Agatea* from the Solomons.
Pulle, Nova Guinea 8 (1911) 669–670.–Descr. of a new *Viola* and *Rinorea.*

Genera

Indovethia: Boerlage, in Feestbundel Taal-, Letter-, Geschied.- en Aardrijkskundige Bijdragen 80sten geboortedag P. J. Veth (1894) p. 89–90, 1 pl.; repr. in Ic. Bog. 1 (1897) t. 1.

Hybanthus (*Ionidium*): Backer, Onkruidfl. Jav. Suiker. (1930) 454–455.–Descr.; in Dutch.
Schulze, Bot. Jahrb. 67 (1936) 437–492.–Revision; keys!

Viola: Becker, Beih. Bot. Centralbl. 34, ii (1916) 208–266; *ibid.* 34, ii (1917) 373–433; *ibid.* 36, ii (1918) 15–59; *ibid.* 40, ii (1923) 20–171.–Misc. notes and descr. on *spp.* from Asia, Malaysia, Australia, and the Pacific; no keys.
—, Bot. Jahrb. 54 (1917) Beibl. 120, p. 156–189. –*Ditto.*
Boissieu & Capitaine, Bull. Soc. Bot. Fr. 57 (1910) 337–344, pl. 11–13.–Account of violets of Herb. Bog.; 1 new sp., 1 new var.
Lin, Taiwania 1 (1950) 269–283.–Key to Formosan *spp.*
Ridley, J. Bot. 73 (1935) 13–19.–Critical notes and new *spp.* and var. from West Malaysia.
Van Steenis, Bull. Jard. Bot. Btzg III, 13 (1934) 258–260[1].–List.

VITACEAE

(*Ampelidaceae, incl. Leeaceae*)

Gagnepain, F., Révision des Ampélidacées Asiatiques et Malaises (Bull. Soc. Nat. Autun 24, 1911, 1–41).–Key to genera & *spp.*; no descr.; enum. coll.; several transfers but no new *spp.*

King, G., Notes on the Indian species of Vitis (J. As. Soc. Beng. 65, ii, 1896, 108–114).–Critical notes; no key.

Miquel, F. A. W., Ampelideae novae (Ann. Mus. Bot. Lugd.-Bat. 1, 1863, 72–101).–Survey Mal. *spp.*; no keys.

Planchon, J. E., Monographie des Ampélidées

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(1) Dr Becker determined all sheets of Herb. Bog. before he died; unfortunately no MS was left. The list is made according to his identifications.

vraies (in DC. Mon. Phan. 5, 1887, 305–654).– Monogr. without *Leea*.

SUESSENGUTH, K., Pflanzenfamilien ed. 2, 20d (1953) 174–398, fig. 50–104.

Local

Sumatra: MERRILL, Contr. Arn. Arb. 8 (1934) 97–99.–List.
—, Pap. Mich. Acad. Sc. Arts & Lett. 19 (1934) 167–168, t. 30.–New *Pterisanthes*.
—, *ibid.* 23 (1938) 184–185.–2 records of *Ampelocissus*.

Java: BACKER, Schoolfl. Java (1911) 244–256.–In Dutch; key.

Borneo: WINKLER, HUB., Bot. Jahrb. 44 (1910) 534–537.–Records; new *spp.* of *Ampelocissus*.

Celebes: SUESSENGUTH, in FEDDE, Rep. 49 (1940) 13–14.–New *Ampelopsis* and *Ampelocissus* leg. RIEDEL.

Philippines: ELMER, Leafl. Philip. Bot. 10 (1939) 3799–3803.–New *sp.* of *Leea*, *Cayratia*, and *Tetrastigma*.
MERRILL, Philip. J. Sc. 11 (1916) Bot. 125–145. –Records and new *spp.* in *Ampelocissus*, *Cissus*, *Columella*, *Tetrastigma*, and *Leea*.
QUISUMBING, Philip. J. Sc. 76 (1944) 45–47.– Recombinations of Philip. *Cayratias*; new *Leea*.
— & MERRILL, Philip. J. Sc. 37 (1928) 164–166. –Descr. 2 new *Ampelocissus* and one new *Leea*.

New Guinea: LAUTERBACH, Nova Guinea 8 (1910) 301–303; (1912) 831–833; 14 (1924) 136–138.
—, Bot. Jahrb. 59 (1925) 505–534; *ibid.* 61 (1927) 31.–Revision; keys.
MERRILL & PERRY, J. Arn. Arb. 22 (1941) 375–383.–Records; new *spp.* of *Leea*, also from Solomons.
VALETON, Ic. Bog. 3 (1908) t. 258.–*Leea macropus* from New Guinea.

Genera

Cayratia (*Columella*): GAGNEPAIN, Not. Syst. 1 (1911) 339–362.–Segreg. of the genus; revision; key for Mal. & As. *spp.*

Cissus: GAGNEPAIN, Not. Syst. 1 (1911) 339–362.– Key to 23 *spp.*

Leea: BURTT, Kew Bull. (1935) 304–305.–Descr. 4-merous *sp.* from Solomons.
CLARKE, J. Bot. 19 (1881) 100–106, 135–142, 163–167.–Revision of Indian *spp.*, including several Malaysian ones.
CORNER, Gard. Bull. Str. Settl. 10 (1939) 45–46.– Critical note on *L. gigantea*.
GAGNEPAIN, Not. Syst. 1 (1910) 229–231.–Some new *Leeas* from Indo-China.
—, Bull. Soc. Bot. Fr. 57 (1910) 331–336.–Revision Asiatic *spp.*; key.
HALLIER *f.*, Ann. Jard. Bot. Btzg 14 (1897) 241–247.–Descr. *L. amabilis* from Borneo; anat. & ecol. of this *sp.* with water-containing buds.

Parthenocissus (*Landukia*): MERRILL, Philip. J. Sc. 11 (1916) Bot. 129.–Nomencl.

Pterisanthes: BACKER, Trop. Natuur 6 (1917) 12–16, 2 fig. –Key & descr. of 2 Jav. *spp.*

Tetrastigma: GAGNEPAIN, Not. Syst. 1 (1910) 261–271, 306–326; *ibid.* (1911) 376–379.–New *spp.* from Indo-China, China, and Mal.; revision; key!

WINTERACEAE

HUTCHINSON, J., The family Winteraceae (Kew Bull. 1921, 185–191).–Key to the genera; incl. also *Illicium*.

SMITH, A. C., Taxonomic notes on the Old World species of Winteraceae (J. Arn. Arb. 24, 1943, 119–164, 6 fig.).–Precursory to monograph; keys to genera and species.

—, Geographical distribution of the Winteraceae (J. Arn. Arb. 26, 1945, 48–59).

Local

New Guinea: BURTT, in HOOK. Ic. Pl. V, 4 (1936) t. 3315.–Note on *Bubbias*; many *Drimys* and *Belliolum* reduced.
—, Kew Bull. (1938) 458–460.–Reduction of *Tetrathalamus* to *Bubbia*.
DANDY, J. Bot. 72 (1934) 41–42.–Transfers from *Drimys* to *Bubbia*, mostly New Cal.
DIELS, Bot. Jahrb. 54 (1916) 240–245.–Key to *Drimys*!
SMITH, J. Arn. Arb. 23 (1942) 417–441.–Descr. & records; no key.

XYRIDACEAE

MALME, G. O., De nonnullis speciebus Xyridis praecipue Australisiensibus et Asiaticis (Svensk Bot. Tidskr. 21, 1927, 381–396).–Key to Austral. and Asiat. *spp.*

—, Xyridaceae Indiae Batavae (Bull. Jard. Bot. Btzg III, 10, 1929, 385–392).–Incomplete revision Mal. *spp.*; key.

—, Pflanzenfamilien ed. 2, 15a (1930) 35–38, fig. 10–15.

NILSON, A., Studien über die Xyrideen (Kongl. Svenska Vet. Akad. Handl. 24, *no* 14, 1892, 1–75, pl. 1–6).–Descr. of two *Xyris* from Malaya & Sum.; further on Amer. *Abolboda*.

RENDLE, A. B., Notes on Xyris (J. Bot. 37, 1899, 497–509).–Notes & descr.; no key.

ROYEN, P. VAN, Fl. Mal. I, 4 (1953) 366–376, fig. 1–10; 598–599.

—, Blumea 7 (1953) 307–309.–Descr. new *spp.* & var.

STEUDEL, E. G., Enumeratio plantarum Glumacearum pars II. Stuttgart (1855) 283–290.– Enum. descr.; in Latin.

Local

Indo-China: MALME, Bull. Mus. Hist. Nat. Paris II, 2 (1930) 684–685.–2 new *spp.*

Java: BACKER, Handb. Fl. Java 3 (1924) 4–5.–Key!; in Dutch.
BEUMÉE, Trop. Natuur 6 (1917) 155–159, fig. 1–10.–Ecol. & anat. *X. indica* L.; in Dutch.

New Guinea: HALLIER *f.*, Nova Guinea 8 (1913) 903.–Record.

ZINGIBERACEAE

HOLTTUM, R. E. See under Malay Peninsula.

HORANINOW, P., Prodromus monographiae Sci-

taminarum, *etc.* (1862) 1–45, t. 1–4.–Survey; no keys.

LOESENER, TH., Zingiberaceae novae vel minus cognitae (Notizbl. Berl.-Dahlem 10, 1927, 62–68).–Critical notes on *Achasma*, *Geanthus*, and *Costus*.

—, *ditto* (*ibid.* 10, 1929, 706–716).

—, Pflanzenfamilien ed. 2, 15a (1930) 541–640, fig. 236–289.

MIQUEL, F. A. W., Observationes de Zingiberaceis (Ann. Mus. Bot. Lugd.-Bat. 4, 1869, 99–102).–Notes & descr. of *Hedychium* and *Tapeinocheilos*.

SCHUMANN, K., Monographie der Zingiberaceae von Malaisien und Papuasien (Bot. Jahrb. 27, 1899, 259–350, t. 2–6).–Keys to genera and *spp.*

—, Pflanzenreich Heft 20 (1904) 1–458, fig. 1–52.

VALETON, TH., Ic. Bog. 2 (1904–1906) t. 154–175, 188–200; *ibid.* 3 (1906–1909) t. 202–203, 249, 275, 300; *ibid.* 4 (1913–1914) t. 350, 372–378. –Descr. various new or noteworthy *spp.*

—, Bull. Jard. Bot. Btzg II, *no* 27 (1919) 1–167, pl. 1–30.–New notes on *Zing.* of Java and Mal. Arch.; no keys!

Local

Indo-China: GAGNEPAIN, Bull. Soc. Bot. Fr. (1906) 132–150.–Descr. new *spp.* Herb. PIERRE.

Sumatra: BURKILL, Gard. Bull. Str. Settl. 3 (1923) 18–19.– New *Haplochorema*.
RIDLEY, J. Fed. Mal. Stat. Mus. 8, 4 (1917) 114–115.–List of records.
—, J. Mal. Br. R. As. Soc. *no* 87 (1923) 98–100. –Descr. several new *spp.* Sum. East Coast.
VALETON, Bull. Jard. Bot. Btzg III, 3 (1921) 148–149, t. 9.–Descr. new *Elettariopsis*.

Malay Peninsula: HOLTTUM, Gard. Bull. Sing. 13 (1950) 1–249, 33 fig.–Complete revision; of great value for a future monograph of Mal. *spp.*; keys!
RIDLEY, J. Str. Br. Roy. As. Soc. *no* 32 (1899) 87–175.–Descr. revision; no keys.
RIDLEY, Mat. Fl. Mal. Pen. (Monocot.) 2 (1907) 1–55.–Keys!

Borneo: MERRILL, Sarawak Mus. J. 3 (1928) 519.
RIDLEY, J. Str. Br. R. As. Soc. *no* 46 (1906) 229–245.–Records & descr. new *spp.*
—, J. Str. Br. R. As. Soc. *no* 63 (1912) 62.
—, J. Bot. 51 (1913) 247.–Descr. new *Alpinia*.
—, J. Linn. Soc. Bot. 42 (1914) 162–164.–List; descr. 2 new *Globbas* and 2 new *Alpinias*.
— & HUB. WINKLER, Bot. Jahrb. 44 (1910) 529–532.–List; several new *spp.*

Java: VALETON, Bull. Inst. Bot. Btzg I, *no* 20 (1904) 1–99.–Descr. new and noteworthy *spp.*; keys!
—, Bull. Jard. Bot. Btzg II, *no* 27 (1919) 1–167, t. 1–30.–New notes on Jav. *Zing.*; no keys.
VAN ZIJP, Rec. Trav. Bot. Néerl. 12 (1915) 340–347, t. 2–3.–Descr. new *Curcuma* & notes on a *Zingiber*.
— & VALETON, *ibid.* 14 (1917) 127–142, t. 11–13. –Further notes on *Curcuma* with descr. new *spp.*

Celebes: VALETON, Bull. Jard. Bot. Btzg III, 5 (1923) 343–344.–Key to 5 *spp.*

Philippines: ELMER, Leafl. Philip. Bot. 8 (1915) 2885–2919.–Descr. many new *spp.*
—, *ibid.* 8 (1919) 2963–2995.–Descr. new *spp.* Sorsogon Peninsula.
—, *ibid.* 9 (1934) 3225–3226.–New *Alpinia*.
—, *ibid.* 10 (1939) 3803–3806.–Descr. 2 new *spp.*
MERRILL, Philip. J. Sc. 30 (1926) 390–391.–Record of *Amomum* and new *Boesenbergia* from Sulu Arch.
QUISUMBING & MERRILL, Philip. J. Sc. 37 (1928) 138–141.–Descr. 2 new *Alpinias* (Languas).
RIDLEY, Govt Lab. Publ. Philip. *no* 35 (1905) 83–87.–List records with descr. new *spp.*
—, Philip. J. Sc. 4 (1909) Bot. 155–193.–Survey; descr. new *spp.*; keys!
—, in ELMER, Leafl. Philip. Bot. 2 (1909) 569–572.–Records and descr. new genera (*Elmeria*) and new *spp.*
—, *ibid.* 2 (1909) 603–607.–Records and new *spp.* from S. Negros; *Adelmeria* new name for *Elmeria*.

Moluccas: VALETON, Bull. Jard. Bot. Btzg III, 5 (1923) 343–345, t. 39.–Descr. new *spp.*

New Guinea: RIDLEY, J. Bot. 24 (1886) 356–358. –New *spp.* coll. FORBES.
—, Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 209–226.–List; several new genera, many new *spp.*
—, Proc. R. Soc. Queensl. 34 (1922) 19–21.–Records; 2 new *Riedelias*, 1 new *Eriolopha*.
VALETON, Nova Guinea 8 (1913) 923–988, t. 162–179.–List; many new *spp.*; subdivision of *Riedelia*.
—, Bot. Jahrb. 52 (1914) 40–100, 11 fig.–List and descr. new *spp.*; keys!; only German New Guinea.
—, in GIBBS, Contr. Fl. Phytog. Arfak Mts (1917) 102–103.–List; one new *Riedelia*.

Genera

Amomum: VALETON, Bull. Jard. Bot. Btzg III, 2 (1920) 354–356.–Records and descr. new *spp.*

Burbidgea: RIDLEY, J. Bot. 75 (1937) 202–203.–2 new *spp.* Borneo.

Elettariopsis: VALETON, Bull. Jard. Bot. Btzg III, 3 (1921) 148–149, t. 9.–Descr. new *sp.* from Sumatra.

Eriolopha: RIDLEY, Trans. Linn. Soc. II, Bot. 9 (1916) 217–222.–Descr. new *sp.*; key!

Geanthus: VALETON, Bull. Jard. Bot. Btzg III, 3 (1921) 143–146, t. 7–8.–Descr. 2 new *spp.* from Java & Sumatra.

Geostachys: VALETON, Bull. Jard. Bot. Btzg III, 3 (1921) 146–147.–Descr. new *sp.* from Sumatra.

Globba: GAGNEPAIN, Bull. Soc. Bot. Fr. 48 (1901) 201–216, t. 4–8.–Survey of *Globbas* preserved at Paris; no key!
VALETON, Ann. Jard. Bot. Btzg 31 (1921) 18–25, t. 5–6.–Descr. 3 new *spp.*, from Sumatra (2) and Borneo (1).

Hedychium: TURRILL, Kew Bull. (1914) 368–372, 2 pl., 8 fig.–Key to 8 *spp. aff. H. coronarium*.

Hornstedtia (subg. of *Amomum*): VALETON, Bull. Jard. Bot. Btzg III, 3 (1921) 150–179, t. 9–13.–Reconsideration of generic limits; key!

Phaeomeria (*Nicolaia*): VALETON, Bull. Jard. Bot. Btzg III, 3 (1921) 128–140, t. 1–6.–Descr. misc. *spp*.

Rhynchanthus: VALETON, Bull. Jard. Bot. Btzg III, 3 (1921) 141–142, t. 7.–Descr. new *sp*. from Sumatra.

Riedelia: VALETON, Nova Guinea 8 (1913) 959–961.–Infrageneric subdivision.

ZYGOPHYLLACEAE

ENGLER, A., Geographische Verbreitung der Zygophyllaceen in Verhältnis zu ihrer systematischen Gliederung (Abh. K. Preuss. Akad. Wiss., Phys. Abh. 1896 ii, 1–36, 1 map).

—, Pflanzenfamilien ed. 2, 19a (1931) 144–184, fig. 68–87.

STEENIS, C. G. G. J. VAN, Bull. Jard. Bot. Btzg III, 3 (1934) 104–105.–Revision.

—, Fl. Mal. I, 4 (1949) 64, 2 fig.

Local

New Guinea: MERRILL & PERRY, J. Arn. Arb. 21 (1940) 511.–Record.

C. G. G. J. VAN STEENIS

CITATION OF SERIALS AND SOME BOOKS

The abbreviations used are in general in conformity with common usage in botanical taxonomy, though, where possible, the citation has been limited to the minimum necessary for strict taxonomic reference, *e.g.*: 'F.v.M. Fragm.'—for F. VON MUELLER, Fragmenta phytographiae Australiae, 'Walp. Ann.'—for Walpers, Annales, 'BAILEY, Compr. Cat. Q. Pl.'—for F. M. BAILEY, Comprehensive Catalogue of Queensland Plants.

'In' after the author's name has been used only if one author has published in the work of another author, *e.g.*: 'BENTH. in B. & H. Gen. Pl.', 'CLARKE in Hook. *f.* & Th. Fl. Br. Ind.', or in the serial which, for the sake of clearness should be preceded by the name of its editor, *e.g.* 'SCHLTR in Fedde, Rep.'; 'Rep.' alone would not be sufficient, since there are several repertoria.

Serials and very large Floras are rarely attached to a single (author or) editor, but there are some, *e.g.* 'Desvaux, J. Bot.', 'Hook. J. Bot.', 'Miq. J. Bot. Néerl.', 'Morot, J. Bot.', 'Fedde, Rep.', *etc.* The editor's name is added when confusion with other periodicals is possible.

If the names of several consecutive authors or editors have (officially) been attached to the name of the work these names are left out, as the references to one serial or work would be different for different volumes. These are, therefore, treated as anonymous works, for example: 'Bot. Jahrb.', 'Not. Syst.', 'Pfl. R.' (Pflanzenreich), 'Fl. Gén. I.-C.', 'Fl. Trop. Afr.', 'Fl. Cap.', *etc.*

I should not like to go so far as has been done in the Florae Siamensis Enumeratio and Flora of East Tropical Africa, *i.e.* to abbreviate works in reducing each word to one letter: 'F.B.I.' for Flora of British India, 'F.I.B.' for Flora Indiae Batavae, 'F.M.P.' for Flora of the Malay Peninsula, *etc.*, as the meaning of these abbreviations can be understood and remembered only by very few insiders. It is preferable to have concise abbreviations which make some sense and give no particular trouble for all those who are normally acquainted with bibliography and taxonomy.[1]

Still, there are some well-known, much-used items which have rather complicated Dutch titles and others which are, from the standpoint of botanical science, 'works in their own right' but have been published in little known serials. An example of the first is the list of plants of North Celebes, compiled by S. H. KOORDERS. This book bears the title: 'Verslag eener botanische dienstreis door de Minahasa, tevens eerste overzicht der Flora van N.O. Celebes uit een wetenschappelijk en praktisch oogpunt' and has been published as '*No* 19' of the 'Mededeelingen van 's Lands Plantentuin te Buitenzorg', pp. 1–716, but is always mentioned as 'KOORDERS, Minahasa', since the account was limited to the collection made in a special province of NE. Celebes, named Minahasa; for this unmanageable title I have chosen the abbreviated reference: 'KOORD. Minah.'.

Of the 2nd category I mention MERRILL's 'A Bibliographic Enumeration of Bornean plants', published as 'Journal of the Straits Branch of the Royal Asiatic Society, special number', pp. 1–637. If in citing this work only a reference would be made to the 'J. Str. Br. R. As. Soc.'—which is in many countries a rare serial—the citation would certainly be difficult to locate, as in most libraries this work will not have been arranged in the serial but as a separate book. Therefore in Flora Malesiana we refer to it as 'MERR. En. Born.'.

A similar case is that with MERRILL's 'An Enumeration of Philippine Flowering Plants', which has been issued in a series named 'Government of the Philippine Islands. Department of Agriculture and Natural resources. Bureau of Science, Manila. Publication *no* 18'. This will have been indexed in various ways in different libraries. We refer to it as 'MERR. En. Philip.' which should be perfectly comprehensible to trained taxonomists. And this is all we aim at.

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(1) As a matter of fact the editors of some journals have themselves recommended very shortened abbreviations for citation, *e.g.* 'B. B. C.' for Beih. Bot. Centralbl. and in Germany botanists have lately frequently referred to 'B. J.' standing for Bot. Jahrb. and 'F. R.' *ditto* for Fedde, Repert. I believe this principle should not be encouraged.

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As regards serials it may seem at first thought that the equivalents for Royal and Imperial in different languages are better omitted from the abbreviated citations. The more so as societies, institutes, *etc.*, usually start without that predicate, acquire it at a certain time, and will lose it any time when the involved country becomes a republic instead of a kingdom or empire. After ample thought this predicate will, however, be represented in the citations in Flora Malesiana, *i.e.* taking into consideration each volume separately. An example to prove the necessity of this, is the Journal of the Horticultural Society in London, of which nine volumes were published from 1846–1855. In 1868 the publication was resumed under the same title with the predicate Royal, starting with volume 1 again.

In general it must be said that the numerous changes of title of one and the same periodical in the course of years, tend to bring a bibliographer to despair, and we may seriously ask 'what's in a name', and is it really worthwhile, or possibly often a point of honour for a new editor? It seems to me that at least here some wise conservatism would be in place.

Between the author's name which has been printed in small capitals and the title of the book which is printed in Roman type, there is only one punctuation mark, *viz* either a comma if the author's name is not abbreviated or only contracted (LAMK for LAMARCK, SCHLTR for SCHLECHTER), or a full stop in case it has been abbreviated.

Editor's names connected with a serial are printed in Roman type, as part of the title.

In exactly following the use of capitals in titles of books and serials in different languages there would be an annoying variation, as this differs considerably in the English, French, Latin, and German languages. This inconformity, resulting from a strictly keeping to linguistic practice, is distinctly unpleasant from the visual point of view. Therefore, Flora Malesiana keeps to the simple rule of starting all whole or abbreviated words of cited titles with a capital. After all, the decapitalization of specific epithets has been adopted to simplify citation and there is no eminent reason for unnecessarily complicating other formulas!

Volumes, numbers and plates have in literature variously been numbered in Arabic or Roman numerals. To copy this, as it is in the original, may be strict from the standpoint of a bibliographer 'pur sang', but it appears to be rather far-fetched for the botanist, and it is for him disadvantageous by being either unclear or difficult to cite in a concise and at the same time conformable way.

For Flora Malesiana the following simple scheme has been adopted: volumes have not been specially marked as such and have always been printed in Arabic numerals.[1] Roman numerals are reserved for indicating the series if a work has been issued in more than one subsequent series. Volumes and pages have been separated by the year of actual publication by brackets, or when the whole citation stands between brackets, by commas. Thus 'Bull. Jard. Bot. Btzg III, 13 (1933) 345' means that the reference is found on page 345 of the 13th volume of the third series of this Bulletin, and that this page has been published in 1933. The second instance in which Roman numerals are used, is for citing pages which are numbered in that way (prefatory matter mostly), as in that case any other citation would be confusing; those page numbers are given in small type. Thirdly small Roman numerals are sometimes used for indicating the section, following the volume number.

Serials not issued in volumes but in numbers are indicated by *no* (*numero*) for example: 'J. Str. Br. R. As. Soc. *no* 65 (19 . .)'. Sometimes the issued parts have both a number and are at the same time incorporated in a volume, as *e.g.* the 'Notizblatt des Botanischen Gartens Berlin-Dahlem'. Here the paging is continuous, and a certain number of parts actually constitute a regular volume with a common title page, contents, index, *etc.* In this case only the volume is referred to, and reference to the numbered parts is omitted. The 'Pflanzenreich' has also a double

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(1) Of a few journals, *e.g.* the Kew Bulletin, the volumes have not been numbered and are indicated by years. If parts of some of these have been published in a subsequent year, the year of issue is added in brackets, *e.g.* Kew Bull. 1950 (1951) 343. It seems far-fetched to do this consistently retroactive as the majority was issued in the proper year; it appears reasonable to restrict this to those pages which were published in the fascicles falling outside the volume-year.

numbering of its parts; in Flora Malesiana only the numbers of the separate volumes ('Hefte') are referred to.

In special cases, *e.g.* in some Scandinavian journals where fascicles or articles form part of a regular volume but are paged separately, both volume and number of the paper or fascicle will have to be cited. Rightly the latter at the top of the volume-number, *e.g.* 6^2.

When in a year two volumes are issued, as many times in Flora, both with the same number, these must be cited *e.g.* as 15, 1 and 15, 2.

If journals are edited in sections, *e.g.* the 'Journal of the Asiatic Society of Bengal', the 'Beihefte zu dem Botanischen Centralblatt', some volumes of the 'Philippine Journal of Science', and many 'Proceedings' of Academies of Science, an extra indication is incorporated in the reference.

From the subjoined lists it will be evident at a glance that the serials are far more completely represented than the books and pamphlets. This had a practical reason, as, in general, tracing serials in a catalogue gives more difficulties than tracing books with a known author. Books, theses, *etc.*, dealing with one family only are left out altogether. When they have to be repeatedly cited, when this special family is published in Flora Malesiana, otherwise incomprehensible citations are explained in the text or in a footnote.

In volume four the present way of citation has been followed only approximately; from now onwards it will be tried to be more consistent in this matter.

M. J. VAN STEENIS-KRUSEMAN

A. REFERENCE LIST OF SERIAL ABBREVIATIONS

Abh. K. (Bayer.) Ak. Wiss. M.-Ph. Kl. (Münch.) – Abhandlungen der Mathematisch-physikalischen Klasse der Königlichen (Bayerischen) Akademie der Wissenschaften zu München. München.

Abh. (K.) Böhm. Ges. Wiss. M.-N. Cl. – Abhandlungen der mathematisch-naturwissenschaftlichen Classe der (Königlichen) Böhmischen Gesellschaft der Wissenschaften. Prag.

Abh. K. (Preuss.) Ak. Wiss. Ph. Kl. (Berl.) – Abhandlungen der Physikalischen Klasse der Königlichen (Preussischen) Akademie der Wissenschaften zu Berlin. Berlin.

Abh. K. Leop.-Car. Deut. Ak. Naturf. – Abhandlungen der Kaiserlichen Leopoldinisch-Carolinischen Akademie der Naturforscher. Breslau und Bonn.
See *Nov. Act. Ac. Caes. Leop.-Car.*

Abh. Naturf. Ges. Halle – Abhandlungen der Naturforschenden Gesellschaft zu Halle. Halle.

Abh. Naturw. Ver. Bremen – Abhandlungen herausgegeben vom Naturwissenschaftlichen Verein zu Bremen. Bremen.

Abh. Naturw. Ver. Hamb. – Abhandlungen aus dem Gebiete der Naturwissenschaften. Herausgegeben von dem Naturwissenschaftlichen Verein, Hamburg. Hamburg.

Abh. Schles. Ges. Vaterl. Cult. – Abhandlungen der Schlesischen Gesellschaft für vaterländische Cultur. Breslau.

Abh. Senck. Naturf. Ges. Frankf. – Abhandlungen, herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft. Frankfurt a.M.

Ac. Nat. Sc. Philad. Mon. – Academy of Natural Sciences of Philadelphia. Monographs.

Act. Ac. Caes. Leop.-Car. – Acta physico-medica Academiae caesareae leopoldino-carolinae naturae curiosorum exhibentia ephemerides, sive . . . Norimbergae.
Continued as: *Nov. Act. etc.*
See also *Misc. Cur. Ac. Nat. Cur.* and *Ephem. Ac. Caes. Leop.*

Act. Ac. Sc. Petrop. – Acta Academiae scientiarum imperialis Petropolitanae.
Series III of *Mém. Ac. Imp. Sc. St. Pétersb.*

Act. Ac. Theod. Palat. – Acta Academiae Theodoro-Palatinae. Mannhemii.

Act. Bot. Neerl. – Acta botanica Neerlandica. Official publication of the Koninklijke Nederlandse Botanische Vereniging. Amsterdam.

Act. Bot. Taiw. – Acta botanica Taiwanica. Taiwan.

Act. Congr. Int. Bot. Brux. 1910 – Actes du 3^{me} Congrès international de botanique, Bruxelles, 1910.

Act. Congr. Int. Bot. Hort. A'dam, 1877 – Actes du Congrès international de botanistes, d'horticulteurs, de négociants et de fabricants de produits du règne végétal, tenu à Amsterdam, en 1877.

Act. Faun. Fl. Un. Bot. – Acta pro fauna et flora universali. Seria 2. Botanica. Bucharest.

Act. Hort. Berg. – Acta horti Bergiani. Meddelanden från Küngl. (Kongl.) Svenska Vetenskaps-Akademiens Trädgård Bergielund. Stockholm, Up(p)sala.

Act. Hort. Got(h)ob. – Acta horti Got(h)oburgensis. (Meddedlanden från Göteborgs Botaniska Trädgård.) Göteborg.

Act. Hort. Petrop. – Acta horti Petropolitani. (Trudy Imperatorskago S.-Petersburgskago Botanicheskago Sada.) St. Petersburg.

Act. Phytotax. Geobot. – Acta phytotaxonomica et geobotanica. Kyoto.

Act. Soc. Bot. Pol. – Acta Societatis botanicorum Poloniae. (Organ Polskiego Towarzystwa Botanicznego Warszawa.) (Publication de la Société botanique de Pologne.) Warszawa.

Act. Soc. Faun. Fl. Fenn. – Acta Societatis pro fauna et flora Fennica. Helsingforsiae.

Act. Soc. R. Sc. Indo-Neerl. – Acta Societatis regiae scientiarum Indo-Neerlandicae. (Verhandelingen der Natuurkundige Vereeniging in Nederlandsch Indië.) Batavia.

Act. Soc. R. Sc. Upsal. – Acta Societatis regiae scientiarum Upsaliensis. Upsala, Stockholm.
Continued as: *Nov. Act. Soc. Sc. Upsal.*

Act. Un. Lund. – Acta Universitatis Lundensis. (Lunds Universitets Årsskrift.) Afdelningen för Mathematik och Naturvetenskap. Lund.
For varying secondary titles see Merrill & Walker, Bibliogr. East. As. Bot. 1938, p. (xiii).

Adansonia – Adansonia. Receuil (périodique) d'observations botaniques. Paris.

Addisonia – Addisonia, colored illustrations and popular descriptions of plants. New York.

Agr. Angol. – Agronomia angolana. Luanda.

Agr. Bull. Str. & F. M. S. – Agricultural Bulletin of the Straits and Federated Malay States. Singapore.

Agr. Ledg. – The Agricultural Ledger. Calcutta.

Allg. Gartenz. – Allgemeine Gartenzeitung.
Later replaced by *Berl. Allg. Gartenz.*

Am. J. Bot. – The American Journal of Botany. Official organ of the Botanical Society of America. Lancaster, Brooklyn.

Am. Midl. Nat. – The American Midland Naturalist. Notre Dame, Ind.

Am. Orch. Soc. Bull. – American Orchid Society Bulletin. Washington, D.C.

Ames, Orch. – O. Ames, Orchidaceae: illustrations and studies of the family Orchidaceae issuing from the Ames Botanical Laboratory, North Easton, Mass.

An. Cienc. Nat. – Anales de ciencias naturales. Instituto José de Acosta. Madrid.
Replaced *An. Hist. Nat.*

An. Hist. Nat. – Anales de historia natural. Madrid. Vols 1–2, replaced by *An. Cienc. Nat.*

An. Inst. Biol. – Anales del Instituto de biologia. Mexico.

An. Soc. Esp. Hist. Nat. – Anales de la Sociedad española de historia natural. Madrid.

Ann. Bog. – Annales Bogorienses. A journal of tropical general botany being a continuation of the Annals of the Botanic Gardens, Buitenzorg. Bogor.

Ann. Bot. – See Kön. & Sims, Ann. Bot.

Ann. Bot. – See Walp. Ann.

Ann. Bot. – Annals of Botany. Oxford, London. Edited by Balfour *etc.* from 1887 → .

Ann. Bot. Gard. Btzg – Annals of the Botanic Garden, Buitenzorg.
A continuation of the *Ann. Jard. Bot. Btzg*; at present *Ann. Bog.*

Ann. Cons. Jard. Bot. Genève – Annuaire du Conservatoire et du Jardin botaniques de Genève.
In 1924 continued as: *Candollea.*

Ann. Hort. Bot. – Annales d'horticulture et de botanique; ou Flore des jardins du Royaume des Pays-Bas. Leide.

Ann. Inst. Col. Mars. – Annales de l'Institut colonial de Marseille.
Continued as: *Ann. Mus. Col. Mars.*

Ann. Inst. Sup. Agr. – Annaes do Instituto superior de agronomia. Lisboa.

Ann. Jard. Bot. Btzg – Annales du Jardin botanique de Buitenzorg. Java. Leiden.
Continued as: *Ann. Bot. Gard. Btzg*; at present: *Ann. Bog.*

Ann. Mag. Nat. Hist. – The Annals and Magazine of Natural History. London.

Ann. Mo. Bot. Gard. – Annals of the Missouri Botanical Garden. St. Louis.

Ann. Mus. Bot. Lugd.-Bat. – See Miq. Ann. Mus. Bot. Lugd.-Bat.

Ann. Mus. Col. Mars. – Annales du Musée colonial de Marseille.
Continuation of *Ann. Inst. Col. Mars.*

Ann. Mus. Congo Belge Bot. – Annales du Musée du Congo belge. Série b. Botanique. Bruxelles.

Ann. Mus. Hist. Nat. Paris – Annales du Muséum (nationale) d'histoire naturelle. Paris.
Continued as: *Mém. Mus. Hist. Nat. Paris.*

Ann. N.Y. Ac. Sc. – Annals of the New York Academy of Sciences. New York.

Ann. (K.K.) Naturh. (Hof) Mus. Wien – Annalen des (K.K.) Naturhistorischen (Hof)Museums in Wien. Wien.

Ann. R. Bot. Gard. Calc. – Annals of the Royal Botanic Garden. Calcutta.

Ann. R. Bot. Gard. Perad. – Annals of the Royal Botanic Gardens, Peradeniya. Dept of Agriculture, Ceylon.
Continued as: *Ceyl. J. Sc. Bot.*

Ann. R. Ist. Bot. Roma – Annuario del R. Istituto botanico di Roma. Milano *etc.*

Ann. Rep. Br. New Guinea – Annual Reports of British New Guinea. Brisbane.

Ann. Rep. Mo. Bot. Gard. – Annual Report of the Missouri Botanical Garden. St. Louis.

Ann. Rep. Papua – Annual Reports of Papua. Melbourne.

Ann. Rep. Taih. Bot. Gard. – Annual Reports of the Taihoku Botanic Garden. Faculty of Science and Agriculture, Taihoku Imperial University, Formosa.

Ann. Sc. Nat. Bot. – Annales des sciences naturelles. Botanique. Paris.

Ann. Scu. Sup. Agr. Portici – Annali della Scuola superiore di agricoltura in Portici. Napoli.

Ann. Soc. Linn. Lyon – Annales de la Société linnéenne de Lyon.

Ann. Soc. Sc. Brux. (sér. B.) – Annales de la Société scientifique de Bruxelles. Louvain.
From vol. 47 (1927) onwards: Sér. B. Sciences physiques et naturelles.

Ann. Transv. Mus. – Annals of the Transvaal Museum. Pretoria.

Ann. Un. Curie-Sklodowska Biol. – Annales Universitatis Mariae Curie-Sklodowska. Sect. C. (Biology). Lublin.

Anz. Ak. Wiss. Wien M.-N. Kl. – Anzeiger der Akademie der Wissenschaften zu Wien, Mathematisch-naturwissenschaftliche Klasse.

Arb. Bot. Inst. Braunsberg - Arbeiten aus dem Botanischen Institut des Kgl. Lyceum Hosianum in Braunsberg, Ostpreusen. Braunsberg.
Later: des Kgl. Akademie in *etc.*

Arch. Bot. Caen Mém. – Archives de botanique, publiés par René Viguier . . . Mémoires.

Arch. Hydrobiol. – Archiv für Hydrobiologie (und Planktonkunde). Berlin.

Arch. Klaus-Stift. – Archiv der Julius Klaus-Stiftung für Vererbungsforschung, sozialanthropologie und Rassenhygiene. Zürich.

Arch. Jard. Bot. Rio Jan. – Archivos do Jardim botanico do Rio de Janeiro.
Replaced by: *Arq. Inst. Biol. Veg.*

Arch. Mus. Hist. Nat. Paris – Archives du Muséum d'histoire naturelle. Paris.
Continued as: *Nouv. Arch. Mus. Hist. Nat. Paris*; from ser. VI vol. 1 onwards under the title *Arch. Mus. Hist. Nat. Paris* again.

Arch. Néerl. Sc. Ex. Nat. – Archives néerlandaises des sciences exactes et naturelles. Haarlem.

Arch. Serv. Flor. – Archivos (Arquivos) do Serviço florestal do Brasil. Rio de Janeiro.

Ark. Bot. – Arkiv för botanik. Utgivet av (af) Kongl. Svenska Vetenskapsakademien. Stockholm.

Arn Arb. Publ. – See Publ. Arn. Arb.

Arq. *etc.* – Arquivos, see also *sub* Arch.(ivos).

Arq. Inst. Biol. Veg. – Arquivos do Instituto de biologia vegetal. Rio de Janeiro.
Superseding *Arch. Jard. Bot. Rio Jan.*

Asa Gray Bull. – The Asa Gray Bulletin. Edited and published for the Gray Memorial Botanical Association, Botanical Gardens Association of the University of Michigan and the Michigan Botanical Club. Ann Arbor, Michigan.

Atoll Res. Bull. – Atoll Research Bulletin, issued by the Pacific Science Board, Nat. Res. Council, Washington, D.C. Mimeographed.

Att. Ac. Sc. Fis. Mat. Napoli – Atti della Accademia delle scienze fisiche e matematiche di Napoli. Napoli.

Att. R. Ac. Fisiocr. Siena – Atti della reale Accademia dei fisiocritici di Siena. Siena.

Att. (R.) Ist. Incor. Sc. Nat. Napoli – Atti dell' (del reale) Istituto d'incoraggiamento alle scienze naturali *etc.* Napoli.

Att. Soc. Ital. Sc. Nat. – Atti della Società italiana di scienze naturale. Milano.

Att. Soc. Tosc. Sc. Nat. – Atti della Società Toscana di scienze naturali residente in Pisa. Pisa.

Austr. Chem. Drug. – Australian Chemist and Druggist. Melbourne.

Superseded the *Austr. Suppl. Chem. Drug.*

Continued as: *Austr. J. Pharm.* in 1886.

Austr. Herb. News – Australasian Herbarium News. A journal for the interchange of information among the systematic botanists of Australia and New Zealand. Sydney.

Austr. J. Appl. Sc. – Australian Journal of Applied Science. Publ. by the C.S.I.R.O. (Council for Scientific and Industrial Research Organization). Melbourne.

Austr. J. Bot. – Australian Journal of Botany. C.S.I.R.O. in collaboration with the Austr. Nat. Res. Council. Melbourne, Vict.

Austr. J. Pharm. – (The) Austral(as)ian Journal of Pharmacy. Melbourne.

Superseded the *Austr. Chem. Drug.*

Austr. Suppl. Chem. Drug. – The Australasian Supplement to The Chemist and Druggist. Melbourne.

Replaced the *Melb. Chem. Drug.*

Continued as: *Austr. Chem. Drug.*

Baileya – Baileya. A quarterly Journal of Horticultural Taxanomy. Published at the Bailey Hortorium of the New York State College of Agriculture, Cornell University, Ithaca, N.Y.

Beih. Bot. Centralbl. – Beihefte zu dem Botanischen Centralblatt. Cassel, Dresden.

Often abbreviated *B.B.C.* There are several sections; systematics, plant geography and applied botany in Abt. ii, from vol. 52 (1934) onwards designated as Abt. B.

Beih. Nachr. Kais. Wilh. Land – Beihefte zu den Nachrichten über Kaiser Wilhelms-Land und den Bismarck Archipel, herausgegeben im Auftrag der Neu-Guinea Kompagnie zu Berlin. Berlin.

Ber. Deut. Bot. Ges. – Berichte der Deutschen Botanischen Gesellschaft. Berlin.

Often abbreviated *Ber. D.B.G.*

Ber. Schweiz. Bot. Ges. – Berichte der Schweizerischen Botanischen Gesellschaft. (Bulletin de la Société botanique Suisse.) Bern.

Bibl. Bot. – Bibliotheca botanica. Original-Abhandlungen aus dem Gesammtgebiete der Botanik. Cassel, Stuttgart.

Biol. Jaarb. – See Dodonaea.

Biol. Rev. – Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society. Great Britain.

Blumea – Blumea. Tijdschrift voor de systematiek en de geografie der planten. Leiden.

Replaces the *Med. Rijksherb.*

Bois & For. Trop. – Bois et forêts des tropiques. Paris.

Boissiera – Boissiera. Mémoires du Conservatoire de botanique et de l'Institut de botanique systématique de l'Université de Genève.

Bol. Mus. Goeld. – Boletim do Museu Goeldi de historia natural e ethnographia. Para.

Bol. Soc. Arg. Bot. – Boletin de la Sociedad argentina de botanica. La Plata.

Bol. Soc. Brot. – Boletim annual: Sociedade Broteriana. Coimbra.

From vol. 4 (1886) onwards the title was *Boletim da Sociedade Broteriana.*

Bol. Soc. Venez. Cienc. Nat. – Boletin de la Sociedad venezolana de ciencias naturales. Caracas.

Bonplandia – Bonplandia. Zeitschrift für die gesammte Botanik. Hannover, London, Paris.

Bost. J. Nat. Hist. – Boston Journal of Natural History, containing papers and communications read to the Boston Society of Natural History. Boston, Mass.

Replaced by a new series: *Mem. Bost. Soc. Nat. Hist.*

Bot. Arch. – See Mez, Bot. Arch.

Bot. Bull. Ac. Sin. – Botanical Bulletin of Academia Sinica. Shanghai.

Bot. Bull. Queensl. Dep. Agr. – Botany Bulletin of the Queensland Department of Agriculture and Stock. Brisbane.

Bot. Centralbl. – Botanisches Centralblatt. Cassel, Jena.

Bot. Gaz. – The Botanical Gazette. Chicago, Ill.

Bot. Jahrb. – Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie. Herausgegeben von A. Engler. Leipzig.

Bot. Jahrb. Beibl. – Beiblätter zu den Botanischen Jahrbüchern (see above).

Bot. Jahrb. Lit. – Botanische Jahrbücher (see above). Literaturbericht.

Bot. Leafl. – See Sherff, Bot. Leafl.

Bot. Mag. – Curtis's Botanical Magazine. London.

Bot. Mag. Tokyo – The Botanical Magazine. Published by the Tokyo Botanical Society.

Bot. Mus. Leafl. – Botanical Museum Leaflets, Harvard University. Cambridge, Mass.

Bot. Not. – Botaniska Notiser. Lund.

See also *Nya Bot. Not.*

Bot. Reg. – The Botanical Register: later Edward's Botanical Register. London.

Bot. Rev. – The Botanical Review. Interpreting botanical progress. Lancaster, Pa.

Bot. Tidsskr. – Botanisk Tidsskrift, udgivet af den Botaniske Forening i Kjøbenhavn. (Journal de botanique publié par la Société botanique de Copenhague.) Kjøbenhavn.

The first 6 volumes do not bear the French subtitle.

Bot. Zeit. – Botanische Zeitung. Leipzig, Berlin. For Flora oder allgemeine botanische Zeitung, see *Flora.*

Bot. Zeit. Regensb. – Botanische Zeitung. Herausgegeben von der Botanischen Gesellschaft in Regensburg.

Vols 1–6 (1802–07).

Bothalia – Bothalia. National Herbarium. Pretoria.

Brittonia – Brittonia. A series of botanical papers. Published by the New York Botanical Garden.

Bull. Ac. R. Belg. – Bulletin de l'Académie Royale des sciences et belles-lettres de Bruxelles.

Later some minor changes of title occur.

Bull. Ac. Sc. Petrogr. – Bulletin de l'Académie des sciences. Petrograd.

Part of 6th series of the Leningrad Academy (see *Bull. Ac. Sc. U.R.S.S.*).

Bull. Ac. Sc. Russ. – Bulletin de l'Académie des sciences de Russie. Petrograd, Leningrad.
Last part of the 6th series of the Leningrad Academy (see *Bull. Ac. Sc. U.R.S.S.*).

Bull. Ac. Imp. Sc. St. Pétersb. – Bulletin de l'Académie impériale des Sciences de St. Pétersbourg. St. Pétersbourg.
3rd up to part of the 6th series of the Leningrad Academy (see *Bull. Ac. Sc. U.R.S.S.*).

Bull. Ac. Imp. Sc. St. Pétersb. Cl. Ph.-M. – Bulletin de la Classe physico-mathématique de l'Académie impériale des sciences de St. Pétersbourg. St. Pétersbourg.
2nd series of the Leningrad Academy (see *Bull. Ac. Sc. U.R.S.S.*).

Bull. Ac. Sc. U.R.S.S. – Bulletin de l'Académie des Sciences de l'Union des Républiques Soviétiques Socialistes. Izvestiia Akad. Nauk Soiuza Sovetskikh Sotsialisticheskikh Respublik. Leningrad.
Preceded by several other series, see *Bull. Sc. Ac. Sc. St. Pétersb., Bull. Ac. Sc. St. Pétersb. Cl. Ph.-M., Bull. Ac. Sc. St. Pétersb., Bull. Ac. Sc. Petrogr., Bull. Ac. Sc. Russ.* For full particulars see Merrill & Walker, Bibliogr. East. As. Bot. 1938, p. xviii.

Bull. Appl. Bot. Gen. Pl.-Breed. – Bulletin of Applied Botany, Genetics and Plant-breeding. Trudy po Prikladnoi Botanike, Genetike i Selektsii. Leningrad.
The title varies, see Merrill & Walker, Bibliogr. East. As. Bot. 1938, xviii.
In 1932 ten parallel series were instituted; taxonomy in series i.

Bull. Appl. Bot. Leningr.–See above.

Bull. Bish. Mus. – Bulletin Bernice P. Bishop Museum. Honolulu, Hawaii.

Bull. Bot. Gard. Btzg – Bulletin of the Botanic Gardens, Buitenzorg. Being a continuation of the Bulletin du Jardin botanique de Buitenzorg. Buitenzorg.

Bull. Bot. Soc. Bengal – Bulletin of the Botanical Society of Bengal. Calcutta.

Bull. Br. Mus. Nat. Hist. Bot. – Bulletin of the British Museum (Natural History). Botany. London.
There are other sections too.

Bull. Bur. Agr. Philip. – Bulletin. Bureau of Agriculture, Philippine Islands. Manila.

Bull. Bur. For. Philip. – Bulletin of the Bureau of Forestry, Philippine Islands. Manila.

Bull. Bur. Sc. Philip. – Bulletin. Bureau of Science, Philippine Islands. Manila.

Bull. Congr. Int. Bot. Hort. – Bulletin du Congrès international de botanique et d'horticulture, réuni à Bruxelles, Amsterdam, St. Pétersbourg, *etc.*

Bull. Dép. Agr. Ind. Néerl. – Bulletin du Département de l'Agriculture aux Indes Néerlandaises. Buitenzorg. Java.

Bull. Dep. Land Rec. Agr. Bengal – Bulletin of the Department of Land Records and Agriculture, Bengal. Calcutta.

Bull. Fac. Sc. Egypt. Un. – Bulletin of the Faculty of Science. Egyptian (Fouad I) University. Cairo.

Bull. Fan Mem. Inst. Biol. – Bulletin of the Fan Memorial Institute of Biology. Peiping.

Bull. Herb. Boiss. – Bulletin de l'Herbier Boissier. Genève, Bâle.

Bull. Inst. Agr. & St. Rech. Gembl. – Bulletin de l'Institut agronomique et des Stations de recherches de Gembloux.

Bull. Inst. Bot. Btzg – Bulletin de l'Institut botanique de Buitenzorg ('s Lands Plantentuin). Buitenzorg.
Later series published as *Bull. Jard. Bot. Btzg* and *Bull. Bot. Gard. Btzg* and *Reinwardtia.*

Bull. Inst. R. Col. Belg. – Bulletin de l'Institut Royal Colonial Belge. Bruxelles.

Bull. Jard. Bot. Ac. Sc. U.R.S.S. – Bulletin du Jardin botanique de l'Académie des sciences de l'U.R.S.S. Leningrad.
Vol. 30 only; for preceding volumes see: *Bull. Jard. Bot. St. Pétersb., Bull. Jard. Bot. Petrogr.,* and *Bull. Jard. Bot. Rép. Russ.*
Continued as: *Sovetskaia botanika.*

Bull. Jard. Bot. Brux. – Bulletin du Jardin Botanique de l'Etat à Bruxelles.

Bull. Jard. Bot. Btzg – Bulletin du Jardin botanique. Buitenzorg.
Continued as: *Bull. Bot. Gard. Btzg*; at present: *Reinwardtia.*

Bull. Jard. Bot. Petrogr. – Bulletin du Jardin (impérial) botanique de Pierre le Grand. Izviestiia Botanicheskago Sada Petra Velikago. Petrograd.
Vols 14–16 of the Leningrad Botanical Garden (see *Bull. Jard. Bot. Ac. Sc. U.R.S.S.*).

Bull. Jard. Bot. Russ. – Bulletin du principal Jardin botanique de la République russe. Izviestiia Glavnogo Botanicheskago Sada R.S.F.S.R. (S.S.S.R.). Petrograd.
Vols 18–29 of the Leningrad Botanical Garden (see *Bull. Jard. Bot. Ac. Sc. U.R.S.S.*).

Bull. Jard. Imp. Bot. St. Pétersb. – Bulletin du Jardin impériale botanique de St. Pétersbourg. Izvestiia S.-Petersburgskago Botanicheskago Sada. St. Pétersbourg.
Vols 1–13 of the Leningrad Botanical Garden (see *Bull. Jard. Bot. Ac. Sc. U.R.S.S.*).

Bull. Kol. Mus. Haarlem – Bulletin van het Koloniaal Museum te Haarlem.

Bull. Miyazaki Coll. Agr. For. – Bulletin of the Miyazaki College of Agriculture and Forestry. Miyazaki, Japan.

Bull. Mo. Bot. Gard. – Bulletin. Missouri Botanical Garden. St. Louis.

Bull. Mus. Hist. Nat. Paris – Bulletin du Muséum national d'histoire naturelle. Paris.

Bull. N.Y. Bot. Gard. – Bulletin of the New York Botanical Garden. New York.

Bull. Nat. Sc. Mus. Tokyo n.s. – Bulletin of the National Science Museum, new series. Tokyo, Japan.
Continuation of *Bull. Tokyo Sc. Mus.*

Bull. R. Soc. Tosc. Ort. – Bulletino della reale Società Toscana di orticultura. Firenze.

Bull. Sc. Ac. Imp. Sc. St. Pétersb. – Bulletin scientifique publié par l'Académie impériale des sciences de Saint-Pétersbourg.
1st series of the Leningrad Academy (see *Bull. Ac. Sc. U.R.S.S.*).

Bull. Soc. Bot. Belg. – See Bull. Soc. R. Bot. Belg.
Bull. Soc. Bot. Fr. – Bulletin de la Société botanique de France. Paris.
Bull. Soc. Bot. Genève – Bulletin de la Société botanique de Genève.
Bull. Soc. Bot. Ital. – Bullettino della Società botanica italiana. Firenze.
Bull. Soc. Bot. Lyon C.R. – Bulletin (trimestriel) de la Société botanique de Lyon. Comptes rendus des séances. Lyon.
Bull. Soc. Bot. Suisse – Bulletin de la Société botanique Suisse = French title of Ber. Schweiz. Bot. Ges.
Bull. Soc. Hist. Nat. Autun – Bulletin de la Société d'histoire naturelle d'Autun. Autun.
Bull. Soc. Linn. Lyon – Bulletin (bi-mensuel) mensuel de la Société linnéenne de Lyon, *etc.*
Bull. Soc. Linn. Norm. – Bulletin de la Société linnéenne de Normandie. Caen, Paris.
Bull. Soc. Linn. Paris – Bulletin mensuel de la Société linnéenne de Paris. Paris.
Bull. Soc. (Imp.) Nat. Mosc. – Bulletin de la Société (impériale) des naturalistes de Moscou. Moscou.
Bull. Soc. R. Bot. Belg. – Bulletin de la Société Royale de Botanique de Belgique. Bruxelles.
Vols 18–22 contain two separate parts, the first Mémoires, the second Compt. Rend.
Bull. Tokyo Sc. Mus. – Bulletin of the Tokyo Science Museum. Tokyo.
Continued as: *Bull. Nat. Sc. Mus. Tokyo n.s.*
Bull. Tokyo Imp. Un. For. – Bulletin of the Tokyo Imperial University forests. Tokyo Teikoku-Daigaku Nogakubu Enshurin-Hokoku.
Bull. Torr. Bot. Cl. – Bulletin of the Torrey Botanical Club. New York, Lancaster, Pa.
Bull. U.S. Dep. Agr. – Bulletin. United States Department of Agriculture. Washington, D.C.
Bull. U.S. Dep. Agr. Bur. Pl. Ind. – Bulletin. United States Department of Agriculture. Bureau of Plant Industry. Washington, D.C.
Bull. U.S. Dep. Agr. Div. Agrost. – Bulletin. United States Department of Agriculture. Division of Agrostology. Washington, D.C.
Bijdr. Nat. Wet. – See van Hall, Bijdr. Nat. Wet.
C.R. . . . see after Contr. . . .
Cact. & Succ. J. – Cactus and Succulent Journal. Los Angeles.
Cact. & Succ. J. G. B. – Cactus and Succulent Journal. Great Britain.
Calc. J. Nat. Hist. – Calcutta Journal of Natural History, and Miscellany of the Arts and Sciences in India. Calcutta.
Caldasia – Caldasia. Boletin del Instituto de ciencias naturales. Universidad nacional de Colombia. Bogota.
Candollea – Candollea. Organe du Conservatoire et du Jardin botaniques de la ville de Genève.
Continuation of *Ann. Cons. Jard. Bot. Genève.*
Carib. For. – Caribbean Forester. Rio Piedras. Puerto Rico.
Carn. Inst. Wash. Publ. – See Publ. Carn. Inst. Wash.
Castanea – Castanea. The Journal of the Southern Appalachian Botanical Club. Morgantown, W. Va.
Ceiba – Ceiba. A scientific journal issued by the Escuela agricola Panamericana. Tegucigalpa. Honduras.
Ceyl. J. Sc. Bot. – Ceylon Journal of Science. Sect. A. Botany.
Continuation of *Ann. R. Bot. Gard. Perad.*
Chron. Nat. – Chronica Naturae. Batavia, Djakarta, Bandung.
A continuation of *Nat. Tijd. N. I.*; at present: *Indon. J. Nat. Sc.*
Cohn, Beitr. Biol. Pfl. – Beiträge zur Biologie der Pflanzen; herausgegeben von Dr Ferdinand Cohn. Breslau.
Comm. For. Res. Inst. – Communication of the Forest Research Institute. Bogor.
Continuation of *Med. Proefst. Bos(ch)w.*; at present: *Peng. Penjel. Kehut.*
Comm. Gen. Agr. Exp. Stat. – See Med. Alg. Proefst. Landb.
Comp. Bot. Mag. – Companion to Curtis's Botanical Magazine. London.
See also Hook. Comp. Bot. Mag.
Compt. Rend. *etc.* – See C.R. *etc.* below.
Contr. Arn. Arb. – Contributions from the Arnold Arboretum of Harvard University. Jamaica Plain, Mass.
Continued as: *Sargentia.*
Contr. Biol. Lab. Sc. Soc. China Bot. – Contributions from the Biological Laboratory of the Science Society of China. Botanical series. Nanking.
Contr. Bot. Lab. Un. Penn. – Contributions from the Botanical Laboratory. University of Pennsylvania. Philadelphia.
Contr. Chuo Noozi Sikenzyoo – Contribution Chuo Noozi Sikenzyoo, Bogor, Djawa.
Issued under the Japanese occupation of Java, replacing *Med. Alg. Proefst. Landb.*
Contr. Gen. Agr. Res. St. Bog. – Contribution of the General Agricultural Research Station. (Pemberitaan Balai Besar Penjelidikan Pertanian.) Bogor. Indonesia.
A continuation of *Med. Alg. Proefst. Landb.*
Contr. Gray Herb. – Contributions from the Gray Herbarium of Harvard University. Cambridge, Mass.
Contr. Inst. Bot. Un. Montréal – Contributions de l'Institut botanique de l'Université de Montréal.
Contr. Inst. Hort. Ec. Bot. Fac. Agr. Taih. Imp. Un. – Possibly a continuation of Contributions from the Horticultural Institute, Taihoku Imperial University, Taiwan, Japan. The full title is unknown to compiler.
Contr. N.S.W. Nat. Herb. – Contributions of the New South Wales National Herbarium. Sydney.
Contr. U.S. Nat. Herb. – Contributions from the United States National Herbarium (Smithsonian Institution; U.S. National Museum). Washington, D.C.
C.R. Ac. Sc. Paris – Comptes-rendus hebdomadaires des séances de l'Académie des sciences. Paris.

C.R. Ac. Sc. U.R.S.S. – Comptes-rendus de l'Académie des sciences de l'Union des Républiques Soviétiques Socialistes. Doklady Akademii Nauk Soi͡uza Sovetskikh Sotsialisticheskikh Respublik. Leningrad.

C.R. Congr. Soc. Sav. – Compte rendu du Congrès des sociétés savantes de Paris et des départements. Section des sciences. Paris.

C.R. Soc. Phys. Hist. Nat. Genève – Compte rendu des séances de la Société de physique et d'histoire naturelle de Genève.

Curr. Sc. – Current Science. Bangalore. India.

Curtis Bot. Mag. – See Bot. Mag.

Dansk Bot. Ark. – Dansk Botanisk Arkiv. Udgivet af Dansk botanisk forening. Kjøbenhavn.

Darwiniana – Darwiniana. Buenos Aires, San Isidro. Argentina.

Denkschr. Allg. Schweiz. Ges. Naturw. – Denkschriften der Allgemeinen Schweizerischen Gesellschaft für die gesammten Naturwissenschaften. Zürich.
Continued as: *Neue Denkschr. etc.*

Denkschr. K. Ak. Wiss. M.-N.Kl. Wien – Denkschriften der Kaiserlichen Akademie der Wissenschaften, Mathematisch-naturwissenschaftliche Klasse. Wien.

Denkschr. K. (Bayer.) Ak. Wiss. (Münch.) – Denkschriften der Königlichen (Bayerischen) Akademie der Wissenschaften zu München. München.

Denkschr. K. Bayer. Bot. Ges. Regensb. – Denkschriften der Königlichen Bayerischen Botanischen Gesellschaft in Regensburg.

Desv. J. Bot. – Journal de botanique appliqué à l'agriculture, à la pharmacie, à la médicine et aux arts. Rédigé (publié) par N. A. Desvaux. Paris.

Dodonaea – Dodonaea. Biologisch Jaarboek uitgegeven door het Koninklijk Natuurwetenschappelijk Genootschap 'Dodonaea' te Gent. Den Haag, Antwerpen.

Ecol. Mon. – Ecological Monographs. Durham, N.C.

École Norm. Sup. Publ. Lab. Biol. Paris – École normale supérieure. Publications des Laboratoires. Biologie. Paris.

Ecology – Ecology. Publication of the Brooklyn Bot. Garden and the Ecological Society of America. Brooklyn, N.Y.
Superseded *The Plant World.* A Journal of Botany. Baltimore.

Econ. Bot. – Economic Botany; devoted to applied botany and plant utilization. Lancaster, Pa.

Edinb. J. Nat. Geogr. Sc. – Edinburgh Journal of Natural and Geographical Science. Edinburgh.

Edinb. New Phil. J. – The Edinburgh new Philosophical Journal. Edinburgh.
A continuation of *Edinb. Phil. J.*; partly with the addition *n.s.*

Edinb. Phil. J. – The Edinburgh Philosophical Journal. Edinburgh.
Replaced by *Edinb. New Phil. J.*

Edwards, Bot. Reg. – See Bot. Reg.

Elmer, Leafl. Philip. Bot. – A. D. E. Elmer, Leaflets on Philippine botany. Manila.

Emp. For. J. – Empire Forestry Journal. London.

Emp. For. Rev. – Empire Forestry Review. London.

Ephem. Ac. Caes. Leop. – Ephemerides, Academiae caes.-leopoldinae naturae curiosorum, sive observationum medico-physicarum. Norimberg et Aug. Vindic.
Continuation of *Misc. Cur. Ac. Nat. Cur.*
Superseded by: *Act. Ac. Caes. Leop.-Car.*

Euphytica – Euphytica. Wageningen.

Evolution – Evolution. International Journal of Organic Evolution. Lancaster, Pa.

Fedde, Rep. – Repertorium specierum novarum regni vegetabilis. Centralblatt für Sammlung und Veröffentlichung von Einzeldiagnosen neuer Pflanzen. Berlin-Dahlem. Herausgegeben von Prof. Dr. phil. Friedrich Fedde. Appended (Anhang) to Just's Botanischer Jahresbericht.

Fedde, Rep. Beih. – Repertorium specierum novarum regni vegetabilis; herausgegeben von Prof. Dr. phil. Friedrich Fedde. Beihefte. Berlin-Dahlem.

Fl. Mal. Bull. – Flora Malesiana Bulletin. The Hague, Leyden. Mimeographed.

Fl. Serres – Flora des serres et des jardins de l'Europe, *etc.* Gand.

Flora – Flora, oder (Allgemeine) Botanische Zeitung (Herausgegeben von der Königlichen Bayerischen Botanischen Gesellschaft zu Regensburg). Regensburg, Jena.
From 1818 → .

Flora Beibl. – A separately paged part of the volumes of Flora, 1832–42; each 'Beiblatt' numbered to correspond with the volume to which it belongs.

For. Bur. Bull. Manila – See Bull. For. Bur. Philip.

Gard. Bull. S.S. – The Gardens Bulletin, Straits Settlements. Singapore.
Continued as: *Gard. Bull. Sing.*

Gard. Bull. Sing. – Gardens' Bulletin Singapore.
A continuation of *Gard. Bull. S.S.*

Gard. Chron. – The Gardeners' Chronicle. London.

Gartenflora – Gartenflora. Allgemeine Monatsschrift für deutsche, russische und schweizerische Garten- und Blumenkunde. Erlangen, Stuttgart. The subtitle varies, later: Zeitschrift für Garten- und Blumenkunde. Berlin.

Geneesk. Tijd. N.I. – Geneeskundig Tijdschrift voor Nederlandsch Indië. Batavia.

Genetica – Genetica. Het Nederlandsch Tijdschrift voor Erfelijkheids- en Afstammingsleer. 's-Gravenhage.

Gent. Herb. – Gentes Herbarum; occasional papers on the kinds of plants by L. H. Bailey. Ithaca, N.Y.

Ges. Naturf. Fr. Berl. – See Mag. Ges. Naturf. Fr. Berl.

Gesnerus – Gesnerus. Vierteljahrsschrift für Geschichte der Medizin und der Naturwissenschaften. Zürich.

Gov. Lab. Publ. Philip. – See Publ. Gov. Lab. Philip.

van Hall, Bijdr. Nat. Wet. – H. C. van Hall, W. Vrolijk & G. J. Mulder, Bijdragen tot de natuurkundige wetenschappen. Amsterdam.

Hamb. Gartenz. – Hamburger Garten- und Blu-

menzeitung. Zeitschrift für Garten- und Blumenfreunde, Kunst- und Handelsgärtner. Hamburg.
Vols 1–7 were published under the title: *Neue allgemeine deutsche Garten- und Blumenzeitung.*

Hand. N.I. Nat. Congr. – Handelingen van het Nederlandsch-Indisch Natuurwetenschappelijk Congres. Batavia, Soerabaja, Bandoeng, *etc.*

Herbertia – Herbertia. Orlando, Fla.

Hereditas – Hereditas. Published by the Mendelian Society at Lund, Sweden.

Hikobia – Hikobia. Journal of the Hiroshima Botanical Club.

Hoeven & de Vrieze, Tijd. Nat. Gesch. Phys. – See Tijd. Nat. Gesch. Phys.

Hook. Bot. Misc. – Botanical Miscellany; containing figures and descriptions ... by W. J. Hooker, London.
Vol. 1–3 (1830–33); replaced by *Hook. J. Bot.*

Hook. Comp. Bot. Mag. – Companion to the Botanical Magazine; being a journal containing such interesting botanical information as does not come within the prescribed limits of the magazine, with occasional figures. Ed. by W. J. Hooker. London.

Hook. Ic. Pl. – Hooker's Icones plantarum; or figures with brief descriptive characters and remarks, of new or (and) rare plants, selected from the authors (later: Kew) herbarium. London.
Ed. respectively by W. J. Hooker, J. D. Hooker, and others.

Hook. J. Bot. – Journal of Botany; being a second series of the Botanical Miscellany, by W. J. Hooker, London.
Vols 1–4 (1834–42).
Replaced by: *Hook. Lond. J. Bot.*

Hook. J. Bot. Kew Misc. – Hooker's Journal of Botany and Kew Garden Miscellany. London. Vols 1–9 (1849–57).
Replacing *Hook. Lond. J. Bot.*

Hook. Lond. J. Bot. – The London Journal of Botany, containing figures and descriptions of such plants as recommend themselves *etc.* Ed. by W. J. Hooker. London.
Vols 1–7 (1842–48).
Replaced by *Hook. J. Bot. Kew Misc.*

Ic. Bog. – Icones Bogorienses. Leide.

Ic. Pl. As. Or. – Iconographia plantarum Asiae orientalis. Tokyo.

Ill. Biol. Mon. – Illinois Biological Monographs. University of Illinois, Urbana.

Ind. For. – Indian Forester. Allahabad, Dehra Dun.

Ind. J. Agr. Sc. – Indian Journal of Agricultural Science. Calcutta.

Ind. J. Gen. Pl.-Breed. – The Indian Journal of Genetics and Plant-breeding. New Delhi.

Indon. J. Nat. Sc. – Madjalah ilmu alam untuk Indonesia. (Indonesian Journal for Natural Science.) Bandung.
A continuation of *Nat. Tijd. N.I.* and *Chron. Nat.*

J. Ac. Nat. Sc. Philad. – Journal of the Academy of Natural Sciences of Philadelphia. Philadelphia.

J. Am. Soc. Agr. – Journal of the American Society of Agronomy. Geneva, N.Y.

J. Arn. Arb. – Journal of the Arnold Arboretum (Harvard University). Jamaica Plain, Mass.

J. As. Soc. Beng. – Journal of the Asiatic Society of Bengal. Calcutta.
Vols 1–33 (1832–1864) incorporating the proceedings; onwards of vol. 34 physical (natural) science in part ii. In 1905 continued as *J. Proc. As. Soc. Beng. n. s.*

J. Bish. Mus. – Journal of the Bernice Pauahi Bishop Museum, Honolulu. Hawaii.

J. Bomb. Nat. Hist. Soc. – (The) Journal of the Bombay Natural History Society. Madras, Bombay.

J. Bot. – See Desv. J. Bot.

J. Bot. – See Morot, J. Bot.

J. Bot. – See Schrader, J. Bot.

J. Bot. – Journal of Botany, British and foreign. London.
Preceded in sequence by *Hook. Bot. Misc.*, *Hook. J. Bot.*, *Hook. Lond. J. Bot.* and *Hook. J. Bot. Kew Misc.*; the J. Bot. starts with vol. 1 (1863).

J. Bot. Néerl. – See Miq. J. Bot. Néerl.

J. Coll. Sc. Imp. Un. Tokyo – Journal of the College of Science, Imperial University of Tokyo.
Replaced by *J. Fac. Sc. Un. Tokyo.*

J. Dep. Agr. Kyushu Imp. Un. – Journal of the Department of Agriculture, Kyushu Imperial University, Fukuoka, Japan.

J. Ecol. – The Journal of Ecology. Edited for the British Ecological Society. London, Cambridge.

J. Fac. Agr. Hokk. Imp. Un. – Journal of the Faculty of Agriculture, Hokkaido Imperial University, Sapporo. Sapporo, Japan.

J. Fac. Sc. Hokk. (Imp.) Un. – Journal of the Faculty of Science, Hokkaido (Imperial) University. Sapporo, Japan.

J. Fac. Sc. Imp. Un. Tokyo Bot. – Journal of the Faculty of Science, Imperial University of Tokyo. Sect. 3. Botany.
A continuation of *J. Coll. Sc. Imp. Un. Tokyo.*

J. Fed. Mal. St. Mus. – Journal of the Federated Malay States Museums. Kuala Lumpur.

J. Fl. Jard. – Journal et flore des jardins. Paris.

J. Hered. – The Journal of Heredity. Washington, D.C.

J. Hort. Soc. Lond. – Journal of the Horticultural Society of London. London.
Vols 1–9 (1846–1855); publication resumed in 1868 under the title *J. R. Hort. Soc. Lond.*, starting with vol. 1 again.

J. Ind. Bot. Soc. – The Journal of the Indian Botanical Society. Madras.

J. Jap. Bot. – The Journal of Japanese Botany. Shokubutsu kenkyu zasshi. Tokyo.

J. Linn. Soc. Bot. – Journal of the Linnean Society of London. Botany.
Vols 1–7 were publisheid as *J. Proc. Linn. Soc. Bot.*

J. Lit. Sc. Madras – Journal of Literature and Science; published under the auspices of the Madras Literary Society and auxiliary of the Royal Asiatic Society. Madras.
1 vol. (1833–34), continued as: *Madr. J. Lit. Sc.*

J. Mitch. Sc. Soc. – Journal of the Elisha Mitchell Scientific Society. Chapel Hill, N.C.

J. Mysore Un. – Journal of the Mysore University. Bangalore City.

J. N.Y. Bot. Gard. – Journal of the New York Botanical Garden. Lancaster, Pa.

J. Nat. Hist. Soc. Siam – Journal of the Natural History Society of Siam. London, Bangkok.

J. Proc. As. Soc. Beng. n.s. – Journal and Proceedings of the Asiatic Society of Bengal. Calcutta. A new series of the *J. As. Soc. Beng.* incorporating also *Proc. As. Soc. Beng.*, from 1905 →. Since 1935 continued as *J. R. As. Soc. Beng. Sc.* vol. 1 → .

J. Proc. Linn. Soc. Bot. – Journal of the Proceedings of the Linnean Society. Botany. London. Vols 1–7 of the *J. Linn. Soc. Bot.* were published under this title.

J. Proc. R. Soc. N.S.W. – Journal and Proceedings of the Royal Society of New South Wales. Sydney. The title varies in vol. 1 and 9.

J. R. As. Soc. Beng. Sc. – Journal of the Royal Asiatic Society of Bengal. Science. Calcutta. In two series, Science and Letters. Superseding *J. Proc. As. Soc. Beng. n.s.*

J. R. Hort. Soc. – Journal of the Royal Horticultural Society. London. From vol. 5 (1877–1879) onwards New series (*n.s.*) is used. See also *J. Hort. Soc. Lond.*

J. S.Afr. Bot. – Journal of South African Botany. Cape Town.

J. S.Appal. Bot. Club – Journal of the Southern Appalachian Botanical Club. Morgantown, W.Va.

J. Sc. Agr. Soc. – Journal of the Scientific Agricultural Society. Tokyo.

J. Sc. Hiros(h)ima Un. – Journal of Science of the Hiros(h)ima University. Hiroshima. Japan.

J. Sc. Res. – Journal for Scientific Research, published by the Organization for Scientific Research. Djakarta.

J. Siam Soc. Nat. Hist. Suppl. – Journal of the Siam Society; Natural History supplement. Bangkok, Leipzig.

J. Soc. Bibl. Nat. Hist. – The Journal of the Society for the Bibliography of Natural History. Published by the Society. London.

J. Soc. Nat. Hort. Fr. – Journal de la Société nationale d'horticulture de France. Paris.

J. Soc. Trop. Agr. – Journal of the Society of Tropical Agriculture. Taihoku Imperial University, Taiwan.

J. Str. Br. R. As. Soc. – Journal of the Straits Branch of the Royal Asiatic Society. Singapore.

J. Wash. Ac. Sc. – Journal of the Washington Academy of Sciences. Washington, D.C.

Jack, Mal. Misc. – See Mal. Misc.

Jahrb. Bot. Gart. Berl. – Jahrbuch des Königlichen botanischen Gartens und des botanischen Museums zu Berlin. Berlin.

Jahrb. Hamb. Wiss. Anst. – Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten. Hamburg. Reprints were issued in *Mitt. Bot. Staatsinst. Hamburg.*

Jap. J. Bot. – Japanese Journal of Botany. (National Research Council of Japan.) Transactions and Abstracts. Nippon shokobutsugaku shûhô. Tokyo.

Jard. Fleur. – Le jardin fleuriste, journal général des progrès, et des intérêts horticoles et botaniques . . . rédigé par Ch. Lemaire.

Joint Publ. Imp. Agr. Bur. – Joint Publications. Imperial (Commonwealth) Agricultural Bureaux. Aberystwyth.

Journ. – See J.

Kew Bull. – Bulletin of miscellaneous information (Royal Botanic Gardens, Kew). London.

Kew Bull. add. ser. – Bulletin of miscellaneous information (Royal Botanic Gardens, Kew).) Additional series.

Kön. & Sims, Ann. Bot. – Annals of Botany; editors Ch. König & J. Sims. London. 2 vols only (1805–1806).

Kong. Dansk. Vid. Selsk. Skrift. – Kongelige Danske Videnskabernes Selskabs Skrifter. Kjøbenhavn.

Kongl. Fys. Sällsk. Handl. – Kongliga Fysiografiska Sällskapets Handlingar. Lund.

Kongl. Svensk. Vet.-Ak. Årsb. – Kongliga Svenska Vetenskapsakademiens Årsbok. Uppsala, Stockholm.

Kongl. Svensk. Vet. Ak. Handl. – Kongliga Svenska Vetenskapsakademiens Handlingar. Uppsala, Stockholm.

Kongl. Svensk. Vet. Ak. Handl. n.f. – Kongliga Svenska Vetenskapsakademiens Handlingar. Nya följd. Uppsala, Stockholm.

Kungl. *etc.* – See Kongl. *etc.*

Landbouw – Landbouw. Landbouwkundig maandblad voor Nederlands(ch)-Indië (Indonesië). Uitgegeven door de Vere(e)niging van Landbouwconsulenten in Nederlands(ch)-Indië (Indonedië). Batavia. From 1951 onwards with Indonesian sub-title besides. The name of the editing society varies.

Leafl. Philip. Bot. – See Elmer, Leafl. Philip. Bot.

Lecomte, Not. Syst. – See Not. Syst.

Lejeunia – Lejeunia. Revue de botanique. Liège.

Lilloa – Lilloa. Revista de botanica del Instituto 'Miguel Lillo'. Tucuman, Rep. Argentina.

Lindenia – Lindenia. Iconographie des orchidées. Gand.

Lingn. Agr. Rev. – Lingnaam Agricultural Review. See under Lingn. Sc. J.

Lingn. J. – Lingnan Journal. Canton.

Lingn. Sc. J. – Lingnan Science Journal. Canton. The first 4 volumes published as *Lingn. Agr. Rev.*

Lingn. Un. Sc. Bull. – Lingnan University Science Bulletin. Canton. *Nos* 1 and 2 issued as Science Bulletin. (Published by) Lingnan University.

Linnaea – Linnaea. Ein Journal für die Botanik in ihrem ganzen Umfange. Berlin, Halle.

Lloydia– Lloydia, a quarterly journal of biological science. Menasha, Wis.

Lunds Un. Årsskrift. – Lunds Universitets Årsskrift. See Act. Un. Lund.

M.A.H.A. Mag. – The official organ of the Malayan Agri-Horticultural Association. Kuala Lumpur.

Madjalah ilmu alam untuk Indonesia – See Indon. J. Nat. Sc.

Madras J. Lit. Sc. – The Madras Journal of Literature and Science. Madras.
The first vol. published as *J. Lit. Sc. Madras.*

Madroño – Madroño. Journal of the California Botanical Society. San Francisco, Oakland.

Mag. Ges. Naturf. Fr. Berl. – Magazin der Gesellschaft Naturforschender Freunde zu Berlin für die neuesten Entdeckungen in der gesammten Naturkunde. Berlin.

Makil. Echo – Makiling Echo. (Manila University, College of Agriculture. Division of forest studies and research.) Laguna.
Superseded by *Philip J. For.*

Mal. For. – The Malayan Forester. Kuala Lumpur.

Mal. For. Rec. – Malayan Forest Records. Kuala Lumpur.

Mal. Gard. Pl. – Malayan Garden Plants. Bot. Garden Singapore.

Mal. Misc. – Malayan Miscellanies. Printed and published at the Sumatran Mission Press. Bencoolen.

Mal. Nat. J. – The Malayan Nature Journal. Kuala Lumpur.

Malpighia – Malpighia; rassegna mensuale di botanica. Messina, Genova.

Mat. Veget. – Maveg (Materiae vegetabiles). St. Gallen.

Med. Alg. Proefst. Landb. – Medede(e)lingen van het Algemeen Proefstation voor de Landbouw. Buitenzorg. Java. (Communications of the General Agricultural Experiment Station Buitenzorg, Java.)
Later continued as: *Contr. Gen. Agr. Res. St.*

Med. Bot. Mus. Herb. Utrecht – Medede(e)lingen van het Botanische Museum en Herbarium van de Rijksuniversiteit te Utrecht. Amsterdam.
Partly reprints of papers from *Rec. Trav. Bot. Néerl.* and *Acta Bot. Neerl.*

Med. Landb. Ho(o)gesch. Wageningen – Medede(e)lingen van de Landbouwho(o)geschool. Wageningen.

Med. Lands Pl. Tuin – Mededeelingen uit 's Lands Plantentuin (te Buitenzorg). Batavia.

Med. Proefst. Bos(ch)w. – Medede(e)lingen van het Proefstation voor het Bos(ch)wezen. Departement van Landbouw, Nijverheid en Handel te Buitenzorg (later: in Nederlands(ch)-Indië).
Continued as: *Comm. For. Res. Inst.*; at present: *Peng. Penjel. Kehut.*

Med. Rijksherb. – Mededeelingen van 's Rijksherbarium te Leiden. Leiden.
Continued as *Blumea.*

Medd. Göteb. Bot. Trädg. – Meddelanden från Göteborgs Botaniska Trädgård = Act. Hort. Gothob. (see there).

Melb. Chem. Drug. – The Melbourne Chemist & Druggist.
Only vol. 1 (1878).
Continued as: *Austr. Chem. Drug.* (see there).

Mém. Ac. R. (Imp.) Lyon Sc. – Mémoires de l'Académie royale (impériale) des sciences, belles-lettres et arts de Lyon. Section des sciences. Lyon & Paris.

Mém. Ac. Imp. Sc. St. Pétersb. – Mémoires de l'Académie impériale des sciences de St. Pétersbourg. See also *Act. Ac. Sc. Petrop.* and *Nov. Act. Ac. Sc. Imp. Petrop.*
Complete information in Merrill & Walker, Bibliogr. East. As. Bot. 1938, p. xxix.

Mém. Arch. Bot. Caen – See Arch. Bot. Caen Mém.

Mem. Bost. Soc. Nat. Hist. – Memoirs (read before) (of) the Boston Society of Natural History; being a new series of the Boston Journal of Natural History. Boston.

Mem. Coll. Sc. Kyoto Imp. Un. – Memoirs of the College of Science, Kyoto Imperial University.

Mem. Fac. Agr. Kagosh. Un. – Memoirs of the Faculty of Agriculture, Kagoshima University.

Mem. Fac. Sc. Kyushu Un. Biol. – Memoirs of the Faculty of Science Kyushu University. Series E (Biology). Fukuoka. Japan.

Mém. Herb. Boiss. – Mémoires de l'Herbier Boissier. Genève.

Mém. Inst. Ét. Centrafr. – Mémoires de l'Institut d'études centrafricaines. Brazzaville (A.E.F.).

Mém. Inst. Sc. Madag. – Mémoires de l'Institut scientifique de Madagascar.

Mém. Mus. Hist. Nat. Paris – Mémoires du Muséum (national) d'Histoire naturelle. Paris.
Continuation of *Ann. Mus. Hist. Nat. Paris;* later *Nouv. Ann. . . .*; *etc.*

Mém. Mus. Hist. Nat. Paris n.s. – Mémoires du Muséum national d'Histoire naturelle, nouvelle série.
This new series started in 1936.

Mém. Mus. Hist. Nat. Paris n.s. Bot. – Mémoires du Muséum national d'Histoire naturelle, nouvelle série. Série B, Botanique.
Started in 1950 with vol. 1.

Mem. N.Y. Bot. Gard. – Memoirs of the New York Botanical Garden. Bronx Park. New York.

Mem. Nat. Ac. Sc. – Memoirs of the National Academy of Sciences, Washington, D.C.

Mem. R. Ac. Cienc. Madr. – Real Academia de ciencias exactas, físicas y naturales de Madrid. Memorias. Madrid.

Mem. Sc. Soc. China – Memoirs of the Science Society of China. Shanghai.

Mem. Soc. Brot. – Memórias da Sociedade Broteriana. Univ. de Coimbra.

Mém. Soc. Imp. Nat. Mosc. – Mémoires de la Société impériale des naturalistes de Moscou. Moscou.

Mém. Soc. Linn. Paris – Mémoires de la Société linnéenne de Paris. Paris.

Mém. Soc. Phys. Hist. Nat. Genève – Mémoires de la Société de physique et d'histoire naturelle de Genève. Paris, Genève.

Mém. Soc. Sc. Lille – Mémoires de la Société (d'amateurs) des sciences, de l'agriculture et des arts de Lille. Lille.

Mém. Soc. Sc. Nat. Math. Cherb. – Mémoires de la Société (impériale) (nationale) des sciences naturelles (et mathématiques) de Cherbourg. Paris & Cherbourg.

Mem. Torr. Bot. Cl. – Memoirs of the Torrey Botanical Club. New York.

Mem. Wern. Nat. Hist. Soc. – Memoirs of the Wernerian Natural History Society. Edinburgh.

Mez, Bot. Arch. – Botanisches Archiv; Zeitschrift für die gesammte Botanik; herausgegeben von Dr Carl Mez. Leipzig, Königsberg.

Minnesota Stud. Pl. Sc. – Minnesota Studies in Plant Science. Minneapolis.

Miq. Ann. Mus. Bot. Lugd.-Bat. – F. A. W. Miquel, Annales Musei botanici Lugduno-Batavi. Amstelodami, Lipsiae.

Miq. J. Bot. Néerl. – F. A. W. Miquel, Journal de botanique néerlandaise. Amsterdam, *etc.*

Misc. Cur. Ac. Nat. Cur. – Miscellanea curiosa sive ephemeridum medico-physicarum germanicarum Academiae naturae curiosum.
After vol. 1 (1670) the title was: Miscellanea curiosa medico-physica Academiae naturae curiosum, sive ephemeridum medico-physicarum germanicarum curiosum. Lipsiae, Jenae, Francofurti, *etc.*
Continued as: *Ephem Ac. Caes. Leop.*

Misc. Publ. Austr. Ass. Adv. Sc. – Miscellaneous Publications of the Australasian Association for the Advancement of Science.
Continued as: *Rep. Austr. Ass. Adv. Sc.*

Misc. Publ. U.S. Dep. Agr. – Miscellaneous Publication. United States Department of Agriculture. Washington.

Misc. Rep. Nat. Sc. Mus. Tokyo – Miscellaneous Reports of the National Science Museum. Tokyo. Japan.

Mitt. Bot. Gart. Mus. Berl.-Dahl. – Mitteilungen aus dem Botanischen Garten und Museum Berlin-Dahlem.
A new series, continuation of the *Notizbl. Berl.-Dahl.;* after the first instalment the title was changed into *Willdenowia.*

Mitt. Bot. Mus. Hamb. – Mitteilungen aus dem Botanischen Museum Hamburg.
Reprints of papers from *Jahrb. Hamb. Wiss. Anst.* 1896–1900.

Mitt. Bot. Mus. Un. Zürich – Mitteilungen aus dem Botanischen Museum der Universität Zürich. Genève.
Contains chiefly reprints of papers published in *Bull. Herb. Boiss.*

Mitt. Bot. Staatsinst. Hamb. – Mitteilungen aus den Botanischen Staatsinstituten in Hamburg. Reprints of papers from *Jahrb. Hamb. Wiss. Anst.*; continued as: *Mitt. Inst. Allg. Bot. Hamburg.*

Mitt. Bot. Staatssamml. Münch. – Mitteilungen der botanischen Staatssammlung München.

Mitt. Deut. Dendr. Ges. – Mitteilungen der Deutschen Dendrologischen Gesellschaft. Bonn-Wilmersdorff.

Mitt. Deut. Schutzgeb. – Mitteilungen aus den deutschen Schutzgebieten, mit Benutzung amtlicher Quellen. Berlin.

Mitt. Inst. Allg. Bot. Hamb. – Mitteilungen aus dem Institut für Allgemeine Botanik in Hamburg. Replaced *Mitt. Bot. Staatsinst. Hamb.*

Miyazaki Coll. Agr. For. Bull. – See Bull. Miyazaki Coll. Agr. For.

Mon. Ac. Nat. Sc. Philad. – See Ac. Nat. Sc. Philad. Mon.

Morot, J. Bot. – L. Morot, Journal de botanique. Paris.

N. Queensl. Nat. – The North Queensland Naturalist. The journal and magazine of the North Queensland Naturalists' Club. Cairns.

Nachr. Kais. Wilh. Land – Nachrichten über Kaiser Wilhelms-Land und den Bismarck Archipel, herausgegeben i.A.d. Neu-Guinea Kompagnie zu Berlin. Berlin.

Nat. Appl. Sc. Bull. Un. Philip. – Natural and Applied Science Bulletin of the University of the Philippines. Manila.

Nat. Geneesk. Arch. N.I. – Natuur- en Geneeskundig Archief voor Neêrland's Indië. Batavia.

Nat. Hist. Misc. – Natural History Miscellanea. (Academy of Sciences.) Chicago.

Nat. Tijd. N.I. – Natuurkundig (vol. 100, 1941 and 102, 1942: Natuurwetenschappelijk) Tijdschrift voor Nederlandsch-Indië. Uitgegeven door de (Koninklijke) Natuurkundige Vereeniging in Nederlandsch-Indië.
Continued as: *Chron. Nat.* and at present: *Indon. J. Nat. Sc.*

Nat. Verh. Holl. Mij. Wet. – Natuurkundige Verhandelingen van de Hollandsche Maatschappij der Wetenschappen te Haarlem.

Nature – Nature, a weekly illustrated journal of science. London.

Naturw. Woch. – Naturwissenschaftliche Wochenschrift. Berlin, Jena.

Ned. Kruidk. Arch. – Nederlandsch Kruidkundig Archief (Verslagen en medede(e)lingen der Nederlandsche Botanische Vereeniging). Holland.
In three subsequent series; at present incorporated in *Act. Bot. Neerl.*

Neue Denkschr. Schweiz. Ges. Naturw. – Neue Denkschriften der Allgemeinen Schweizerischen Gesellschaft für die gesammten Naturwissenschaften. (Nouveaux mémoirs de la Société helvétique des sciences naturelles.) Neuchâtel & Zürich.
Continuation of *Denkschr. Schweiz. Ges. Naturw.*

New Phyt. – The New Phytologist. A British botanical journal. London.

New Zeal. J. For. – New Zealand Journal of Forestry. Christchurch.

New Zeal. J. Sc. Techn. – New Zealand Journal of Science and Technology. Wellington.

Not. Nat. Ac. Nat. Sc. Philad. – Notulae naturae of the National Academy of Natural Sciences of Philadelphia. Philadelphia.

Not. R. Bot. Gard. Edinb. – Notes from the Royal Botanical Garden, Edinburgh.

Not. Syst. – Notulae systematicae. Herbier du Museum de Paris. Phanérogamie.

Notizbl. Berl.-Dahl. – Notizblatt des Königlich Botanischen Gartens und Museums zu Berlin-Dahlem, *etc.* Berlin, Leipzig.
Continued as: *Mitt. Bot. Gart. Mus. Berl.-Dahl.*; at present *Willdenowia.*

Nouv. Ann. Mus. Hist. Nat. Paris – Nouvelles annales du Muséum d'histoire naturelle. Paris. Continuation of *Ann. Mus. Hist. Nat. Paris* and *Mém. Mus. Hist. Nat. Paris.*

Nouv. Arch. Mus. Hist. Nat. Paris – Nouvelles archives du Muséum d'histoire naturelle. Paris. Continuation of *Arch. Mus. Hist. Nat. Paris*; beginning with ser. VI vol. 1 (1926) the original title *Arch. Mus. Hist. Nat. Paris* was used again.

Nouv. Mém. Soc. Helv. Sc. Nat. – See Neue Denkschr. Schweiz. Ges. Naturw.

Nov. Act. Ac. Caes. Leop.-Car. – Nova Acta physico-medica Academiae caesareae leopoldino-carolinae naturae curiosorum. Norimbergae, Erlangae, Bonnae, *etc.*
Also with a German title, see *Verh. Kais. Leop. etc.* and *Abh. Kais. Leop.-Carol. etc.* For previous series see *Misc. Cur. Ac. Nat. Cur.* and *Act. Ac. Caes. Leop.-Car.*

Nov. Act. Ac. Sc. Imp. Petrop. – Nova Acta Academiae scientiarum imperialis Petropolitanae. Series IV of *Mém. Ac. Imp. Sc. St. Pétersb.*

Nov. Act. R. Soc. Sc. Upsal. – Nova Acta regiae Societatis scientiarum Upsaliensis.
Continuation of *Act. Soc. Sc. Upsal.*

Nova Guinea – Nova Guinea. Résultats des expéditions scientifiques à la Nouvelle Guinée. Leide.
Following vol. 18 a new series was started.

Nuov. Giorn. Bot. Ital. (n.s.) – Nuovo giornale botanico italiano. Firenze.
Continuation of *Giorn. Bot. Ital.*
From 1894 onwards *Nuov. Giorn. Bot. Ital. n.s.*– Nuovo giornale . . . Nuova ser. Memorie della Società botanica italiana. Firenze.

Nya Bot. Not. – Nya Botaniska Notiser. Lund.
From 1849 to 1856 the *Bot. Not.* was issued under this title.

Occ. Pap. Bish. Mus. – Occasional papers of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History. Honolulu. Hawaii.

Occ. Pap. Un. Hawaii – Occasional Papers University of Hawaii. Honolulu.

Öfv. Kongl. (Svensk.) Vet.-Ak. Förh. – Ofversigt af Kongl. (Svenska) Vetenskaps-Akademiens Förhandlingar. Stockholm.

Oest. Bot. Woch. – Oesterreichisches botanisches Wochenblatt. Wien.
Vols 1–7; replaced by *Oest. Bot. Z.*

Oest. Bot. Z. – Oesterreichische botanische Zeitschrift. Wien, Leipzig.
Vols 1–7 published under the title *Oest. Bot. Woch.*

Ohio J. Sc. – The Ohio Journal of Science. Official organ of the Ohio State Univ. Sc. Society and of the Ohio Academy of Science. Columbus.

Orch. Digest – Orchid Digest. Berkeley, Cal.

Orch. Rev. – The Orchid Review. London, Kew, *etc.*

Orchis – Orchis. Mitteilungen des Orchideenausschusses des Vereins zur Beförderung des Gartenbaues. Berlin.

Otia Bot. Hamb. – Otia botanica hamburgensia.

Pac. Sc. – Pacific Science. Honolulu. Hawaii.

Palaeobot. – The Palaeobotanist, Birbal Sahni Institute of Palaeobotany. Lucknow.

Pap. Mich. Ac. Sc. – Papers of the Michigan Academy of Science, Arts & Letters. New York.

Pap. Proc. R. Soc. Tasm. – Papers and Proceedings of the Royal Society of Van Diemen's Land (Tasmania). Hobart Town.

Paxton Mag. Bot. – Paxton's Magazine of Botany and Register of Flowering Plants. London.

Pemberitaan Balai Besar Penjelidikan Pertanian. Bogor. Indonesia. – See Contr. Gen. Agr. Res. St. Bog.

Peng. Alam – Penggemar Alam. Pelandjutan dari De Tropische Natuur.
Continuation of *Trop. Natuur.*

Peng. Penjel. Kehut. – Pengumuman balai penjelidikan kehutanan. Bogor.
Continuation of *Comm. For. Res. Inst.*

Phil. Trans. R. Soc. Lond. – Philosophical Transactions of the Royal Society of London.

Philip. Agr. – The Philippine Agriculturist; published by the College of Agriculture of the University of the Philippines. Los Baños.

Philip. Agr. Rev. – The Philippine Agricultural Review. Manila.
Continuation of *Bull. Bur. Agr. Philip.*; replaced by *Philip. J. Agr.*

Philip. For. Bur. Bull. – See Bull. Bur. For. Philip.

Philip. J. Agr. – The Philippine Journal of Agriculture. A continuation of the Philippine Agricultural Review. Manila.

Philip. J. For. – The Philippine Journal of Forestry. Published by the Department of Agriculture and Natural Resources. Manila.

Philip. J. Sc. – The Philippine Journal of Science. Manila. In vols 2–13 the botanical papers are published in separate annual volumes designated Section C. Botany; in vol. 1 the botany was contained in a Supplement. Cited respectively as Philip. J. Sc. . . . (. . .) Bot. . . .–. . ., and Philip. J. Sc. 1 (. . .) Suppl. . . .–. . .

Philip. Orch. Rev. – Philippine Orchid Review. Published by the Philippine Orchid Society. Manila.

Physis (Buenos Aires) – Physis. Revista de la Sociedad argentina de ciencias naturales. Buenos Aires.

Phytologia – Phytologia. Designed to expedite botanical publication. New York. Mimeographed.

Phytologist – The Phytologist. London.

Phytomorph. – Phytomorphology. An International Journal of Plant Morphology. Delhi. India.

Phyton – Phyton (Annales rei botanicae). Horn, N.O.

Pittonia – Pittonia. A series of papers relating to botany and botanists. Edited by E. L. Green. Berkeley, Cal., & Washington, D.C.

Planta – Planta. Archiv für wissenschaftliche Botanik. Berlin.

Proc. Am. Ac. Arts Sc. – Proceedings of the American Academy of Arts and Sciences. Boston, Mass.

Proc. Am. Phil. Soc. – Proceedings of the American Philosophical Society held at Philadelphia for promoting useful knowledge. Philadelphia.

Proc. Am. Soc. Hort. Sc. – Proceedings of the American Society for Horticultural Science. College Park, Md.

Proc. As. Soc. Beng. – Proceedings of the Asiatic Society of Bengal. Calcutta.
In 1905 incorporated in *J. Proc. As. Soc. Beng.* n.s. vol. 1.

Proc. Biol. Soc. Wash. – Proceedings of the Biological Society of Washington, D.C.

Proc. Cal. Ac. Sc. – Proceedings of the California Academy of Sciences. San Francisco.

Proc. Hort. Soc. Lond. – Proceedings of the Horticultural Society. London.
Continued as: *Proc. R. Hort. Soc. Lond.*

Proc. Linn. Soc. Lond. – Proceedings of the Linnean Society of London. London.

Proc. Linn. Soc. N.S.W. – The Proceedings of the Linnean Society of New South Wales. Sydney.

Proc. Nat. Inst. Sc. Ind. – Proceedings of the National Institute of Sciences of India. Calcutta.

Proc. 1st Pan-Pac. Sc. Conf. Honolulu – Proceedings of the First Pan-Pacific Science Conference, held under the auspices of the Pan-Pacific Union, Honolulu, Hawaii, August 2 to 20, 1920.

Proc. Pan-Pac. Sc. Congr. Austr. – Proceedings of the Pan-Pacific Science Congress, Australia, 1923. This was the 2nd Congress.

Proc. 3rd Pan-Pac. Sc. Congr. Tokyo – Proceedings of the Third Pan-Pacific Science Congress, Tokyo, 1926.

Proc. 4th Pac. Sc. Congr. Java – Proceedings of the Fourth Pacific Science Congress, Java, May–June 1929.

Proc. R. Ac. Sc. A'dam – Proceedings of the Royal Academy of Sciences. Amsterdam.

Proc. R. Hort. Soc. Lond. – Proceedings of the Royal Horticultural Society. London.
Continuation of *Proc. Hort. Soc. Lond.*

Proc. R. Soc. Queensl. – Proceedings of the Royal Society of Queensland. Brisbane.

Proc. R. Soc. Vict. – Proceedings of the Royal Society of Victoria. Melbourne.

Proc. U.S. Nat. Mus. – Proceedings. United States National Museum. Washington, D.C.

Proc. Wash. Ac. Sc. – Proceedings of the Washington Academy of Sciences. Washington, D.C.

Progr. Rei Bot. – Progressus rei botanicae. Fortschritte der Botanik, *etc.* Herausgegeben von der Association Internationale des Botanistes. Jena.

Publ. Arn. Arb. – Publications of the Arnold Arboretum. Cambridge, Mass.

Publ. Bur. Sc. Manila – Publications of the Department of Agriculture and Natural Resources, Bureau of Science of the Philippine Islands at Manila. Manila.

Publ. Carn. Inst. Wash. – Publications of the Carnegie Institution of Washington. Washington, D.C.

Publ. Field Mus. Nat. Hist. Bot. – Publications of the Field Museum of Natural History. Botanical series. Chicago.

Publ. Gov. Lab. Philip. – Publication of the Department of the Interior, Bureau of Government Laboratories, Manila.

Publ. I.N.E.A.C. – Publications de l'Institut national pour l'étude agronomique du Congo Belge (I.N.E.A.C.). Bruxelles.

Quart. J. Flor. Ac. Sc. – Quarterly Journal. Florida Academy of Sciences. Gainsville.

Quart. J. Taiw. Mus. – Quarterly Journal of the Taiwan Museum. Taipei. Taiwan.

Queensl. Agr. J. – Queensland Agricultural Journal. Brisbane.

Rapp. Bos(ch)b. Proefst. – Rapport van het Bos(ch)bouwproefstation. Buitenzorg.
Continued as: *Rep. For. Res. Inst. Bogor.*

Rec. Auckl. Inst. Mus. – Records of the Auckland Institute and Museum. Auckland, N.Z.

Rec. Bot. Surv. Ind. – Records of the Botanical Survey of India. Calcutta.

Rec. Domin. Mus. – Records of the Dominion Museum. Wellington, N.Z.

Rec. Trav. Bot. Néerl. – Recueil des travaux botaniques néerlandais; publié par la Société botanique néerlandaise, *etc.* Nimègue, Amsterdam. At present incorporated in Act. Bot. Neerl.

Reichenb. Xenia Orch. – H. G. Reichenbach, Xenia orchidacea. Beiträge zur Kenntnis der Orchideen. Leipzig.

Reinwardtia – Reinwardtia. Being a continuation of the Bull. Jard. Bot. Btzg (Bull. Bot. Gard. Btzg). Published by Herbarium Bogoriense, Kebun Raya Indonesia.

Rep. Austr. Ass. Adv. Sc. – Reports of the . . . meeting of the Australasian Association for the Advancement of Science. Sydney, Melbourne.

Rep. Bot. Exch. Club Br. Isl. – Report of the Botanical (Society and) Exchange Club of the British Isles. Manchester.

Rep. For. Res. Inst. Bog. – Report of the Forest Research Institute, Buitenzorg (Bogor).

Res. Pamphl. For. Res. Inst. Mal. – Research Pamphlet. Forest Research Institute. Forest Department Federation of Malaya. Mimeographed.

Rev. Agr. – Revista agronomica. Lisboa.

Rev. Arg. Agr. – Revista argentina de agronomia. Buenos Aires.

Rev. (Int.) Bot. Appl. Agr. Col. – Revue (internationale) de botanique appliquée et d'agriculture coloniale. Paris. Organe mensuel d'agriculture scientifique pour la France et ses colonies.
Replaced by *Rev. Bot. Appl. Agr. Trop.*

Rev. Bot. Appl. Agr. Trop. – Revue de botanique appliquée et d'agriculture tropicale; revue mensuelle contenant les Actes & Comptes Rendus de l'Association Colonies-sciences. Paris.
Replacing *Rev. Bot. Appl. Agr. Col.* from vol. 9 onwards.

Rev. Fac. Agr. – Revista de la Facultad de agronomía. La Plata. Rep. Argentina.

Rev. Fac. Agr. Vet. – Revista de la Facultad de agronomia & veterinaria. Buenos Aires.

Rev. Gén. Bot. – Revue général de botanique. Paris.

Rev. Hort. – Revue horticole; journal d'horticulture pratique. Paris.

Rev. Int. Bot. Appl. Agr. Col. – See Rev. Bot. Appl. Agr. Col.

Rev. Mus. La Plata – Revista del Museo de La Plata.

Rev. Progr. Cienc. – Revista de los progresos de las ciencias exactas, físicas naturales. Madrid.

Rhodora – Rhodora. Journal of the New England Botanical Club. Lancaster, Boston.

Rodriguesia – Rodriguesia. Revista do Instituto de biologia vegetal. Rio de Janeiro.

Sarawak Mus. J. – The Sarawak Museum Journal. Kuching.

Sargentia – Sargentia. A continuation of the Contributions from the Arnold Arboretum of Harvard University. Jamaica Plain, Mass.

Sc. Cult. – Science and Culture. Calcutta.

Sc. Mem. Med. Off. Army Ind. – Scientific Memoirs by medical officers of the army of India. Calcutta.
The subtitle varies.

Sc. Monthly – The Scientific Monthly. Lancaster, Pa.

Sc. Proc. R. Dubl. Soc. – The Scientific Proceedings of the Royal Dublin Society. Dublin.
It was preceded by the *Proc. R. Dubl. Soc.*; a new series of the Sc. Proc. was started with vol. 12 (1909/10).

Schrader, J. Bot. – Journal für die Botanik; herausgegeben von Medizinalrath H. A. Schrader. Göttingen.
See also *Schrader*, *Neu. J. Bot.*

Schrader, Neu. J. Bot. – Neues Journal für die Botanik; herausgegeben von Prof. H. A. Schrader. Erfurt, Göttingen.
Superseded *Schrader*, *J. Bot.*

Science – Science. A weekly journal devoted to the advancement of science. Published by the American Association for the Advancement of Science. New York.

Sherff, Bot. Leafl. – E. E. Sherff, Botanical Leaflets. Chicago.

Sinensia – Sinensia. Contributions from the Metropolitan Museum of Natural History, National Research Institute (of Biology). Nanking.

Sing. Nat. – The Singapore Naturalist. Official organ of the Singapore Natural History Society. Singapore.

Sitz. Ber. K. Ak. Wiss. M.-N. Kl. (Cl.) Wien – Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch-naturwissenschaftliche Klasse (Classe). Wien.

Sitz. Ber. K. (Bayer.) Ak. Wiss. M.-Ph. Kl. Münch. – Sitzungsberichte der Mathematisch-physikalischen Klasse der Königlichen (Bayerischen) Akademie der Wissenschaften zu München. München.

Skrivt. Nat. Selsk. Kjøbenh. – Skrivter af Naturhistorie-Selskabet. Kjøbenhavn.

South. Sc. Rec. – The Southern Science Record. Melbourne.
Continued as: *Wing's South. Sc. Rec.*

Sunyatsenia – Sunyatsenia. Journal of the Botanical Institute, College of Agriculture, Sun Yatsen University, Canton, Hongkong.

Svensk Bot. Tidskr. – Svensk Botanisk Tidskrift, utgivet af Svenska botaniska föreningen. Stockholm, Uppsala.

Syll. Pl. Ratisb. – Sylloge plantarum novarum itemque minus cognitarum a praestantissimis botanicis adhuc viventibus collecta et a Societate regia botanica Ratisbonensi edita. Ratisbonae.

Symb. Bot. Upsal. – Symbolae botanicae Upsalienses; Arbeten från Botaniska Institutionen i Uppsala.

Syokubutu-Iho – Fascicle of the *Ann. Bot. Gard. Btzg* issued under Japanese occupation in Java, 1 part, dated 2603 (= 1943).

Taiwania – Taiwania. Taipei, Taiwan.

Taxon – Taxon. Official News Bulletin of the International Association for Plant Taxonomy and Nomenclature.

Techn. Bull. Dep. Agr. Bangk. – Technical Bulletin. Department of Agriculture, Bangkok, Thailand.

Tectona – Tectona. Bos(ch)bouwkundig Tijdschrift. Uitgave van de Vere(e)niging van Ho(o)gere Ambtenaren bij het Bos(ch)wezen in Ned. Oost-Indië (Indonesië). Semarang, Buitenzorg.

Temminck Verh. Nat. Gesch. – See under books.

Teysmannia – Teysmannia. Batavia.

Torreya – Torreya. A monthly journal of botanical notes and news. New York.

Trans. Ac. Sc. St. Louis – Transactions of the Academy of Science of St. Louis. St. Louis, Mo.

Trans. Am. Phil. Soc. – Transactions of the American Philosophical Society held at Philadelphia for promoting useful knowledge. Philadelphia.

Trans. As. Soc. Japan – Transactions of the Asiatic Society of Japan. Tokyo.

Trans. (Proc.) Bot. Soc. Edinb. – Transactions (and Proceedings) of the Botanical Society (of Edinburgh). Edinburgh.
The title varies.

Trans. Cambr. Phil. Soc. – Transactions of the Cambridge Philosophical Society. Cambridge.

Trans. Hort. Soc. – Transactions of the Horticultural Society of London. London.

Trans. Linn. Soc. – The Transactions of the Linnean Society of London. London.
The first series contained both botany and zoology; for continuation, see next entry.

Trans. Linn. Soc. Bot. – *Ditto*, second series. Botany. London.

Trans. Nat. Hist. Soc. Form. – Transactions of the Natural History Society of Formosa. Taiwan hakubutsu gakkai Kaiho. Taihoku.

Trans. Nat. Inst. Sc. Ind. – Transactions of the National Institute of Sciences of India. Calcutta.

Trans. New Zeal. Inst. – Transactions of the New Zealand Institute. Wellington, N.Z.

Trans. Phil. Inst. Vict. – Transactions of the Philosophical Institute of Victoria. Melbourne.

Trans. Proc. Bot. Soc. Edinb. – See Trans. Bot. Soc. Edinb.

Trans. R. Soc. New Zeal. – Transactions of the Royal Society of New Zealand. Dunedin.

Trans. R. Soc. S. Austr. – Transactions of the Royal Society of South Australia. Adelaide.

Trans. R. Soc. Vict. – Transactions of the Royal Society of Victoria. Melbourne.

Trav. Biol. Inst. Carnoy – Travaux biologiques de l'Institut J. B. Carnoy. Louvain.

Trop. Agr. Ceyl. – Tropical Agriculturist and Magazine of the Ceylon Agricultural Society. Peradeniya.

Trop. Natuur – De Tropische Natuur. Orgaan der Nederlandsch-Indische Natuurhistorische Vereeniging. Weltevreden, Bogor.
Continued as: *Orgaan van de Natuurhistorische Vereniging in Indonesië* (1952 →); at present: *Penggemar Alam.*

Trop. Woods – Tropical Woods. Yale University School of Forestry. New Haven, Connecticut.

Tijd. K.N.A.G. – Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig Genootschap. Amsterdam.

Tijd. Nat. Gesch. Phys. – Tijdschrift voor Natuurlijke Geschiedenis en Physiologie. Uitgegeven door J. van der Hoeven en W. H. de Vriese. Amsterdam, Leiden.

Tijd. Ned. Mij. Bev. Nijv. – Tijdschrift uitgegeven door de Nederlandsche Maatschappij ter Bevordering van Nijverheid te 's Gravenhage. Haarlem.

U.S. Dept Agr. – See respectively under Bull. U.S. *etc.* and Misc. Publ. U.S. *etc.*

Un. Cal. Publ. Bot. – University of California Publications in Botany. Berkeley, Los Angeles.

Un. Queensl. Pap. Dep. Biol. – University of Queensland Papers. Department of Biology. Brisbane.

Van Hall – See under Hall.

Verh. Bat. Gen. K. W. – Verhandelingen van het (Koninklijk) Bataviaasch Genootschap van Kunsten en Wetenschappen. Rotterdam, Amsterdam, Batavia.

Verh. Bot. Ver. Brand. – Verhandlungen des Botanischen Vereins für die Provinz Brandenburg. Hannover, Berlin.

Verh. Ges. Deut. Naturf. Aerzt. – Verhandlungen der Gesellschaft Deutscher Naturforscher und Aerzte. Leipzig.

Verh. K. K. Zool.-Bot. Ges. Wien – Verhandlungen der Kaiserlich-königlichen Zoologisch-botanischen Gesellschaft in Wien. Wien.
Replaced *Verh. Zool.-Bot. Ver. Wien.*

Verh. K. Leop.-Carol. Ak. Naturf. – Verhandlungen der Kaiserlichen Leopoldinisch-Carolinischen Akademie der Naturforscher. Breslau und Bonn. See *Nov. Act. Ac. Caes. Leop.-Car.*

Verh. Kon. (Ned.) Ak. Wet. A'dam sect. 2 – Verhandelingen der Koninklijke (Nederlandse) Akademie van Wetenschappen te Amsterdam. Afde(e)ling Natuurkunde. Tweede sectie. Amsterdam.
Replaced *Verh. Kon. Ned. Inst. Wet.*

Verh. Kon. Ned. Inst. Wet. – Verhandelingen der 1e klasse van het (vol. 1: Hollandsch) Koninklijk Nederlandsch Instituut van Wetenschappen, Letteren, en Schoone Kunsten te Amsterdam. Amsterdam.
Continued as: *Verh. Kon. Ak. Wet. A'dam.*

Verh. Nat. Ver. N.I. – See Act. Soc. R. Sc. Indo-Neerl.

Verh. Naturf. Ges. Basel – Verhandlungen der Naturforschenden Gesellschaft in Basel. Basel.

Verh. Naturw. Ver. Hamb. – Verhandlungen des Naturwissenschaftlichen Vereins (von Hamburg-Altona) in Hamburg. Hamburg.

Verh. Ned. Inst. – See Verh. Kon. Ned. Inst. Wet.

Verh. Zool.-Bot. Ver. Wien – Verhandlungen. Zoologisch-botanischer Verein in Wien.
Vols 1–7; replaced by *Verh. K.K. Zool.-Bot. Ges. Wien.*

Versl. Med. Kon. (Ned.) Ak. Wet. Afd. Nat. A'dam – Verslagen en medede(e)lingen der Koninklijke (Nederlandse) Akademie van Wetenschappen. Afde(e)ling Natuurkunde. Amsterdam.

Verz. Vorles. K. Ak. Braunsb. – Verzeichnis der Vorlesungen an der Kgl. Akademie Braunsberg.
The title varies.

Vict. Nat. – The Victorian Naturalist: The Journal and Magazine of the Field Naturalist Club of Victoria. Melbourne.

Vid. Medd. Nat. For. Kjøbenhavn – Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjøbenhavn. Kjøbenhavn.

Vierteljahresschr. Naturf. Ges. Zürich – Vierteljahresschrift der Naturforschenden Gesellschaft in Zürich. Zürich.

Viguier Arch. Bot. – See Arch. Bot. Caen Mém.

Walp. Ann. – W. G. Walpers, Annales botanices systematicae. Lipsiae.

Webbia – Webbia. Raccolta di scritti botanici *etc.* Firenze.
The subtitle varies.

Willdenowia – Willdenowia. Mitteilungen aus dem Botanischen Garten und Museum Berlin-Dahlem, früher Notizblatt. Continuation of: *Notizbl. Berl.-Dahl.* and *Mitt. Bot. Gart. Mus. Berl.-Dahl.* (1 part only).

Wing's South. Sc. Rec. – Wing's Southern Science Record. Melbourne.
Superseded *South. Sc. Rec.*

Woch. Gärtn. Pflanzenk. – Wochenschrift (des Vereins zur Beförderung des Gartenbaues in den königlichen preussischen Staaten) für Gärtnerei und Pflanzenkunde. Berlin.
The title varies.

Z. Bot. – Zeitschrift für Botanik. Jena.

Z. Naturw. – Zeitschrift für die gesammten Naturwissenschaften, herausgegeben von dem Naturwissenschaftlichen Verein für Sachsen und Thüringen in Halle. Berlin.

B. BOOKS AND OTHER SEPARATELY CITED ARTICLES AND WORKS

either abbreviated in a less usual way, or well-known issues not familiar to non-Malaysian residents or non-Dutch botanists

Alston, Fl. Ceyl. (Suppl.) – = Trimen, A Handbook of the Flora of Ceylon vol. 6 (1931) by A. H. G. Alston.

B. & H. Gen. Pl. – G. Bentham & J. D. Hooker, Genera plantarum ad exemplaria imprimis in herbariis Kewensibus servata definita. 3 vols. London (1862–83).

Back. Bekn. Fl. Java (em. ed.) – C. A. Backer, *c.s.*, Beknopte Flora van Java (nooduitgave). Leiden (1940–*hodie*).
Mimeographed emergency edition of a concise Flora of Java. In Dutch.

Back. Fl. Bat. – C. A. Backer, Flora van Batavia. Vol. 1, Batavia (1907).
Only one volume issued. In Dutch.

Back. Handb. Fl. Java – C. A. Backer, Handboek voor de Flora van Java. 3 parts. Batavia (1924–'28). In Dutch.

Back. Krakatao – C. A. Backer, The Problem of Krakatao as seen by a Botanist. Weltevreden, The Hague (1929).

Back. Krit. – C. A. Backer, Kritiek op de Exkursionsflora von Java (bearbeitet von Dr S. H. Koorders). Weltevreden (1913).
Criticism on the Flora of Java by Koorders. In Dutch.

Back. Onkr. Suiker. – C. A. Backer, Onkruidflora der Javasche suikerrietgronden. Soerabaja (1928–34); with Atlas (1928–41), still not completed.
Weed Flora of Javanese sugar-cane fields. In Dutch.

Back. Schoolfl. – C. A. Backer, Schoolflora voor Java. Weltevreden (1911).
Only one volume issued. In Dutch.

Back. Voorl. – C. A. Backer, Voorlooper eener Schoolflora voor Java. Departement van Landbouw. Batavia (1908).
Precursor of a school-flora of Java. In Dutch.

Back. & Sloot. Theeonkr. – C. A. Backer & D. F. van Slooten, Geïllustreerd handboek der Javaansche theeonkruiden en hunne beteekenis voor de cultuur. Batavia (1923).
Illustrated handbook of weeds of tea-plantations in Java. In Dutch.

Bailey, Compr. Cat. Q. Pl. – F. M. Bailey, Comprehensive Catalogue of Queensland Plants, *etc.* Brisbane (1913).

Becc. For. Born. – O. Beccari, Nelle foreste di Borneo. Firenze (1902); 2nd ed. (1921).
In Italian; for English translation see Becc. Wand.

Becc. Malesia – O. Beccari, Malesia, raccolta di osservazioni botaniche intorno alle piante dell'archipelago Indo-Malese e Papuano . . . destinata principalmente a discrivere ed illustrare le piante da esso raccolte in quelle regioni durante i viaggi eseguiti dall'anno 1865 all'anno 1878. 3 vols. Genova (1877–1890).

Becc. Wand. – O. Beccari, Wanderings in the great Forests of Borneo. Travels and researches of a naturalist in Sarawak. Transl. of 'Nelle Foreste', revised and edited by F. H. H. Guillemard. London (1904).

Benn. & Br. Pl. Jav. Rar. – J. J. Bennett & R. Brown, Plantae javanicae rariores, descriptae iconibusque illustratae, quas in insula Java, annis 1802–1818, legit et investigavit Thomas Horsfield, M.D. Londini (1838–52).
The articles are either by R. Brown or by Bennett.

Benth. & Hook. *f.* – B. & H.

Bisschop Grev. Pl. N.I. – A. H. Bisschop Grevelink, Planten van Nederlandsch-Indië bruikbaar voor Handel, Nijverheid en Geneeskunde. Amsterdam (1883).
Useful plants of the Dutch East Indies. In Dutch.

Bl. Bijdr. – C. L. Blume, Bijdragen tot de Flora van Nederlandsch Indië. 17 parts. Batavia (1825–27).
Descriptions in Latin.

Bl. Cat. – C. L. Blume, Catalogus van eenige der merkwaardigste zoo in- als uit-heemsche gewassen, te vinden in 's Lands Plantentuin te Buitenzorg. Batavia (1823).
Descriptions in Latin.

Bl. En. Pl. Jav. – C. L. Blume, Enumeratio plantarum Javae et insularum adjacentium minus cognitarum vel novarum ex herbariis Reinwardtii, Hasseltii et Blumii. 2 parts. Lugduni Batavorum (1827–28); 2nd ed. Hagae (1830).

Boerl. Bijdr. Fl. Sum. – A. L. van Hasselt & J. G. Boerlage, Bijdragen tot de kennis der Flora van Midden-Sumatra (in P. J. Veth: Midden-Sumatra. Reizen en Onderzoekingen der Sumatra-expeditie, *etc.* 1877–1879, vol. 4^2 Flora). Leiden (1884).
In Dutch.

Boerl. Cat. Hort. Bog. – J. G. Boerlage, Catalogus plantarum phanerogamarum quae in horto botanico Bogoriensi coluntur herbaceis exceptis. 2 parts. Bataviae (1899–1901).

Boerl. Handl. – J. G. Boerlage, Handleiding tot de Kennis der Flora van Nederlandsch Indië. Beschrijving van de families en geslachten der Nederl. Indische Phanerogamen. 3 vols. Leiden (1890–1900).
Families and genera only. In Dutch.

Bold. Zakfl. – I. Boldingh, Zakflora voor de landbouwstreken op Java. Batavia (1916).
In Dutch.

Brown, Min. Prod. Philip. For. – W. H. Brown, Minor Products of Philippine Forests. 3 vols (Bull. For. Bur. Philip. *no* 22). Manila (1920–21).

Brown, Useful Pl. Philip. – W. H. BROWN, Useful Plants of the Philippines. 3 vols. Manila (1950).

Bruggeman, Ind. Tuinb. – L. BRUGGEMAN, Indisch tuinboek. Amsterdam (1939); 2nd ed. (1948). Popular book on ornamental plants with good coloured figures. In Dutch.

Burk. Dict. – I. H. BURKILL, A Dictionary of the Economic Products of the Malay Peninsula. 2 vols. London (1935).

Ceron, Cat. Pl. Herb. Manila – S. CERON, Catálogo de las plantas del herbario recolectado por el personal de la suprimida comisión de la flora forestal. Manila (1892).

Christm. & Panz. Pfl. Syst. – G. F. CHRISTMANN & G. F. W. PANZER, Des Ritters Carl von Linné Königlich schwedischen Leibarztes a.a. vollständiges Pflanzensystem nach der dreizehnten lateinischen Ausgabe und nach Anleitung des holländischen Houttuynischen Werkes übersetzt, und mit einer ausführlichen Erklärung ausgefertigt. 14 vols (1777–1788).

Corner, Ways, Trees – E. J. H. CORNER, Wayside trees of Malaya. 2 vols. Singapore (1940); 2nd ed. (1952).

DC. Mon. Phan. – A. & C. DE CANDOLLE, Monographiae phanerogamarum, prodomi nunc continuatio nunc revisio. 9 vols. Parisiis (1878–96).

Doct. v. Leeuwen, Pangrango – W. M. DOCTERS VAN LEEUWEN, Biology of plants and animals occurring in the higher parts of Mount Pangrango-Gedeh in West-Java (Verh. Kon. Ak. Wet. A'dam, sect. 2, 31, 1933).

Doct. v. Leeuwen, Zoocecidia – W. M. DOCTERS VAN LEEUWEN, The Zoocedidia of the Netherlands Indies. Weltevreden (1926).

van Dijk, Boschbedrijf *etc.* – L. J. VAN DIJK, Boschbedrijf en boschbeheer in de Residentie Molukken in het bijzonder in Noord-Nieuw-Guinea (Eilanden der Geelvinkbaai). Dienst der Bosschen in de Buitengewesten (1940).
Mimeographed report on forests of islands in the Geelvink Bay, N.W. New Guinea. In Dutch.

E. & P. Pfl. Fam. – A. ENGLER & K. PRANTL, Die natürlichen Pflanzenfamilien nebst ihren Gattungen und wichtigeren Arten insbesondere den Nutzpflanzen, unter Mitwirkung zahlreicher hervorragender Fachgelehrten, begründet von A. Engler und K. Prantl, fortgesetzt von A. Engler. Leipzig. Teil 1–4 (1887–1898), Nachtr. 1–4 (1897–1915), Gesamtregister (1898–99); 2nd ed. (1924–*hodie*).

Endert, Gesl. Tab. – F. H. ENDERT, Geslachtstabellen voor Nederlandsch-Indische boomsoorten naar vegetatieve kenmerken met een beschouwing over de practische en systematische waarde dezer kenmerken. Thesis, Wageningen (1928).
Also as Med. Proefst. Boschw. *no* 20 (1928). Key to genera of Malaysian trees; based on vegetative characters. In Dutch.

Endert, M. O. Born. Exp. – F. H. ENDERT, Botanisch en floristisch verslag, in Midden-Oost-Borneo-Expeditie 1925. Issued by Ind. Com. Wet. Onderz. (1927).
Botanical report of Centr. E. Borneo Expedition. In Dutch.

Eng. & Prantl – See E. & P.

F.v.M. Descr. Not. – F. VON MUELLER, Descriptive notes on Papuan plants. 9 parts in 2 vols. Melbourne (1875–90).

F.v.M. Fragm. – F. VON MUELLER, Fragmenta phytographiae Australiae. 11 parts. Melbourne (1858–81).

F.-Vill. Nov. App. – A. NAVES & C. FERNANDEZ-VILLAR, Novissima appendix ad floram philippinarum R. P. Fr. Emmanuelis Blanco, seu enumeratio contracta plantarum philippinensium hucusque cognitarum. Cum synonymis P.P. Blanco, Llanos, Mercado et aliorum auctorum (in Blanco Fl. Filip. ed. 3, 4^3, 1880–83).

Filet, Pl. Bot. Tuin Weltevr. – G. J. FILET, De planten in den Botanischen Tuin bij het Groot Militair Hospitaal te Weltevreden, hunne inl. benamingen, groeiplaats en gebruik. Batavia (1855).
In Dutch.

Fl. Gén. I.-C. – Flore générale de l'Indo-Chine. Paris (1907–51).

Fl. Mal. – Flora malesiana. Djakarta (1948 onwards).

Fl. Siam. En. – Florae siamensis enumeratio. A list of the plants known from Siam with record of their occurrence. Bangkok (1931 onwards).

Forbes, Wand. – H. O. FORBES, A naturalist's wanderings in the Eastern Archipelago. A narrative of travel and exploration from 1878–1883. London (1885); German ed. Jena (1886).

Gibbs, Arfak – L. S. GIBBS, Dutch North West New Guinea: A contribution to the Phytogeography and Flora of the Arfak Mountains, *etc.* London (1917).

Gresh. Schets. – Dr M. GRESHOFF, Schetsen van Nuttige Indische planten. 6 parts. Amsterdam (1894–1900).
In Dutch.

Hassk. Cat. Hort. Bog. – J. K. HASSKARL, Catalogus plantarum in horto botanico Bogoriensi cultarum alter. Batavia (1844).

Hemsl. Bot. Chall. – W. B. HEMSLEY, Report on the Scientific Results of the Voyage of H.M.S. Challenger during the years 1873–76. Botany. Vol. 1. London (1884–85).

Hend. Mal. Wild Fl. – M. R. HENDERSON, Malayan Wild Flowers (in Mal. Nat. J.). Kuala Lumpur. 3 parts Dicotyledons (1949–51), 1 vol. Monocotyledons (1954).

Heurck, Obs. Bot. – H. F. VAN HEURCK, Observationes botanicae et descriptiones plantarum novarum herbarii van Heurckiani; recueil d'observations botaniques et de descriptions de plantes nouvelles. Anvers & Berlin (1870–71).

Heyne, Nutt. Pl. – K. HEYNE, De nuttige planten van Ned. Indië. 2nd ed. 3 vols. Buitenzorg (1927); reprinted *literatim* as De nuttige planten van Indonesië. 2 vols. 's Gravenhage/Bandung (1950).
In Dutch.

Hochr. Cat. Bog. Nov. – B. P. G. HOCHREUTINER, Catalogus Bogoriensis novus. Plantarum phanerogamarum quae in horto botanico bogoriensi coluntur herbaceis exceptis. Buitenzorg (1904).

Hochr. Pl. Bog. Exs. – B. P. G. Hochreutiner, Plantae Bogorienses exsiccatae novae vel minus cognitae. Buitenzorg (1904).

K. & G. Mat. Fl. Mal. Pen. – G. King & J. S. Gamble, Materials for a flora of the Malay Peninsula (J. As. Soc. Beng. vol. 58, ii →, 1889–1915; preferably cited from the Journal and not from the separately paged reprints).

K. & V. Bijdr. – S. H. Koorders & Th. Valeton, Bijdragen tot de kennis der boomsoorten van Java. 13 vols. Batavia & 's Gravenhage (1894–1914).
Description in Dutch and in Latin of tree species from Java.

K. Sch. & Hollr. Fl. Kais. Wilh. Land – K. Schumann & M. Hollrung, Die Flora von Kaiser Wilhelmsland (Beih. Nachr. Kais. Wilh. Land 1889).

K. Sch. & Laut. Fl. Schutzgeb. – K. Schumann & C. Lauterbach, Die Flora der deutschen Schutzgebiete in der Südsee. Leipzig (1900).

K. Sch. & Laut. Nachtr. – Nachträge to *ditto*. Leipzig (1905).

King & Gamble – See K. & G.

Koord. Atlas – S. H. Koorders, Atlas der Baumarten im Anschluss an die 'Bijdragen tot de kennis der boomsoorten van Java'. 4 vols. Leiden (1913–18).

Koord. Exk. Fl. Java – S. H. Koorders, Exkursionsflora von Java. 3 vols. Jena (1911–1912); 1 vol. Atlas (1913–37).

Koord. Fl. Tjib. – S. H. Koorders, Flora von Tjibodas. Batavia (1918).

Koord. Minah. – S. H. Koorders, Verslag eener botanische dienstreis door de Minahasa (Med. Lands Pl. Tuin *no* 19, 1898).
In Dutch; descr. in Latin.

Koord. Suppl. Cel. – S. H. Koorders, Supplementen op het eerste overzicht der Flora van N.O. Celebes. 3 parts. Batavia (1918–22).

Koord. & Val. – See K. & V.

Koord.-Schum. Syst. Verz. – Systematisches Verzeichnis der zum Herbar Koorders gehörenden, in Niederländisch-Ostindien, besonders in den Jahren 1888–1903 gesammelten Phanerogamen und Pteridophyten nach den Original-Einsammlungsnotizen und Bestimmungsetiketten unter Leitung von Dr S. H. Koorders zusammengestellt und herausgegeben von Frau Koorders-Schumacher. 5 parts. Buitenzorg (1910–14).

Korth. Kruidk. – P. W. Korthals, Kruidkunde (in C. J. Temminck, Verhandelingen over de Natuurlijke Geschiedenis der Nederlandsche overzeesche bezittingen. Botanie). Batavia (1840–44).

Kuntze, O. – See O.K.

Kurz, Fl. Burm. – S. Kurz, Forest Flora of Burma. 2 vols. Calcutta (1877).

Kurz, Rep. Pegu – S. Kurz, Report on the Forests and Vegetation of Pegu. Calcutta (1875).

Lane-Poole, For. Res. – C. E. Lane-Poole, The Forest Resources of the Territories of Papua and New Guinea. Parliam. Commonw. Australia, State of Victoria (1925).

Masamune, En. Phan. Born. – G. Masamune, Enumeratio Phanerogamarum bornearum. Taihoku (1942).

Merr. Comm. Lour. – E. D. Merrill, A commentary on Loureiro's 'Flora cochinchinensis' (Trans. Am. Phil. Soc. n.s. 24, pt 2, 1935).

Merr. En. Born. – E. D. Merrill, A Bibliographic Enumeration of Bornean plants (J. Str. Br. R. As. Soc. 1921, Special number).

Merr. En. Philip. – E. D. Merrill, An Enumeration of Philippine Flowering Plants. 4 vols. Manila (1923–26).

Merr. Fl. Manila – E. D. Merrill, A Flora of Manila. Manila (1912).

Merr. Ind. Rafin. – E. D. Merrill, Index Rafinesquianus. Jamaica Plain, Mass. (1949).

Merr. Int. Rumph. – E. D. Merrill, An Interpretation of Rumphius's Herbarium Amboinense. Manila (1917).

Merr. Pl. Elm. Born. – E. D. Merrill, Plantae Elmerianae borneenses (Un. Cal. Publ. Bot. 15, 1929).

Merr. Sp. Blanc. – E. D. Merrill, Species Blancoanae. A critical revision of the Philippine species of plants described by Blanco and by Llanos. Manila (1918).

Miq. Analecta – F. A. W. Miquel, Analecta botanica indica. 3 parts (1850–52). (in Verh. Kon. Ned. Inst. Wet. 1e kl. 3e reeks, vol. 3–5).

Miq. Choix – F. A. W. Miquel, Choix des plantes rares et nouvelles, cultivées et dessinées dans le jardin botanique de Buitenzorg. La Haye (1863).

Miq. Fl. Ind. Bat. – F. A. W. Miquel, Flora Indiae Batavae. Flora van Nederlandsch Indië. 3 vols. Leipzig (Lipsiae) *etc.* (1855–59).
For the Supplement see Miq. Sum.

Miq. Illustr. – F. A. W. Miquel, Illustrations de la flore de l'Archipel Indien. 3 parts. Amsterdam (Leipzig) (1870–71).

Miq. Pl. Jungh. – F. A. W. Miquel, *c.s.*, Plantae Junghuhnianae. 5 parts. Lugd. Bat. (1851–56).

Miq. Sum. – F. A. W. Miquel, Flora Indiae Batavae. Supplementum I. Prodromus Florae Sumatranae. Lipsiae *etc.* (1860–61).
Text in Dutch, descr. in Latin; another ed. with German text (1862).

Moll & Janss. Mikr. – J. W. Moll & H. H. Janssonius, Mikrographie des Holzes der auf Java vorkommenden Baumarten. 6 vols. Leiden (1906–36).

Mor. Syst. Verz. – A. Moritzi, Systematisches Verzeichniss der von H. Zollinger in den Jahren 1842–44 auf Java gesammelten Pflanzen, nebst einer kurzen Beschreibung der neuen Gattungen und Arten. Solothurn (1846).

Muell., F. (von) – See F.v.M.

Naves & Fern.-Villar – See under F.-Vill.

Ochse & Bakh. Fruit – J. J. Ochse & R. C. Bakhuizen van den Brink, Fruit and fruit culture in the Dutch East Indies. Batavia-C. (1931).
English translation of *Ochse & Bakh. Vruchten.*

Ochse & Bakh. Ind. Groent. – J. J. Ochse & R. C. Bakhuizen van den Brink, Indische groenten. Batavia-C. (1931).

In Dutch; see English translation mentioned below.

Ochse & Bakh. Veg. D.E.I. – J. J. Ochse & R. C. Bakhuizen van den Brink, Vegetables of the Dutch East Indies. Batavia-C. (1931).
English translation of the foregoing work.

Ochse & Bakh. Vruchten – J. J. Ochse & R. C. Bakhuizen van den Brink, Vruchten en vruchtenteelt in Nederlandsch-Indië. Batavia-C. (1931).
In Dutch; see English translation mentioned above.

O.K. Rev. Gen. Pl. – O. Kuntze, Revisio generum plantarum vascularium omnium atque cellularium multarum secundum leges nomenclaturae internationales cum enumeratione plantarum exoticarum in itinere mundi collectarum. Pars 1–3^{2}. Würzburg (1891–98).

Perk. Fragm. Fl. Philip. – J. Perkins, Fragmenta florae philippinae. Contributions to the Flora of the Philippine Islands. Leipzig (1904–05).

Pfl. R. – Das Pflanzenreich. Regni vegetabilis conspectus. Im Auftrage der Preussischen Akademie der Wissenschaften. Berlin (1900 →).

Pierre, Fl. Coch. – L. Pierre, Flore forestière de la Cochinchine. 26 parts. Paris (1879–1907).

Prain, Bot. Not. Pap. – D. Prain, Botanical Notes and Papers. Calcutta (1901).
Reprints from periodicals, 1895–1901.

Prain, Contr. Ind. Bot. – D. Prain, Contributions to Indian Botany. London (1906).
Reprints from periodicals, 1902–1906.

Prain, Memoirs – D. Prain, Memoirs and Memoranda, chiefly botanical. Calcutta (1894).
Reprints from periodicals, 1887–1893.

Quis. Med. Pl. Philip. – E. Quisumbing, Medicinal plants of the Philippines (Techn. Bull. Dep. Agr. & Nat. Res. *no* 16, Manila 1951).

Rheede, Hort. Mal. – H. A. van Rheede tot Draakenstein, Hortus Indicus Malabaricus, *etc.* 12 vols. Amstelodami (1678–1703).

Ridl. Disp. – H. N. Ridley, The dispersal of plants throughout the world. Ashford, Kent (1930).

Ridl. Fl. Mal. Pen. – H. N. Ridley, The flora of the Malay Peninsula. 5 vols. London (1922–25).

Ridl. Mat. Fl. Mal. Pen. (Monoc.) – H. N. Ridley, Materials for a Flora of the Malay Peninsula. 3 parts. Singapore (1907–08).

Roxb. Pl. Corom. – W. Roxburgh, Plants of the coast of Coromandel *etc.* 3 vols. London (1795–1820).

Salverda, Expl. N.G. – Z. Salverda, Rapport van een oriënteerende exploratie in ZW.-N. Guinea Nov. 1936–Mei 1937. Dienst van het Boschwezen in N. Indië. 1938.
Mimeographed report of exploration in SW. New Guinea. In Dutch.

Schumann, K. – See K. Sch.

Steen. Fl. Sch. Indon. – C. G. G. J. van Steenis, *c.s.*, Flora voor de scholen in Indonesië. Batavia (1949); 2nd ed. Djakarta (1951).
In Dutch.

Stickm. Herb. Amb. – O. Stickman, Herbarium Amboinense (in Linnaeus, Amoenitates Academicae 4, 2nd ed. 1788, p. 112–143).

Symes, Embassy Ava – M. Symes, An Account of an Embassy to the Kingdom of Ava, sent by the Governor-General of India, in the year 1795. London (1800).

T. & B. Cat. Hort. Bog. – J. E. Teysmann & S. Binnendijk, Catalogus plantarum quae in horto botanico Bogoriensi coluntur. Batavia (1866).

Temminck, Verh. Nat. Gesch. – See Korth. Kruidk.

Thunb. Fl. Jav. – C. P. Thunberg (ed. L. Winberg & F. O. Widmark), Florula javanica. Upsaliae (1825).

Trim. Fl. Ceyl. – H. Trimen & J. D. Hooker, A handbook to the flora of Ceylon. 5 vols + 1 vol. plates. London (1893–1900).
Vols 4 & 5 by J. D. Hooker; vol. 6 see Alston.

Van Dijk – See under D.

Vidal, Phan. Cuming. – S. Vidal y Soler, Phanerogamae Cumingianae Philippinarum, ó Indice numérico y catálogo sistematico de las plantas fanerogamas coleccionadas en Filipinas por Hugh Cuming, con caracteristicas de algunas especies no descritas y del género Cumingia (Malváceas). Manila (1885).

Vidal, Rev. Pl. Vasc. Filip. – S. Vidal y Soler, Revision de plantas vasculares filipinas. Manila (1886).

Vidal, Sinopsis – S. Vidal y Soler, Sinopsis de familias y géneros de plantas leñosas de Filipinas. Introducción a la flora forestal des archipiélago filipino. 2 vols. Manila (1883).

Villar, F. – See F.-Vill.

De Vriese, Pl. Ind. Bat. Or. – W. H. de Vriese, Plantae Indiae batavae orientalis quas in itinere per insulas Archipelagi indici . . . annis 1815–21 exploravit C. G. C. Reinwardt. 2 parts. Lugd. Bat. (1856–57).

De Vriese, Tuinb. Fl. – W. H. de Vriese, Tuinbouw Flora van Nederland en zijne overzeesche bezittingen; bevattende de geschiedenis en afbeeldingen omtrent de kultuur in haren geheelen omvang, in betrekking tot Nederland en zijne overzeesche bezittingen. 3 vols. Leiden (1855–1856).

W. & A. Prod. – R. Wight & G. A. Walker-Arnott, Prodromus florae peninsulae indiae orientalis: containing *etc.* Vol. 1. London (1834).

Wight, Contr. – R. Wight, Contributions to the Botany of India. London (1834).

Wight, Ic. – Wight, Icones plantarum Indiae orientalis, or figures of Indian plants. 6 vols. Calcutta & London (1838–53).

Wight & Arnott – See W. & A.

Willd. Sp. Pl. – Linnaeus, Species plantarum, 4th ed. by C. L. Willdenow. 6 vols. Berolini (1797–1830).

Zoll. Syst. Verz. – H. Zollinger, Systematisches Verzeichniss der im indischen Archipel in den Jahren 1842–48 gesammelten sowie der aus Japan empfangenen Pflanzen. 3 parts. Zürich (1854–1855).

SPECIFIC AND INFRASPECIFIC DELIMITATION

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1. INTRODUCTION

In the hierarchic structure of the plant kingdom the species is, in the ranks of taxa, the most important entity. In comparison with the other ranks it is the one which is most distinct in nature to human and animal observation. The species are the most important building-stones of living matter.

Huxley rightly agrees with Timofeeff-Ressovski (4, p. 3–4) in saying:—"that species have a greater reality in nature, or a greater degree of objectivity, than higher taxonomic categories. Species are in the majority definable as distinct self-perpetuating units with objective existence in nature, and therefore are on a different theoretical footing from genera and families or higher categories, which are not definable in this concrete way".

All hypotheses on evolution have started and will have to start from a most careful consideration of these building-stones and Darwin titled his great work consequently 'The origin of species'.

We know that Darwin who himself composed large zoological monographs, stood in close contact with Bentham and Hooker, who all employed the species concept in accordance with the Linnean standard. In works dealing with 'species' or their origin we have always to consider whether this standard was maintained, in order to avoid misunderstanding, as unfortunately the simple possession of a binomial name is no guarantee that the taxon in question comes up to the Linnean standard.

In distinctness the rank of a species is succeeded by that of a genus.

The distinction of genera and species is not borne out only by academic training; it is most remarkable, though not surprising, that the unpreoccupied eye of the rain-forest nomad tribes, who for their living are in closest contact with plants, frequently distinguishes the same genera and species (and sometimes the family) as the trained botanist.

For the taxonomist working on the relatively poor and well-known floras of temperate and boreal regions the problem of specific delimitation seems not a problem of particular weight, save in some special genera as *Rubus*, *Taraxacum*, *Hieracium*, *Salix*, *Rosa*, *Crataegus*, and some others. Embryological research and experimental taxonomy have shown in most of these cases, however, what are the underlying reasons of the fact that the 'species' of these genera withdraw from the normal specific delimitation and fall outside the usual classification. Hybridization followed by full or partial apogamy plays havoc with species distinction in these genera, and attempts to fit these clones (specimens) or populations by force into the scheme of Linnean specific populations can only be admitted as an artificial procedure for practical aims. Properly it would be advisable to indicate their true nature similarly as has been proposed recently for the cultigens (*cultivar*), contrasting them against free naturally interbreeding specific populations (*linneonts*). Before doing so factual observation should be made to show that they belong to this category indeed.

Apart from these often clone-like 'species' there is little to worry taxonomists working on temperate floras who are mostly engaged with detail work on the infraspecific taxa occurring in their country. In most temperate floras novelties in the way of new species of spermatophytes are practically absent and the description of new genera or families is entirely out of question save by splitting existing ones.

Besides, the botanist working on temperate plants is, generally, provided with abundant material of each species and in case of rarities he is often in a position to check his data with living specimens on the spot or in his experimental garden.

The botanist engaged with tropical plants, however, is confronted with immensely richer floras in a much less advanced state of exploration. His material is often lamentably scarce; he is practically never capable of checking data on the spot; he is almost always compelled to confine his study to herbarium material, which requires far more thought and sense for synthesis to classify in a satisfactory and useful way. He is obliged to build up the frame of systematic botany as he has to work on genera which are often confused, species which are not seldom assigned to the wrong genus, genera which are sometimes placed in the wrong family, genera which have occasionally been described twice or thrice in different families; he has often to emend generic diagnoses and even those of families, and finally he finds in his material sheets which represent obviously entirely unknown species and genera. The number of reductions to be made is sometimes very large as is clear from the figures given on p. ccxxii.

His final goal is, of course not different from that of his colleagues in temperate countries, but he has to pave his own way and explore untrodden fields, in contrast with the temperate botanist whose field has already been ploughed and put in order by numerous predecessors.

There is also no reason to suppose that tropical species 'behave' otherwise in their delimitation than those in temperate countries. Botanists of experience who have worked in some limited tropical areas, where the flora is well-known, successfully employ the same Linnean standards as customary in temperate regions.

There is no reason to suppose that tropical species are more variable or less variable than those temperate; in both cases some species are more variable than others and there is a range in all kinds of degree; further some species are common and others are rare. All that can be said is that the arboreous nature of the bulk of the tropical vegetation provides the tropical botanist with small fragments of often gigantic plants. Further, it is certain that various arboreous groups display a hitherto little known floral dimorphism and there is sometimes an astonishing plasticity (mostly ontogenetic) in the vegetative parts of woody plants and twiners. This, and the general paucity of material alluded to above, and absence of means to recheck data on the spot, put great stress on the ability of the tropical botanist to have a sound estimate on the degree of variation necessary for the delimitation of the species he has to study.

There is therefore special reason for the tropical taxonomist to give a good deal of attention to the species concept in order that his work will be satisfactory and useful to others.

It has been my singular fortune to have been in the tropics for two decades, to work under ideal conditions in the Herbarium Bogoriense of Kebun Raya Indonesia, with a well-stocked, adequately named herbarium and an excellent library at hand, and ample opportunity for field work. During that time I have had daily occasion to try to identify specifically a very great number of specimens by means of Floras, revisions, and monographs. In this way I have acquired a first-hand judgement of the merits of these works in the way of specific delimitation.

Frankly I feel quite alarmed at the way in which various taxonomists have ill-treated specific delimitation and have drawn keys and descriptions which do not work at all. In some cases it was clear that the overcautious had no courage or common sense to have an opinion on the variability of his material, turning his work into specimen description. In other cases it was clearly haste or carelessness which spoiled the work, in still other cases it was clearly the intention of the revisor to deviate from the Linnean concepts and have his own way. Save some precious but lamentably few exceptions, it appeared in most cases impossible to get a satisfactory identification with a key that worked or differential diagnoses that fitted.

This often disgusting experience, about which I feel seriously concerned, has led me to a careful consideration of both the theoretical and practical side of specific delimitation and description which is the basis of all taxonomy, which is decisive for its quality, and *conditio sine qua non* for the exactness of the status of all higher categories.

Without any attempt towards completeness as to citation and discussion of literature and restricting myself to the phanerogams, I feel that I must, in this Flora, once again try to explain the basic aspects of specific delimitation, even though I feel far from capable of writing essays as elegant and concise as those of HOOKER (1, 2) and BENTHAM (3), who handed the torch of *scientia amabilis*, ignited by the synthetic genius of LINNAEUS, to our generations.

It is obvious that many taxonomists of today, hurried as they are, have omitted to work through the masterly essays and lectures of two botanists whose illustrious works have never been surpassed, either in quality or quantity, and whose wisdom, practical and theoretical, should be ours. I can only hope that the essays alluded to, which are still modern and will remain so, though a century old, will be set obligatory to the University student's courses of plant taxonomy, and be studied again closely by anybody who ventures on a monographic study.

I feel also slightly embarrassed in duplicating many things said in that admirable book 'The New Systematics', a team-work of prominent biologists giving a modern version of high standard on various aspects of specific delimitation.

Its editor, JULIAN HUXLEY, expressed the main trend of it in his introductory generalization as follows (4, p. 10):—"Practical convenience as well as the lack of clear alternatives dictates that we should stick to the classical terminology of genera and species and their subdivisions as a general basis for minor systematics, even if there are certain groups such as the blackberries or willows to which they will not apply, and even if in many cases we decide to coin special subsidiary terminologies for special purposes . . . There is no single criterion of species . . . Morphological difference, failure to interbreed, infertility of offspring, ecological, geographical, or genetical distinctness—all those must be taken into account, but none of them singly is decisive. Failure of interbreeding or to produce fertile offspring is the nearest approach to a positive criterion . . . A combination of criteria is needed . . . In the great majority of cases species can be readily delimited, and appear as natural entities, not merely convenient fictions of the human intellect. Whenever intensive analysis has been applied, it on the whole confirms the judgements of classical taxonomy".

TURRILL's opinion is similar; he says (5, p. 13):—"Nothing has as yet appeared to replace, on any large scale, the principles of orthodox taxonomic schemes on the seed-bearing plants. Families, genera, and species are given Latin names and arranged in a hierarchical system which still shows little decline or fall. Nevertheless, there are many groups where the species concept has to be used in a very arbitrary manner, and some in which the genus concept appears in practice as an artificial device retained in order to avoid upsetting a widely used nomenclature".

According to CAMP, however, the days of classical taxonomy are numbered and he expresses himself (6) in the following revolutionary, flowery thesis:—"The day of the taxonomist who putters alone in his herbarium with an other-worldly stare is done. He must shed off his robe of academic classicism and seclusion, brush off the accumulated dust of the centuries, and come face to face with the dynamics of living populations". A most charming appreciation of and tribute to the work our illustrious predecessors, the Makers of Botany, and a rosy prospect for a fresh stimulant to naturalists to study taxonomy by camp-ing.

Since the time that LINNAEUS's genius organized the hierarchy of the plant kingdom by species and genera, *i.e.* respectively individual specimens which show such great resemblance morphologically that they are evaluated to belong to one entity of direct blood-relationship (species) and groups of such entities which have certain essential characters in common that they are estimated to have a mutual blood-relationship in the second remove, a surprising simplicity has replaced the pre-Linnean chaos. The concepts species and genus are, themselves, naturally abstractions. Reality enters the picture as soon as the taxonomist has described the characters of a special species or genus, by which action he automatically combines a certain number of individual specimens, or in the case of genera a certain number of species, fitting the descriptions, under one name. The existence of species is therefore no problem to the taxonomist; he creates them himself and distinguishes them by aid of his diagnoses.

It is most remarkable that taxonomy, the very source of botany, has maintained itself so vigorously with unchanged methodology and concepts for two centuries, that it still proves to possess quality, and will be for ever indispensable for botany both in its own pursuits and essential to other branches of botany, pure and applied. It should be admitted that it has acquired useful data, thanks to information obtained from auxiliary sources—anatomy, palynology, phytochemistry, plant geography, cytogenetics, embryology, and experimental taxonomy—but these are not essentially new ones, but mostly refinements of former methodologies.

It is logical that systematy working downwards from the higher categories towards the lower ones[1] will, onwards of the specific level, meet and overlap the field of research of genetics which starts from the genes through the infraspecific ranks upwards to the specific level. For that reason results of genetics in this field of experimental taxonomy are of distinct importance to the taxonomist.

The possibility of distinguishing genera and species and other taxa is granted by the observation, through comparative morphology, that sets of characters (differences) occur in nature discontinuously in combinations, facilitating the distinction of groups of specimens, species or other taxa, characterized by these sets of characters. These demarcations between likenesses show the discontinuity of living matter, similar to the discontinuity in the inanimate, the atoms in chemistry and the quanta in physics.

It falls outside the scope of this essay to give a discussion or opinion on the possible origin or cause of these demarcations which are deeper *cq.* broader in proportion to higher rank in the taxonomical hierarchy, though some remarks on their origin cannot be avoided with the treatment of the infraspecific taxa (*cf.* p. clxxxiii–cciii).

No more will I enter a discussion on the consequence of the discontinuous structure of the plant kingdom which can *a fortiori* hardly be explained otherwise than by jump-wise origin of the taxa (mutation in the wide sense), though theoretically origin by accumulation of small jumps cannot be excluded *a priori*. As far as we know at present, the sudden origin of good species by mutation (polyploids), both new and existing, has been proved without a shadow of doubt. In these cases at least *the species is a historical happening*: a

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(1) In the Rules of botanical nomenclature the lowest 'rank' is that of *individuum.* This is illogical: an individual specimen belongs to a rank or category, but does not represent a category itself.

sudden event, followed by a period of existence, ending with extinction.[1]

The hierarchic structure of plant taxonomy could be compared with the hierarchic lay out of a polder, where there is a drainage system of smaller and larger and deeper trenches and ditches, water-ways and canals which in ascending hierarchy represent demarcations of increasing depth and width. The 'paddocks' (loci) demarcated by equivalent water-ways represent a similar hierarchy as among the ranks of plant taxonomy. The picture of this man-made hierarchy is, however, too regular and ideal in its artificial lay-out for a complete comparison. The plant hierarchy offers really a less tidy picture: some paddocks of the rank of a species are larger in surface than others and are for the purpose of preventing them becoming boggy provided with many minute trenches (often blind) in proportion to their infraspecific variability (polymorphy). Further some species paddocks are separated by shallow ditches, others by deeper ones of the same width, as an expression of their closer or more remote morphological affinity respectively. Occasionally a group of paddocks seems to possess a very regular pattern bordered again by other paddocks which are deviating. In short: the lay-out of a polder reflecting the hierarchy as found in plant taxonomy would not appear to be acceptable as a satisfactory planning to an active polder-board, but the botanist has to accept the irregular pattern of the paddocks Nature offers him.[2]

In many cases the botanical polder is incomplete in the sense that it comprises large stretches of barren land without paddocks. In other cases it appears to be entirely filled and complete, presenting obviously all potentially possible demarcations. Such a complete picture is for instance offered by the living *Annonaceae* in which DIELS (9) has found that all genera, characterized by the combinations of a limited number of generic characters within the structural plan ('Bauplan'), are represented in living nature. Such a complete representation of combinations of equivalent characters will naturally implicate a reticulate affinity which is found indeed to be realized in many of the larger families and genera.

References:—(*1*) HOOKER *f.* Introductory essay to the Flora of New Zealand (1853) i–xxxix.—(*2*) HOOKER *f.* Introductory essay, in Hook. *f.* & Thomson, Flora Indica (1855) 1–44.—(*3*) BENTHAM, Rep. Brit. Assoc. Adv. Sc. for 1874, p. 27–54 (1874).—(*4*) HUXLEY (ed.), The new Systematics (1940).—(*5*) TURRILL, Brit. Assoc. Adv. Sc. *no* 26 (1950) 1–16.—(*6*) CAMP, Amer. Naturalist 77 (1943) 322–344.—(*7*) TURRILL, J. Ecol. 39 (1951) 205–227.—(*8*) ROBERTY, Candollea 14 (1952) 13 *seq.*—(*9*) DIELS, Sitz. Ber. Preuss. Akad. Wiss. Berlin B 11 (1932) 77–85.

2. GENERAL CONSIDERATIONS

Delimitation of species is performed by the choice of a certain combination[3] of critical characters on a comparative-morphological basis.

At first sight the procedure of this choice seems to contain a strongly personal element, specially as it means not only the *objective observation* of morphological characters but also the assigning of a *different degree of appreciation* of the value to the characters observed. And this appreciation has again itself *no absolute value:* one character may

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(1) TURRILL (7, p. 216–218) says:—"Palaeo-endemics raise the controversial problems of old age in species and other taxa. The terms 'old age', 'senescence', 'senility' and the like are in some ways unfortunate. A false analogy is drawn between individuals and taxa, the latter in any concrete sense being populations. The words tend to introduce teleological and anthropomorphic concepts". Senility in cultivated plants does not exist, "there is no evidence of either physiological or of any genetical degeneration . . . It is most likely that the great majority of plants in nature die out though some may change by homogenesis into new taxa. Species, or other taxa, verging to extinction may thus be species out of the environment to which they are specially adapted and which have few biotypes and are not sufficiently plastic. Old age of taxa is not counted in the sense of years, but is a question of gene constitution relative to environment, the potential ecological plasticity. Certainly nothing unusual in the genetical systems has been recorded in many of the so-called relict species showing supposed ecological signs of 'senility'".

Extinction in the plant kingdom will generally be due to failure (inability) to produce viable adaptations with changing environments. This interferes with autonomous development by which regime a multitude of forms may be possible, of which a certain (possibly very small) percentage will possess characters fit for viable combinations. Change of environment will further narrow down this percentage, permitting only those to survive which are provided with characters of survival value adaptable to the new environment.

(2) The proposal by ROBERTY (8) to force each subgenus with nine species is the most erratic idea I ever came across, utterly unfounded, and destitute of any contact with reality.

(3) As BENTHAM, DE CANDOLLE (15, p. 181), and others pointed out distinction based on a *single* character leads to artificial divisions and delimitation except in the smallest taxa which merely differ in one gene. A combination of independent characters ensures *natural* division and distinction.

be appreciated of distinct value (constancy) in one taxon (species, genus, family), but be of minor or no value in another.

In science there is a general, reasonable tendency to analyse by objective values and avoid those subjective. Whatever charm the personal appreciation may have, methodologies containing it are considered with suspicion and conclusions based on them are found worthy of relative value only.

However factual *observations* in the pure sciences may be, their *appreciation and evaluation* for the synthesis always contain a certain personal element.

And, as to factual observation in plant taxonomy, there is no other way than using all sources from the array of methods (see p. clxix) for obtaining arguments for circumstantial evidence.

A few simple cases may illustrate the way of reasoning in plant taxonomy. Let us consider a plant specimen which answers in all major and minor points the description of *Campanula rotundifolia* save its corolla which, instead of being sympetalous and campanulate, is split to the base into 5 free segments. 'Academically' this would really remove it from *Campanula*, even almost from *Campanulaceae*, and obviously even from sympetalous orders. Common sense says, however, that this 'cannot be'. As a matter of fact it is a teratological (adesmic) sport of *Campanula rotundifolia* and it is questionable whether it is constant if propagated by seed (*cf.* p. clxxxvi, footnote).

The subfamily of the *Caryophyllaceae* is characterized by a connate calyx, but there are reported single flowers or specimens of *Silene cucubalus* which have it split into segments; nevertheless, we know the deviating specimen must belong to *Silene cucubalus* because of all the other characters being in agreement with the description of that species.

Another example is some species of *Aglaia* (*Meliaceae*), an Old World tropical genus described as possessing pinnate leaves. Some species have been found to agree with all characters of the genus *Aglaia*, sexually and vegetative, but possess simple leaves (17). In addition there are species or specimens which possess both simple and 3-foliolate leaves. The only reasonable conclusion is that there is sufficient circumstantial evidence to emend the original generic diagnosis and define its leaf characters as: 'pinnate, rarely simple'.

The family *Orchidaceae* has essentially zygomorphous flowers; still there are specimens which deviate considerably by having a regular perianth, although their further structure, anatomy, embryology, habit, *etc. etc.*, is orchidaceous. In a few cases such regular flowers have been found in one specimen together with zygomorphous flowers. Furthermore similarly regular flowers have been observed in a number of other families or genera with zygomorphous flowers and are classified as pelorics; they have been interpreted as teratological aberrations. In a number of cases genetic analysis has shown these pelorics to be caused by one Mendelian character. The only reasonable conclusion is to include these pelorics in the species with which they have all other characters in common and regard them as a 'peloric' facies or form of it.[1]

These few examples[2] show how circumstantial evidence may lead to the evaluation of characters and establish their proper taxonomic value.

There has been of course much discussion on the relative value of botanical characters and no definite conclusion has ever been drawn on the question whether all morphological characters are, finally, manifestations of intrinsically comparable or uniform genetic units of the genome. VON NAEGELI (1) divided 'characters' already into '*Organisationsmerkmale*' and '*Anpassungsmerkmale*'. VAVILOV (2) opposes "specific complexes of morphological or physiological nature" as '*radicals*' against the 'immense number of parallel homologous variations in various directions', the so-called '*variable characters*'. HERIBERT NILSSON (3) speaks about '*Arten-gene*' for defining specific characters which cover the radicals of VAVILOV. JOHANSSEN is in doubt whether fundamental taxonomic characters may be derived from normal genes or whether they are based in the structure of the protoplasm.

WINGE (4) believes the latter not to be the case and replaces the idea by his hypothesis of the 'taxonomic importance of polymery' by which it is supposed that the hereditary qualities of the fundamental characters occur in multiple at least in one chromosome (possibly in all), which would explain their constancy.

DIELS (5, p. 81) found it difficult to locate the dividing line between radicals and varying characters in the *Annonaceae;* he assumes that in this family the only radical character would be its structural plan.

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(1) In the Rules of botanical nomenclature there still is an obsolete article which prescribes that "a name or epithet of a taxonomic group must be rejected when it is based on a monstruosity", although the concept of what is to be called monstruous is nowhere defined. Monstruous forms occur in degree, some may be caused by foreign agencies (fungi, virusses, gall insects, grazing, and other influence from animals). Or due to environment (soil or climate), others are caused by genetical factors and may be inherited or partly so (fasciations, pelorics, *etc.*). If we consider further that a type specimen may be based on *any* random individual specimen in conjunction with the fact that populations are polymorphous and consist of an endless number of paramorphs *none* of which can be treated as 'normal' or 'average', the concept of what is monstruous appears to be entirely arbitrary and liable to diverse appreciation, hence to confusion. Accepted species as *Polygonum viviparum, Celosia cristata, Poa vivipara,* individuals with cleistogamous flowers, *etc.* can hardly be otherwise understood than being monstruosities. This rule militates against logic and should have been dropped long ago.

(2) A great number has been mentioned earlier in this Flora *cf.* vol. 4 (1948) xix-xliv.

Though it should be admitted that occasionally physiological derangements, as in galls and teratologies (pelorics, laciniations, *etc.*), may hamper or make futile the manifestation of characters which seem structural by virtue of their constancy throughout families or orders and would correspond therefore with radicals (organization characters), the other characters of the species and genus remain intact in manifestation both radical and variable, enabling the correct identification of the species (as in the cases above-mentioned of *Campanula rotundifolia*, *Silene cucubalus*, *etc.*); it would appear that in these cases only one radical was 'misprinted' in its manifestation, obviously independent from the others. It may be, therefore, that the genetic basis of the radical was positively represented in the genome, but during ontogenesis some physiological factor interfered merely with its normal manifestation.

I myself cannot withdraw from the idea that there is in the genome a kind of hierarchy in character-defining structures of different degree, some more structural, some more variable, but I assume it will be impossible to distinguish only two main classes in this array of capacities. Many characters of vegetative nature (wood- and general anatomy, habit, phyllotaxis, occurrence of glands, leaf structure, nervation, and stipules) as well as sexual (structure of inflorescences, *etc.*) must be deeper 'anchored' in the atomic arrangement or frame work of the genome-molecule(s) than are more specific and superficial characters which are likely to be located in the marginal area of the genome-molecule(s).

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If specific delimitation would rest only or predominantly on personal appreciation of characters, the conclusion would be that the number of species would vary freely with each individual taxonomist separately, as artistic creations vary with the artist. The negation of the strongly limited creations of living nature has been employed by a few erratic taxonomists who believed themselves to be free to perpetrate plant taxonomy as if living in clover. GANDOGER has enriched botany with such a work on the flora of Europe which has rightly been neglected by taxonomists of common sense.

The judging of the value of taxonomic work off-hand is impossible, though the qualified taxonomist will have generally not much trouble to verify its usefulness by judging the keys, synonymy, *etc.* Meticulous outward appearance is of course no guarantee for good work; the glamour may be a thin shell concealing a *horribilia botanica* of spongy contents. Careless synonymy and obsolete nomenclature needs not to be a sign of bad work. The work of C. A. BACKER on the flora of Java for instance, in which the latter items are rarely up to date, are invaluable, hard masterpieces of sound, critical, and perfectly reliable specific delimitation standing the test of time.

And though I support adequate synonymy and a polished nomenclature, I am of opinion that taxonomists should never consider this to be their main task; it is only a thin varnish, sometimes very time-consuming, to attach to their proper work:—sound specific distinction.

The standard of quality of plant taxonomic work is found in its usefulness.

Usage learns to discriminate between good and bad Floras of one and the same region or country, between good and inadequate revisions or monographs of the same genus or family. The good quality is always bound to good specific delimitation, which facilitates in turn the drawing of useful keys and hard diagnostic descriptions.

The usefulness is, I feel, an adequate control on the purely personal subjective element.

Indeed of old, classical botanists have shared the opinion that the number of species might be large but limited and LINNAEUS expressed this in saying: "there are as many species as God created."

I would be the last to admit that all species created by botanists are good, but on the other hand there is in my opinion far less disagreement among qualified systematists on the status of good species (linneonts) than sometimes assumed by outsiders. And that, if there is disagreement, this originates from other causes than from a great difference in opinion about the evaluation of characters.

Practice learns that in proportion to the experience of the systematist, the quality of his material, the use of refined methods, the thoroughness, seriousness, criticism, specially self-criticism, disinterestedness, the carrying on until he is satisfied, hence in proportion to, in short, the time, energy, and intelligence embodied in the work, he can reach generally a more or less final result, which has appeared to hold for taxonomy and be useful to other branches of botanical science.

It is gratifying that good taxonomical work is so much appreciated by general biologists and specially by geneticists and that taxonomical affinities and relationships are generally confirmed by chromosome patterns.[1] HUXLEY (6, p. 16) says:—"Classical taxonomy has provided a firm foundation for micro-evolutionary studies whenever it is pushed below the specific level and has taken cognizance of geographical subspecies, ecotypes, cytological variants, and so forth. Population studies, drawing on all relevant biological disciplines, are now needed to complete the edifice". Such population analyses are of course outside the reach of the herbarium botanist and do not belong to the α-taxonomy scope of Floras and monographs. They

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(1) This is of course not so very remarkable as may appear superficially. Interior morphology (anatomy of tissues, cytology of cells, and phytochemical properties) though only observable with the microscope under high magnification is not of an essentially different standard as compared with exterior or gross morphology, both being manifestations of the genetic properties of the same genome.

should follow their frame-work and be the subject of special detail studies.

Vavilov, one of the greatest geneticists working for plant breeding, wrote (6, p. 564):—"Some biologists are of the opinion that the age of classical systematics is at an end. From our personal experience we have come to the conclusion that this is not quite so. But it is sufficiently clear that we regard classical systematics, which works only with Linnean species, merely as a first step".

Winge, who made an extensive study of the microspecies of *Erophila* (13), has shown that they are not apogamous and behave biologically as species; they breed true and possess different chromosome numbers and are capable of forming amphidiploid hybrids. Winge stresses that they should, taxonomically, be considered as one coenospecies (linneont), as there is no end to their number. He says that it:—"jedenfalls in der Praxis unmöglich und widersinnig sein wird, alle die existierenden konstanten Formen zu benennen und zu beschreiben".

Notwithstanding this powerful appreciation from geneticists who are in a unique position to check the quality of good taxonomical work, getting the proof by the eating of the pudding, one finds sometimes among non-taxonomists an unmistakable mistrust in the aims, methods, and results of plant taxonomy.

This uneasiness of outsiders may be due in part to the remarkable fact that since the time of Linnaeus the *methodology* of phytography in α-taxonomy has hardly changed: we still work with dried plants and our main tools are still the 10-times magnifying lens, tweezers, and needle, and for cryptogams the microscope. In this rushing world with avalanches of new ingenious devices and techniques in several branches of the natural and pure sciences, it is remarkable indeed that time seems to have stopped and that taxonomy is assumed to be enveloped in a nimbus of conservatism dooming it to be obsolete. But is the history of the tool situation essentially different in for example astronomy?

Another stone of offence has been given by some ambitious taxonomists who light-heartedly have enriched botanical literature by series of phylogenetical trees showing the descent of the plant kingdom. This former fad has been an eyesore to all taxonomists who possess the common sense to realize that we are still in a stage of hard labour in trying to fit here and there pieces of a colossal jigsaw puzzle and that the situation, specially in palaeontology and genetics, physiology and biochemistry, is unfortunately inadequate for such ambitious synthesis.

A further source of distrust by the public has been the frequent *name changes*, obviously not only regarded as a sign of instability in the nomenclature employed by systematic botany but also as a bad omen for taxonomy as a science.

It is often omitted to consider that *nomenclature* is not an essential part or branch of systematic botany as a science, but exclusively a matter of administration necessary for establishing the correct names of plants. Unfortunately the internationally adopted Rules of Nomenclature are of comparatively recent date. And as these Rules are for a great deal retroactive, and taxonomical literature is very extensive and historical of nature, it is natural that the application of these Rules will bring along a significant number of name changes.

And if the present Rules had been applied from the accepted starting point of botanical nomenclature (1753), and had been acknowledged and followed since, even then the historical growth of botany, by exploration of remote parts of the world, would have brought along a smaller, but still significant number of name changes. And this will not stop before a reliable, permanent inventory and delimitation of genera and species has been adopted.

Disinterested taxonomists fully recognize the importance of stable names and will sustain all practical efforts towards that effect, amongst others by conservation of useful generic names against those obsolete and recently dug up from old works and merely of bibliographic interest. This reluctance to change names, born from a practical, conservative demeanour will, of course, not prohibit them from straightening out positions when unavoidable, even where name changes will be involved.

It cannot be denied that the recently intensified application of the *principle of typification*, which is admittedly inevitable as a basis of a stable nomenclature, has shown itself to be a dangerous tool in the hands of non-experienced botanists who may wrongly assign taxonomical importance to this purely administrative procedure. They sometimes assume they cannot perform botany without having seen the types, which leads to underrating the art of 'reading' descriptions, discourages good diagnoses, and depreciates the technique of phytography, which they assume to be less important than before.

Furthermore they sometimes think that their work is finished with having seen the types. Though I admit that ancient, brief descriptions may often fail to give information on characters which are later found to be important for specific distinction, and may easily be observed in an actual type sheet, the assigning of more than random sheet value to a type specimen may equally lead to entirely erroneous conclusions if the type is not fitting the material with which it is compared. If that is done, the type is often assumed to be a *typical* or *average* specimen, representative of the species. Contrarily, a type specimen being random will rarely represent the average of a specific population *i.e.* belong to the central part of the variation curve of the population. It should be stressed that the identification of *type* with *typical* is an entirely erroneous idea: a type specimen is botanically not of more value than any other random specimen; it is very often incomplete and meagre, as in the past botanists have not always cared to base new species only on rich, complete material, a practice which is emphatically recommended for the future. With the estimate of a type specimen, specially in the tropics, where materials in general are often scarce and from widely spaced localities, it should always be borne in mind that the sheets at hand represent a mere fraction of a fraction of the entire population and that it will be pure chance if for instance three or five specimens[1] contain the major part of the range of variation of the population which will comprise millions or milliards of individuals and measured in time a multitude of them. One hears or reads sometimes: 'my specimen does not precisely agree with the type, *hence* it is specifically different'. This conclusion is wrong in reasoning and may lead to preoccupied thought.

It should never be forgotten that the type specimen is botanically of the same status and weight as any other specimen and that its administrative value as prescribed by the Rules of Nomenclature should not unintentiously lead to making it an undesirable botanical factor in delimiting species populations and give impetous towards narrowing down what is naturally divergent and polymorphous.

It has been assumed sometimes that good taxonomy can only be performed by botanists who possess a sixth sense, *intuition*, which should guide them in tracing affinities and in delimiting species. I am afraid that the assumption of this romantic quality is a myth, unless intuition is generally defined as sublimated experience and not classified as a *deus ex machina*. A taxonomist should of course be devoted to his profession, eventually fanatically, and the *hortus siccus* should be to him a living thing. But intuition as a sixth sense is not included, and even not desirable. Zeal, time, opportunity, and intelligent work are the main factors determining the quality of this kind of work, nothing is simply thrown into his lap. Brilliant ideas are welcome, but the facts should be verified. Similarly to other branches of the pure and natural sciences results are reached on the basis of five percent inspiration and ninety-five percent perspiration. If a taxonomist would trust his 'intuition', he would find himself on the quicksand; instead he should observe and observe again and verify his findings.

As a matter of fact those who are quick in assimilating experience will generally produce more and better professional results than the initiated novice. Experience is gained by dogged perseverance. Much depends on his teacher, his education, and personal examples he can observe. In several countries taxonomical education was mostly performed in the herbaria and not as a separate branch of botany at the universities, for example in Australia. At universities in England, TURRILL writes (6, p. 14), "taxonomy has been, at best, relegated to the position of Cinderella before the fairy Godmother occurred on the scene", though classification is basic to science and taxonomy essential to every branch of botany. At the Sorbonne one cannot attain a doctorate in botany on a purely taxonomic dissertation; in German universities the lamentable position is, that taxonomy occurs on the programme of biology only as a minor item, to teach some names to biologists and pharmacists, save in two or three universities which are in possession of a research herbarium. Fortunately the position is not as bad in many other countries. I am very much satisfied that in my own country leading botanists have always had an admirably broad outlook on botany as a whole in all its branches, by which taxonomy in the broad sense has attained a well balanced position. It is here acknowledged that there is no sensible reason to specialize on certain subjects in botanical science at the expense of others and the methodology and historic nature of taxonomy are accepted as bound to it.

It must be realized that *taxonomy is the autonomic basis of botanical science*, as no reliable work in the other branches of botany can be performed with anonymous material. Each botanical study —botany taken in the widest sense possible— whether it is physiological, anatomical, embryological, ecological, plant-geographical, sociological, palynological, palaeontological, phytochemical, biochemical, or genetical, is bound to the name of the plant(s) which form(s) the subject of the research. This holds of course true for all marginal sciences of the more applied kind as pharmacy, pharmacology, for agriculture, horticulture, forestry, technical botany, and plant industry.

The name of a plant is the key to its literature; the name provides a means for comparing observations and experiments, and enables their repetition.

Taxonomy participates with general botanical disciplines in the ultimate strive towards the *omega* of botany, *i.e.* the exact knowledge of the why and how of the origin and development of living matter, but it is equally certain that taxonomy is the *alpha* of all botanical knowledge.

This alpha character brings along a special responsibility which should be honoured in a laudable manner and taxonomical work should bear the testimony of perfect, professional research work. This is specially urgent as its usefulness cannot be tested immediately, like a sum in arithmetics. It is to some degree a personal achievement; therefore, the mentality of the worker is reflected in it.

On another occasion (7, p. 7) I found fit to allude to the subject of the combination of *mental properties* which are *indispensable to the taxonomist*. A combined devotion to and respect for scientific work and the printed word, patience and accuracy, disinterestedness, continuous self-criticism and readiness to recheck data, observations, and opinions, common sense, perseverance, an orderly mind, and a moderate ambition, will generally result in useful, balanced work. In

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(1) Though it is remarkable that the general experience in the Malaysian flora is that with 15–30 specimens more or less evenly spaced as to origin, the bulk of the range of variability is often covered.

addition, a good memory for forms and names[1] and an allround background of theoretical taxonomy and its concepts and the digest of the papers on this subject will be useful and facilitate development of experience (15, p. 9–16).

There is nothing special in the above-mentioned mental qualities, but the balance of their combination is a delicate one in the sense that each of them should be sympathetic to the others, as the barrel can contain only as much water as the length of the shortest stave. Prejudice, carelessness, stubbornness, haste, and insufficient self-criticism may each represent obstacles for a good result.

But also an excess of, for the rest, in themselves admirable qualities, may dim what could be expected to be excellent results. Among these is *hyper*-consciousness and *hyper*-self-criticism next to extreme modesty or lack of ambition which has in several cases deprived science of what would have been excellent works; they were never finished. In every single case common sense should guide us to the reasonable degree of accuracy which can be obtained under the circumstances and also what limitations are dictated by the material.

As to the latter point: it is for example generally impossible to make a satisfactory population analysis in the herbarium; it is also impossible to expect from scanty herbarium materials a complete range of variability, and conclusions based on such scanty material should include a certain reasonable measure of allowance for gaps, reasoned in the way it has been done for some deviating specimens of African *Cassipourea* by LEWIS (8). And if the material does not allow a further satisfactorily conclusive synthesis, additional critical concise remarks should never be omitted to indicate the expected affinities, as a guide to future workers.

It has to be realized that, both in the past and in the present, a not insignificant number of taxonomists has apparently not fully realized the responsibility of their key position in botany.

One of the main factors involved in the confusion has been the deviation from the Linnean species standard. This has led to extraordinary consequences.

H. HOFFMANN, for example, wrote (9, p. 21, transl.):—"Whether the divergencies of the species are large or small and whether their differences concern essential or non-essential characters is irrelevant for the species problem. For practice it is decisive, whether the differential characters persist (breed true)". For this aim he made extensive breeding experiments on the constancy of characters. All variations, flower colours, *etc.*, which appeared to be inherited, he accepted as species (*Datura tatula*, *Adonis citrina*, *etc.*).

His contemporary SENDTNER (10, p. 188, 315) brought specific delimitation to an absurdity for example in proposing to differentiate *Pinus montana* on limestone (as *P. mughus*) from that on moors (*P. pumilio*) on the argument that "they cannot belong to the same species growing in such different habitats" though he could not distinguish them morphologically. He made true what HOFFMANN stated: "that one can even possibly doubt whether it will be possible in every case to define species by means of morphological structure".

KERNER's definition of species is not very much better (11) in saying "each species (properly each form) which can be described, distinguished, and again recognized later, is a good species". His view on good and bad species is a typical example of the outlook of the local floristic botanist[1] who stubbornly clings to the names with which he is familiar, but who is entirely ignorant of the Linnean issue.

In France[2] a representative following a similar procedure was JORDAN, who set himself intentionally to recognize all forms and races of Linnean species and raise these to specific rank by giving them binomials.

Though at the present time botanists almost unanimously adopt the Linnean standard as their theoretical background, and as far as possible as their practical procedure, a few are still adepts of the beatifying splitting in trying to segregate populations into the smallest entities possible and to put these in the rank of species. This idea is notably advocated and practized by BREMEKAMP in his work on the Malaysian *Rubiaceae* and *Acanthaceae*, in which all taxa are evaluated one rank too high compared with Linnean classification. *Pavetta* with formerly about 20 species increased in his monograph to *c.* 220, *Ixora* was equally 'multiplied' about tenfold. In 1955 he has split the well-known tropical linneont *Thunbergia*

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(1) This was apparently a revelation to JEAN-JACQUES ROUSSEAU who, according to A. DE CANDOLLE (15, p. 15) in his 'Lettres sur la botanique' stated:—"J'ai toujours cru qu'on pouvait être un grand botaniste sans connaître une seule plante par son nom".

(1) *Floristic botany* has a much narrower aim as compared with taxonomy. Its goal is to provide specimens with the best name which can be traced, whereas taxonomy is in addition also aiming at correlating species and genera, finding their delimitation and arranging them to degree of their affinity, in a proper hierarchy with or without distinction of infraspecific taxa.

Naturally good floristic botanists are gradually inclined to taxonomic work as they will find out that the correct name for a specimen cannot be established along the purely floristic line. The limitation of a small local flora is often an obstacle for them to expand their scope to taxonomy. Conversely taxonomists by profession do or have to perform occasionally floristic work. The intrinsic difference between floristics and taxonomy is not that of persons or education but merely of objective.

(2) In the European flora there are still distinguished a considerable number of species which do not deserve that rank.

fragrans into 35 'species' among which were 30 new ones. In mapping these 'species' it appears that they are all based on a few specimens of a very local area (local endemics) and are exclusive: their distribution pattern represents a string of pearls. It is clear that Bremekamp, in accepting all local populations, distinguishable by minute characters, as species, deviates *intentionally* from the Linnean standard.

In a remarkably intelligent essay Celakovski (12, p. 274–275) has shown the deficiency in philosophical outlook of Hoffmann, Sendtner, *c.s.* in stating:—"Bei der systematisch verfahrenden Verstandestätigkeit kommen die beiden Kant'schen Gesetze der Homogeneität und Spezifikation zur Anwendung. Die *Homogeneität* mehr beachtenden Forscher werden die reduktive, die der *Spezifikation* mehr zugewandten werden die multiplizirende Methode vorziehen. Bemerkenswert ist es aber, dass die Letzteren zu allen Zeiten viel zahlreicher gewesen sind als die Ersteren, diese aber grösseren Eklat und zeitweilig grösseren Erfolg hatten. Bei der Bearbeitung der exotische Pflanzenwelt sind Bentham, Hooker, und anderen im Grossen und Ganzen immer mehr der reduzirende Methode gemäss vorgegangen. In Europa und besonders in Mittel-Europa fehlt es schon sehr an Stoff für neue Spezies strengerem Sinne, daher gerade hier die multiplizirende Methode so schwunghaft betrieben wird. Sollte einmal die Zeit gekommen sein, wo auf der gesammten Erdoberfläche die letztere herrschend wird, dan dürfte die spezielle Botanik eine scientia horribilis werden".

With this pointed philosophical analysis of taxonomic methodology, Celakovski arrived at a crucial point, by touching on the existence of the sequence of two phases of scientific work in general, and taxonomic research in particular, *viz* the *analysis* and the *synthesis*, the analysis being the observation and recording of all factual data prior to the synthesis in framing these data and assigning them their proper hierarchical place.

This synthesis according to the standard set by Linnaeus, requires a great measure of wisdom, discretion, and common sense in order to make it useful. Botanical science has not proceeded to the stage that the identity of plants can be weighed and measured with such highly objective methods as has been reached in chemistry or crystallography. And though, ultimately, a plant is a (very complicated) chemical system, the botanist is confronted with a variability of his taxa which appears at first view sometimes desperately chaotic.

Taxonomists, who among their psychical qualities show a deficiency of feeling for synthesis or are overcompensated by consciousness of differences leading to minute analysis, will naturally tend to lay emphasis on difference rather than on conformities. They will naturally tend to keep the smallest units apart and their hierarchic synthesis will be poor. Their overrating of the importance of differences will easily lead them to raise entities to specific rank, which do not deserve that status in the hierarchic frame of Linnean classification. In short: giving too much value to analysis and too little to synthesis leads to so-called 'splitting'.

Sense for synthesis is specially required for workers in tropical botany[1] where the scarcity of material is tempting to 'specimen description' by the predominantly analytic taxonomist, who must be always in doubt and under mental stress to combine specimens which show differences, under one species.

It is most peculiar that they often do not realize that all species, either in the tropics or elsewhere, are populations and that a few random specimens from different places (paramorphs) will always be 'distinguisable'. For them it must appear 'magic' and unwarranted to make a synthesis under these conditions although most of them accept an average variability in common species with which they are closely familiar onwards of their boyhood in their own country. They hesitate to apply their experience with specific variability to species from remote regions.

Though thorough analysis is compulsory for all taxonomy, it represents merely the first phase and without a subsequent synthesis one is stuck halfway. One may become easily accustomed to finish work halfway and seek comfort in forgetting all about synthesis, it works like a mental drug and leads to cheap specimen-description and splitting what is polymorphous by nature.

As Celakovski has pointed out this absence of synthesis leads to a detestable state of affairs in systematic botany against which warnings cannot be too severe.[2]

Firstly because 'splitting' is not in accordance with the original concept of specific standard as defined and put into practice by Linnaeus[3], accepted by all able taxonomists of the 18th and 19th centuries, and found useful up till the present day.

Secondly because it has shown to bring confusion and prevents a clear insight in the hierarchical affinities and distribution of the species and the articulation of the specific populations.

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(1) According to Hedberg (14, p. 471) "many of the difficulties in taxonomic work on the flora of Tropical Africa are due to excessive splitting".

(2) Geneticists complain about the confusion in hierarchic relations in systematic zoology. Goldschmidt (16) wrote:—"In one taxonomic group, what is called a species is hardly distinguishable from the next species, and in an other taxonomic group the species are more different than genera in the first".

(3) It is true that in the pioneer work of Linnaeus some species have been described which must be reduced, *e.g.* in the variable species *Urena lobata.* But these examples are on the whole surprisingly few in number and his philosophical considerations leave no doubt whatever about his concept of species, witness his delimitation of *Primula veris*, *Lychnis dioica*, *&c*, which he knew in the living state.

Thirdly because it lacks a philosophical understanding of the principal and most objective taxon as it occurs in nature.

Fourthly because experience learns that if taxa with very narrow limits of variation are to be ranked as species no satisfactory final result will ever be attained, as many Linnean species of wide distribution show an infinite number of variations, partly bound to variation of the environment, partly not, and partly racial in nature. In a number of cases of well-known species of which the material has been very abundant, the majority of taxonomists agree that only one species is concerned and the polymorphism has been accepted as being of infraspecific value. Devotees of analysis have described and named in these cases an often astonishing number of infraspecific taxa. It is clear that with few, random materials available—as is generally the case in tropical taxonomy—it is wise to set out more widely planned variation than is actually shown by the material at hand, to allow room for the actual variation and polymorphism which can be expected. Additional material will fit in more easily within the borders of such widely planned species than within the strict boundary of those narrowly encompassed. If once the latter standard of microspecies has been accepted, additional material will necessitate the description of still more taxa as species, until the avalanche becomes unwieldy as a chaotic array of false pearls intermixed with sporadic genuine ones. Genera thus spoiled are found 'difficult' and, as nobody can make neither tail nor head of them, experienced taxonomists leave them aside and floristic botanists, anxious to have their specimens named, will add to the chaos by describing still more new 'species'.

The proper task of taxonomy goes, according to the Linnean doctrines, far beyond analytical work: it prescribes to taking a firm grip on diagnostic characters of good species, and genera as groups of these, framing hard, trustworthy keys standing the test of time, and arranging all taxa in a practical hierarchy showing their natural relationships.

It is clear that much of the confusion is caused by the variability of species populations and its evaluation within a hierarchic frame work. It is therefore necessary to give a review of the way in which this variability is developed and the degree to which it can be accepted within the Linnean species.

References:—(*1*) VON NAEGELI, 1884 Mech.-Phys. Theorie der Abstammungslehre (1884).—(*2*) VAVILOV, J. Genet. 12 (1922) 75–77.—(*3*) HERIBERT NILSSON, Lunds Univ. Årsskr. N.F. Avd. 2, 27, *no* 4 (1930) 77.—(*4*) WINGE, J. Linn. Soc. Lond. Sess. 150, 1937/1938, 231–238 (1938).—(*5*) DIELS, Sitz.-Ber. Preuss. Ak. Wiss. Berlin B 11 (1932) 77–85.—(*6*) HUXLEY (ed.), The New Systematics (1940).—(*7*) VAN STEENIS (ed.), Flora Malesiana vol. 4.—(*8*) LEWIS, Taxon 4 (1955) 73–77.—(*9*) HOFFMANN, Untersuchungen zur Bestimmung des Werthes von Spezies und Varietät (1869).—(*10*) SENDTNER, Die Vegetations-Verhältnisse Südbayerns (1854).—(*11*) KERNER, Oesterr. Bot. Z. 15 (1865) 374–378; *cf.* also Gute und schlechte Arten (1866).—(*12*) CELAKOVSKY, Oesterr. Bot. Z. 23 (1873) 233–239, 271–280, 313–318.—(*13*) WINGE, Hereditas 18 (1933) 181–191.—(*14*) HEDBERG, Webbia 11 (1955) 471–487.—(*15*) A. DE CANDOLLE, La phytographie (1880).—(*16*) GOLDSCHMIDT, Science 78 (1933) 540.—(*17*) MERRILL, Webbia 7 (1950) 312–315.

3. PATTERNS OF VARIABILITY WITHIN SPECIFIC POPULATIONS

Each Linnean species is essentially a self-perpetuating population in the genetic sense, *i.e.* a mixture of individuals which are to a larger or smaller degree genetically different.[1] This causes a specific population to be *variable* or *polymorphous*.

The genetically defined characters do not manifest themselves in exactly the same way in different individuals, as their manifestation is influenced during the stages of their ontogenetical development by the environmental conditions, *i.e.* specimens which possess approximately the same genetical properties may look different. This does not hold only for different specimens but also for comparable parts of one individual: leaves of a juvenile specimen may deviate considerably from those of the mature specimen, leaves of suckers differ from those of the flowering twigs, leaves which have developed in the shade show a different structure from those developed in an exposed situation. The different manifestation by the same genetic properties is called *phenotypic variation* or *variability*. It overlies (and sometimes obscures) the variability caused by different genetic composition, *genotypic variability*.

PHENOTYPIC VARIABILITY

Phenotypic modification is the response to environmental conditions, such as climate, soil, exposure, altitude, temperature, wind, fire, and living organisms. The genetic qualities govern the character of the plant, but the environment in which the plant develops determines the actual and final appearance of the individual. The changes or differences from the 'normal plant' are called

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(1) Theoretically it could be imagined that specific populations might occur composed of homozygotous individuals. This is to my knowledge never found to be the case in sexually propagating specific populations. It has also been observed that immediately after its origin a new species is provided with a range of variation between the individual specimens. Therefore the idea of homozygotous populations can be discarded.

modifications. Such changed characters are not themselves inherited, however, though the manner in which a plant reacts to environmental conditions is. In some cases an external change may be reversed by a change in the environment during the development of the individual, but in other cases, when factors act in the seedling stage only, the effects in the individual are irreversible.

It is necessary to agree about the concept 'normal individual plant'. This is far from easy, as each specimen grows under a different combination of CEB-factors (*C*limatic, *E*daphic, *B*iotic). We might approach the idea by saying that "the normal plant results from a genetically average individual under average natural environmental conditions", average to be understood in the sense of optimal. This 'normal' individual is never a reality but remains an abstraction.

Though the difference between phenotypic and genotypic variation is clear, the field botanist—and still more the herbarium botanist—is not always able to recognize it. Only experiments may furnish proof. For instance a dwarf shrub in an area subject to fire or browsing animals may assume this stunted form through these CEB-factors but it is also possible that the stunted form is a specialized race adapted to these conditions and thus selected by nature itself from the specific population. Experimental breeding must decide its constancy.

I have arranged the phenotypic modifications under several headings—which partly overlap and interlock—in the following sequence.

In a former essay (1, p. xix–xxxix) I have rather extensively dwelt on this subject and given a tabulated conspectus of the various factors by which phenotypical variation may be induced in Malaysia. Of each category a number of examples have been given with the relevant references.

It is true that phenotypical variation is not of essential value to the problem of delimitation of Linnean species, but it is emphasized in the essay alluded to above that phenotypic variation has so often misled taxonomists in their judgement of characters of varieties, species, and even sometimes of genera, that I find it of eminent importance to summarize the subject. For this aim the conspectus has been reproduced below.

Intrinsic	Ontogenomorphosis	1. Juvenile forms
		2. Precocious flowering (*paedogenesis*)
		3. Dimorphous foliage
		4. Dimorphous flowers, seeds and fruits
		5. Cleistogamous flowers
	Teratologomorphosis	6. Teratological forms
Climatic	Hypselomorphosis	7. Phenotypic effect of altitude
	Photomorphosis	8. Epiphytes
		9. Shade forms
	Hygromorphosis	10. Influence of drought
	Horamorphosis	11. Seasonal variation
	Anemomorphosis	12. Wind forms
Edaphic	Edaphomorphosis	13. Fumarole plants
		14. Rock plants; calcareous and silicious soils
		15. Solfatara plants
	Hydromorphosis	16. Water and swamp plants
Biotic	Phytomorphosis	17. Fungus and bacterial diseases, and symbiosis
	Zoomorphosis	18. Ant plants (*myrmecomorphosis*)
		19. Galls deceptive to phytographers (*cecidiomorphosis*)
		20. Influence of browsing animals (*pascuomorphosis*)
	Anthropomorphosis	21. Influence of fire (*pyromorphosis*)
		22. Pioneer plants and savannah trees

Ontogenomorphosis

1. Juvenile forms (1, p. xix, fig. 2–4). It has appeared that saplings may be sometimes thorny in their youth and unarmed when mature. Their leaves are often more divided or toothed and generally larger in size than those of flowering twigs of mature trees; good illustrations of this in *Proteaceae* are given on pp. 193, 199, and 200 of this volume.

In these qualities they often resemble leaves from suckers (water-sprouts), which HOWARD found in *Coccoloba* to be a source of confusion for specific delimitation. Leaf margins of saplings are sometimes toothed, serrate, or even spiny; an additional example of the latter is found in *Distylium stellare*. The difference between leaves from juvenile plants and those of mature plants is strongly expressed in many climbing plants; besides they possess often dimorphous foliage (see below). The structure of the mature stem of climbers is also generally very much different from that in the juvenile state. Leaves of juvenile shade plants often show a remarkable, white spotting generally disappearing with age. Juvenile specimens of species with compound leaves may show much more pinnae than mature specimens, but the reverse may be equally the case.

The conclusion is that great caution is required to evaluate characters from specimens taken from juvenile plants as they may show a colossal plasticity in vegetative characters. In sticking to characters derived from fertile material this obvious source for confusion can generally be avoided.

2. *Precocious flowering* or *paedogenesis* (1, p. xxi, fig. 5). This is the phenomenon when juvenile plants are sometimes, even in the very young seedling stage, capable of producing flower and fruit. A number of species have been described which are merely based on this dwarf character of the vegetative parts. Juvenile fructification may be found in pteridophytes.

3. *Dimorphous foliage* (1, p. xxii, fig. 7–8). Leaves from the basal part of mature tree crowns are generally larger than those from flowering twigs. This difference may be stabilized in dimorphous foliage, found in many climbing plants, in which leaves attached to the main stem may be very different in shape, size, margin, phyllotaxis, and texture from those of flowering lateral branches (fig. 1). Several species have been based on (naturally sterile) material from the main stem. In other cases the dimorphism is not clearly separated on different parts of the climber or tree (fig. 2). Heterophylly is far more common than is generally understood; plasticity varies from group to group. There is great urgency for field collectors to make and record observations on labels.

In sticking to description of fertile material the herbarium botanist can usually avoid this source of confusion for delimiting his species, though certainly not in all cases, as *e.g.* in *Pittosporum sinuatum* where both types of leaf, entire and lobed, may be found associated with flowers.

4. *Dimorphous flowers and fruits* (1, p. xxiv). In one plant, or in one inflorescence, different kinds of flowers or fruit may occur. Such dimorphous flowers occur far more frequently in tropical families than is generally known, *e.g.* in *Celastraceae*, *Rutaceae*, *Connaraceae*, *etc.* In *Pittosporum* the occurrence of more ♂ or more ♀ flowers—in which both sexes are present but one of them is functionally sterile—has been the cause of some species which are only valid on paper, but not so in nature.

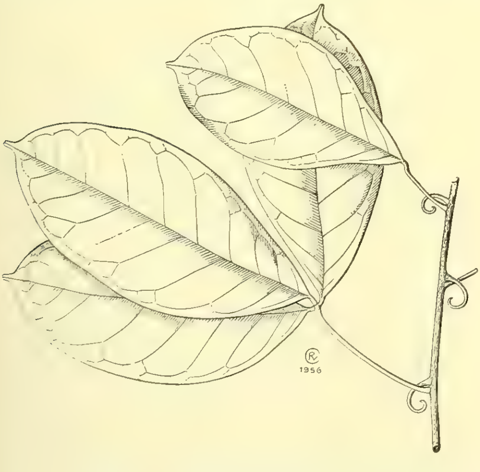

Fig. 1. *Lavanga eleutherandra* (Bl.) Kurz with simple and 3-foliolate leaves, × 1/4.

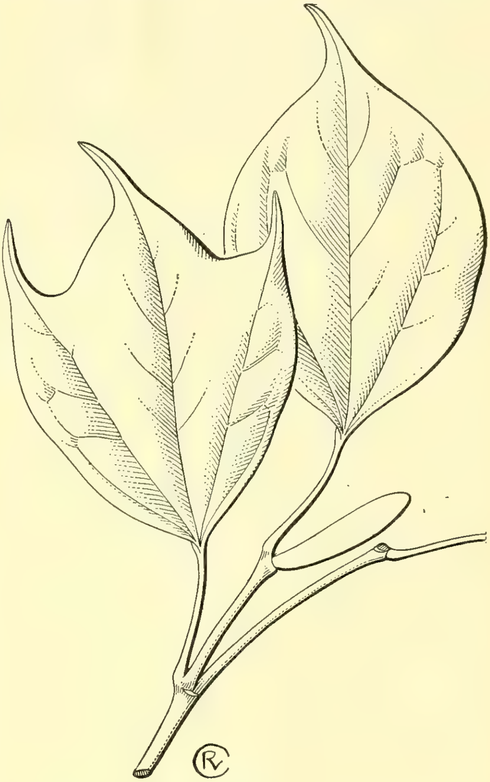

Fig. 2. *Symingtonia populnea* (R.Br. *ex* Griff.) Steen. with dimorphous leaves, × 2/3, the 3-lobed leaf identical with the type of *Liquidambar tricuspis* Miq.

It seems necessary for the herbarium botanist to dissect and examine many flowers from each inflorescence and not to base definition on the dissection of one flower. For pelorics see p. clxxi, clxxxvi.

5. *Cleistogamous flowers* (1, p. xxv). Cleistogamous flowering has been observed in a number of plants, *Acanthaceae*, *Orchidaceae*, *Leguminosae*, *Viola*, *Commelinaceae*, and is said to occur in *Annonaceae*. It has sometimes given confusion, even led to the description of a new leguminous genus on a cleistogamous form of a well-known species. Cleistogamy seems to be favoured by prolonged periods of very wet weather and as such it should be kept in mind as a possible barrier in gaining a clear specific delimitation.

Teratologomorphosis

6. Teratological forms (1, p. xxv, fig. 10). In some cases teratologies or what is termed as such, are inherited, as for example pelorics; others are caused by external or internal factors often unknown. Quite a number of monstrous forms have been recorded in the flower structure of *Orchidaceae* and on some of these new species have been distinguished. See further p. clxxxvi.

If plants agree in all characters save a single one, common sense is necessary to prevent description of new species on aberrant individuals.

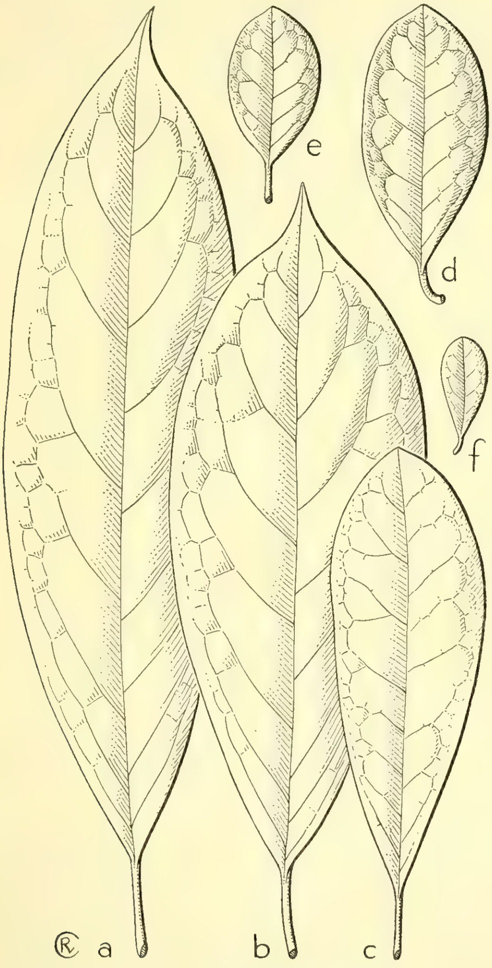

Fig. 3. *Pittosporum pullifolium* BURKILL, × ½ showing the effect of altitude on leaf size and shape of a small tree in the tropics (New Guinea), the 6 leaves being derived, in the sequence *a* to *f*, from specimens collected at 100, 1750, 2150, 3560, 3800, and ?4000 m (*a*. BRASS 7046, *b*. EYMA 5188, *c*. BRASS 22732, *d*. BRASS 9955, *e*. BRASS 9798; *f*. BODEN KLOSS *s.n.*, type of *P. nubigenum* RIDL.).

Hypselomorphosis

7. Phenotypic effect of altitude (1, p. xxvi, fig. 11–12). One of the general features of this effect is mostly a gradual dwarfing of specimens, in proportion with altitude, of herbs, shrubs, and trees. Leaves become smaller, their texture becomes thicker and harder, their margin tends to recurve, intervenal space becomes often somewhat bullate by sulcate nervation on the upper surface. Simultaneously the petiole is reducing in length and the blade is often shortening, getting blunter and rounder, specially at the base. Apparently intercalary longitudinal growth is retarded (by insufficient growth hormones?). The habit of the trees becomes more compact through shorter flush and shorter internodes, giving a stunted bushy or gnarled appearance. Inflorescences are also condensed and often pauciflorous. This is decidedly not only caused by temperature, but may appear also on poor soils on exposed crests at lower elevation. The extremes of such a series may appear, in habit and vegetative characters, very different to the eye. Floral characters show the least variability by the factors involved in altitude and exposure.

A few examples are depicted here, *viz* of *Pittosporum pullifolium* (fig. 3) and *Symplocos laurina* of which *S. sessilifolia* is such an extreme 'summit' form (fig. 4).

Quite a number of phenotypic forms have been described as 'species' though not deserving this distinction.

Those who are not acquainted with the remarkable but very common effect of altitudinal exposure in tropical mountains will only hesitatingly accept the variability caused by it as phenotypic in nature[1], if abundant material appears to contain sufficient transitional specimens.

Here again it is the constancy in floral characters indicating the true specific characters, the vegetative parts showing plasticity and being liable to great phenotypic variation, a variation which is parallel in its manifestation in almost all species which have a wide altitudinal range.

The above does not mean that there may not be allied species or subspecies differing in altitudinal range. A good example is *e.g.* in *Lonicera* of which the two Javanese species are neatly exclusive (1, p. xlix).

But such specific or subspecific distinction can only be accepted if there are well-marked breaks in the variability and at least in the case of species, vegetative characters are never sufficient for specific delimitation.

Photomorphosis

8. Epiphytes (1, p. xxviii, fig. 13–14). Many epiphytes may well grow on rocks and rocky slopes, and terrestrial specimens may even be more

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[1] It may certainly be possible that part of these 'phenotypic' altitudinal forms are caused by an altitudinal series of ecotypes whether or not worthy of taxonomical distinction. This can only be proved by breeding experiments.

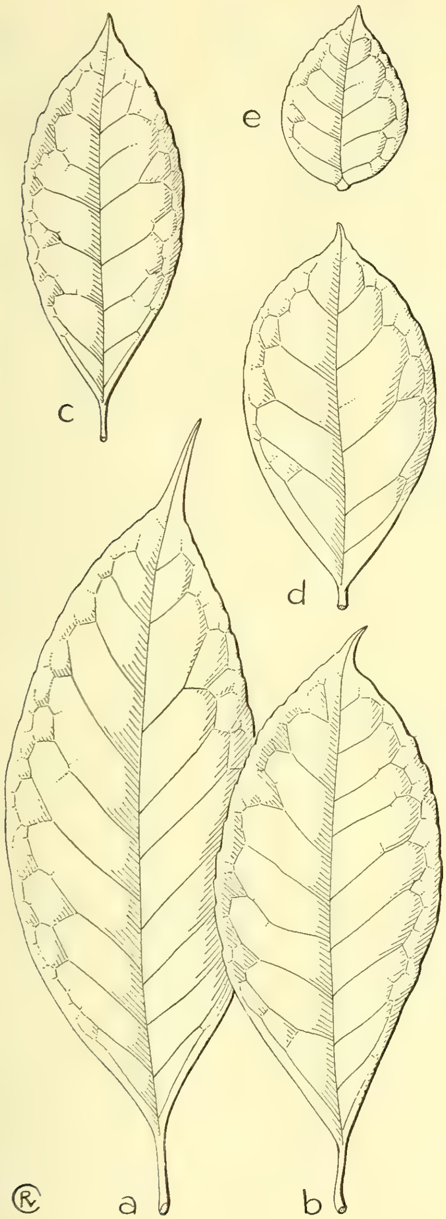

Fig. 4. *Symplocos laurina* (Retz.) Wall., × 2/3. A leaf series comparable to that in fig. 3, but from Java and Enggano Isl. (*a*), the 5 leaves being derived, in the sequence *a* to *e* from specimens collected at 100, 1600, ?1800, 2000, and 3000 m (*a*. Lütjeharms 4561, *b*. Blokhuis 7–12–21, *c*. Blume 1965 B, *d*. FRI Ja 4010; *e*. Docters van Leeuwen 6425, typical of what has been described as *S. sessilifolia* Bl.).

vigorous compared with epiphytic ones. Specially hemi-epiphytes may show a habit remarkably different from terrestrial specimens. I have summarized this for *Wightia borneensis* (2) which is according to field observations sometimes a small to medium-sized tree, sometimes an epiphyte, sometimes a 'liana'. In open, rocky places it grows into such a normal terrestrial tree, but it can equally grow as an epiphyte. This produces roots downward along the stem of the host tree and, on striking ground, the root gets thicker and thicker, until it resembles a large liana or slender stem. If eventually the host tree dies, it remains standing as a slender tree the stem of which is morphologically mostly consisting of a root. The same two habits have been observed in some species of *Ficus*.

Here again habit may differ but affects only the vegetative parts and not the structure of the flowers, which is therefore the only sure guide to specific delimitation.

9. Shade forms (1, p. xxix, fig. 14). A phenotypic effect similar to what has been mentioned on the different habit of lowland and mountain specimens is found in specimens grown either in shade or light. Shade forms tend to have thinner, larger, lighter coloured leaves, longer internodes, *etc.*, and sometimes less brightly coloured flowers. In a few cases shade forms have been described as distinct species, until it could by chance be shown that both 'species' occurred in a single individual.

As the flowers retain essentially their morphological structure, light and shade forms differ only in vegetative parts and sometimes in the amount of anthocyanin in the tissues.

Hygromorphosis

10. Influence of drought (1, p. xxix). Excessive drought causes generally reduction of number of leaves (increased leaf-fall) and reduction in the size of leaves. I have, in Malaysia, not observed n general tendency of increase in indument in proportion to drought conditions. Trees and shrubs which may be typically deciduous under seasonally arid conditions may be evergreen or nearly so in a constantly wet climate. No cases are as yet known to me in Malaysia where the phenotypical influence of drought has led to wrong specific delimitation.

Horamorphosis

11. Seasonal variation (1, p. xxix). 'Autumn' forms are well-known from Europe but as far as I know they are scarce in Malaysian flora. I have observed a few cases in which fruiting plants flowered for the second time or seedlings flowered in the wrong (dry) season; the flowers produced were paler and considerably smaller in size, though further specific characters remained exactly intact.

Anemomorphosis

12. Wind forms (1, p. xxx, fig. 15, 17–18). Constant wind from one direction affects mainly the habit of trees and shrubs, in turning them one-sided or even flag-shaped. In extreme cases they may be dwarfed down to a cushionlike habit.

Edaphomorphosis

13. Fumarole plants (1, p. xxx, fig. 16). On volcanic peaks hot, wet steam escaping under pressure has a dwarfing effect on herbaceous plants, reducing them to very small size and condensed habit. The reduction in size mainly affects the vegetative parts.

14. Rock plants; silicious soils, and other types (1, p. xxxi, fig. 19–23). On poor soil types species which are normally well developed trees may be represented as dwarf shrubs, and several new 'species' have been based on dwarf vegetative characters and pauciflory. The influence of the soil type is in several cases more important than is generally acknowledged. TURRILL & MARSDEN-JONES (3, p. 57) have found that "the greatest and most rapid changes have been recorded for *Plantago major*, an extremely plastic species. Here phenotypes have been produced within two years, from seedlings and ramets of a single clone, which have been classed as varieties and subspecies in a recent monograph of the genus" (*viz* by PILGER in Pflanzenreich). In the latter work *P. asiatica* and *P. major* are distinguished as two different species and even *P. hasskarlii* and *P. incisa* are maintained but could (naturally) not be keyed out, as they are conspecific. BACKER (27) had already observed that several forms of *P. major* had been described from Java under four different specific names.

15. Solfatara plants (1, p. xxxiii, fig. 21–25) are generally dwarfing towards the active part of the solfatara fields, partly due to sterility of the soil, partly to increasingly extreme conditions of temperature, acidity, and poisonous fumes. Oblique, clipped and cushion-like specimens are frequent under these conditions.

Hydromorphosis

16. Water and swamp plants (1, p. xxxiv). In addition to the examples of phenotypic plasticity mentioned, caused by the depth of the water, the amount of aerenchyma developed, the occurrence of aerial roots and conical trunk base, there is the phenomenon of precocious flowering by the drying up of the habitat.

In inundated rice-fields the rice seedlings are planted in the mud by hand. The growth period is about 3–4 months. During the first and second month the field is weeded once or twice. At the end of the growth period the field is gradually drained for the ultimate ripening of the paddy. The aquatic herbs growing in the mud have therefore only a very short period for growing in comparison with their growth in a permanent swamp. Through sheer necessity only those individuals survive which adapt themselves to the planting-scheme rhythm of the rice culture. This adaptation consists often of a dwarf growth and forced flowering at a juvenile stage (precocious flowering), a phenotypic-ecological variant of paedogenesis (1, p. xxi). Normally perennial plants thus may become annual, water and swamp plants produce flower and fruit on specimens which are vegetatively still juvenile. Such precocious forms are of course 'constant', *i.e.* they are *regularly found* in wet rice-fields. Illustrative examples are found in the genus *Monochoria* (*Ponted.*) in which from Malaysia have been described *M. plantaginea*, *M. linearis* and *M. pauciflora* (sometimes treated as varieties), which represent really only stages of phenotypical precocious flowering which has been proved experimentally by Dr BACKER (1, p. 258). Recently I have found that the monotypic *Elattosis apetala* GAGN. from Indo-China is only a precociously flowering phenotype of *Tenagocharis latifolia* BUCH. (1, vol. 5, p. 118). Mr DEN HARTOG found similar cases in the *Alismataceae* and *Hydrocharitaceae*.

Another class of phenotypic forms is that of *terrestrial forms of water plants*. In Europe a classical example is that of *Polygonum amphibium* L., of which the terrestrial form is distinctly different from the aquatic one with practically no intergrades. If such different specimens have been collected in the tropics and come into the hands of herbarium taxonomists, it requires a knowledge and realization of this phenomenon and the common sense to apply this knowledge, even though it cannot be checked on the spot either by observation or by experiments.

Such terrestrial forms do occur in the tropics indeed. In Malaysia examples are found in *Jussieua repens* L. and in the genus *Limnophila* (*Scroph.*). Typical specimens of *L. indica* (L.) DRUCE have submerged leaves large and finely pinnatifid, with emerged leaves nearly simple and toothed. Terrestrial specimens sometimes lack the pinnatifid leaves; there are intergrades. In *Jussieua repens* leaves of terrestrial forms are exceedingly small, crowded and hairy.

In specific delimitation of water plants the above mentioned phenotypic deviations should always be considered. Again here, the plasticity is mainly affecting the vegetative characters.

Phytomorphosis

17. Fungus and bacterial diseases, and symbiosis (1, p. xxxv, fig. 26–27). Several examples are known in which phytographers have been deceived in their specific delimitation by malformations caused by micro-organisms; these generally affect only vegetative characters, but may, occasionally, cause (abnormal) changes in the generative parts. It seems to me not admissable to take the presence or absence of certain symbionts or parasites into consideration for specific delimitation.

Zoomorphosis

18. Ant plants (myrmecomorphosis) (1, p. xxxv). Much of what has been said in the foregoing paragraph is valid for ant plants. The presence or absence of ants and, henceforth, the presence or absence of cavities inhabited by them, seems to me irrelevant to specific delimitation. Fortunately these cavities are generally found only in the vegetative system.

19. Galls (cecidio-morphosis) (1, p. xxxvi, fig. 27). There are several instances in which galls, specially those deforming flowers or fruits have been entered into specific distinction. Fortunately the number of these cases is very restricted. Admittedly galls are, in a number of cases, confined to distinct species, but their occurrence is of secondary nature and should not be evaluated as an argument in specific delimitation, though it may add to circumstantial evidence.

20. Effects of browsing (*pascuo-morphosis*) (1, p. xxxvi, fig. 28). Very aberrant forms may arise from repeated trimming by browsing animals, resulting in fastigiate habit, dwarfing of leaves, and pseudonanism. Though I do not know of cases in which these abnormalities have been described as distinct 'species', some have been referred to varieties, although the difference in vegetative habit is merely of a phenotypic nature.

Anthropomorphosis

21. Influence of fire (pyromorphosis) (1, p. xxxvii, fig. 29–31). Changes caused by repeated fires concern mainly the vegetative parts and the dwarfing of specimens including their inflorescences. Fire forces many plants to 'go underground' in developing thickened roots and 'lignotubers'. In pyrogenic areas many plants are flowering and fruiting in a dwarf stage. Furthermore individuals produced by rootsuckering may show somewhat deviating characters. In the genus *Premna* several species have been described from such localities, and even two genera (*Tatea* and *Pygmaeopremna*) have been based erroneously on such pyrogenic forms as MERRILL (4) has shown.

In dealing with species of grasslands and savannahs the above-mentioned circumstances should always be taken into consideration; as a matter of fact the deviations mainly effect the vegetative characters and habit of the plants.

Trees grown up under open conditions tend to assume a short trunk and a globular crown.

22. Pioneer plants (1, p. xxxviii). Pioneer plants, either those invading bare soil, or shrubs and trees invading grassland, often flower and fruit in a juvenile stage of their ontogeny. It may seem queer to the herbarium botanist to find no floral differences between a large forest tree and a shrub of one or two metres size, but it has been repeatedly observed that this difference is merely phenotypic and induced by seedling growth in different habitats. Open conditions will generally be favourable for precocious flowering, whereas the growing up under forest conditions is a striving for light resulting into extended vegetative growth prior to flowering. Trees with large 'clear boles' may have hardly an unbranched bole if grown up under spaced conditions.

General summary:—As has been shown in field studies phenotypic variability is exceedingly common among Malaysian plants. In the past it has been much underrated in phytography and by using it for taxonomical delimitation has given rise to a multitude of 'paper' species and varieties without any taxonomical value. It has been found that phenotypic deviations mainly affect the vegetative structure of plants. Vegetative characters should therefore be handled with care with regard to specific delimitation. They should be only used in addition to structural characters of flower and fruit. Experience has shown that good species differ in both their vegetative and reproductive structures, though the one may be at times more spectacular than the other. Species should never be distinguished merely on vegetative differences.

GENOTYPIC VARIABILITY

From the foregoing paragraph it appears that phenotypic variation is of distinct importance and wide interest for a correct insight into the variability of specific populations. If phytographers have been deceived by phenotypic plasticity and have described non-existing species and genera, these deficiences in correct interpretation of specimens have rather the character of errors.

Genotypic variability or polymorphism, however, is still far more important than phenotypic plasticity, as it deals directly with the interpretation of the genetical structure of specific populations.

A proper insight into matters of genotypic variability is required for the delimitation of nearly every Linnean species.

Breeding experiments have appeared to be a powerful tool for the genotypical analysis of populations and this complement to the study of the herbarium taxonomist has been recognized for nearly two centuries. Simultaneously with the development of genetics it has been revived and intensified in this century in various parts of the world, for example by TURESSON in Sweden, by TURRILL & MARSDEN-JONES in England, by DANSER in Holland, by WINGE in Copenhagen, by CLAUSEN *c.s.*, CAMP, and many others in America, and by COCKAYNE and ALLAN in New Zealand. TURESSON had specially in mind to find correlation between geographical distribution and ecology (ecological characters of the variants).

It is natural that a really thorough picture and interpretation of the infraspecific variability cannot be gained by herbarium study; population analysis should be based on or at least sustained by breeding experiments.

I have already had occasion to allude briefly to the idea of some earlier authors that the constancy (breeding pure) of specimens had been for some of them the decisive argument for the specificity of the taxon in question. This criterion was for instance accepted by JORDAN who, on this basis, came to accept an exceedingly narrow specific delimitation. TURRILL has been able to show (3, p. 50) that the microspecies, or jordanonts, are not fictitious but exist. In a certain species used by JORDAN twelve combinations could be expected, according to TURRILL, based on the size of the fruit and its indument. TURRILL found eleven of them represented on a very restricted surface and further experiments showed that their distinction rested on a few normal Mendelian characters. A similar result was obtained by WINGE with the Jordanian *Erophilas*. Every specific population is a complex of genotypically heterogeneous specimens and this polymorphism is one of the essential characters of a linneont.

The very narrow specific delimitation accepted in several South European Floras point to the desirability of the application of experimental taxonomical methodology to show the proper appreciation of their taxonomic status.

* * *

A general factor is always active within a panmictic population in which heterozygotes are common and homozygotes rare or non-existent is *migration* or *dispersal* within the population.

It is of course a common phenomenon that the area of each species, if mapped, generally consists of a number of smaller and larger dots; hardly any species is so densely distributed over its whole area that one finds a few specimens on every acre of it. This means, that not all specimens are in nature in a position to interbreed (connected genetically). Considering that no seed of any specimen will contain the whole of the genetic polymorphism of the species, this means that genetically the area of specific distribution is a fine mosaic pattern of partly isolated specimens and smaller or larger aggregates of these; in the aggregates inbreeding takes place. As dispersal is random, there is generally no stability in time and the mosaic pattern is dynamic, changing from year to year. As dispersal has generally a wider reach than pollination, seeds of specimens from one aggregate will occasionally reach others. An overall picture of the dynamism will be that of a melting pot of paramorphs.[1]

It is significant here to cite the conclusion of VAVILOV (3, p. 550): "After many years of collective studies of the most important cultivated plants, with the aid of cytologists, geneticists, physiologists, anatomists, and immunologists, we are coming to the *concept of a Linnean species as a definite, dynamic system differentiated into geographical and ecological types and comprising sometimes an enormous number of varieties*".

Finally I will raise a question which must unfortunately be left unanswered. *Why have certain species produced a racial segregation, either very distinct (as in Geum,* cf. p. clxxxviii*), or less distinct (as in Hanguana,* cf. p. clxxxix*), or indistinct (as in clinal or marginal differentiation)?*

This raises the general question about the very different degree of variability displayed by Linnean species. Generally the range of variability increases proportionally to the size of the area of distribution. This is causal, as the increase of potential (genetic) polymorphism, both morphological and ecological, increases also the opportunities for adaptation to greater variety of soils and climates. This is, however, merely an observation.

I believe that an explanation of the phenomenon that this or that species has a much wider capacity of potential polymorphism, and hence of differentiation, must be left unanswered. This is rooted in the genome structure and different for each particular case.

Among the *dissociation* or *differentiation in genotypical characters within a specific population* there are two main types: firstly, variation which occurs '*occasionally*', here and there, without forming a regional facies of the population and without any special ecological correlation or preference, and secondly, such variation as appears *regionally*, either in time or place.

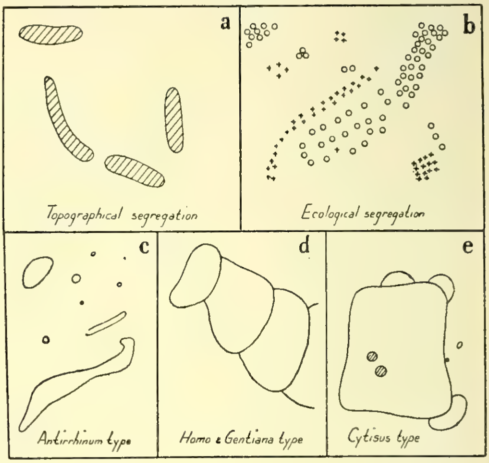

Fig. 5. Schematic types of racial differentiation. *a.* Disjunct distribution by topographical conditions, *b.* localities of two replacing races by ecological conditions, *c.* population consisting of colonies of different size, *d.* regional differentiation of replacing races, *e.* a large population with marginal and altitudinal (2 hatched dots) racial differentiation.

A random example of occasional occurrence is for instance a special form of *Lamium album* in which the teeth of the underlip have developed into two broad lobes nearly equalling the midlobe in size. This form has been found in a few places, always a few plants in surroundings where the population with 'normal' flowers is common. A similar example is the extremely rare occurrence of a yellow-flowered variety of the very common *Gynura crepidioides* in Malaysia and SE. Asia.

Among the regional types, one of them is the pattern of a *cline*, a name HUXLEY has given (5) to a variation through the population in one direction, but so gradual that no demarcations can be found.[1] A few instances are known where

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(1) *Paramorph* has been introduced by TURRILL as a convenient term to designate all specimens which deviate in one or more characters from the 'average' composition of a population.

(1) The original definition is "*cline* meaning a gradation in measurable characters", what REINIG has called character gradient or geographical progression of characters.

hairiness, size of plant, fruit or leaf, *etc*., increase or decrease in a certain direction.

A special case of the cline is the fact that *most populations vary gradingly from the centre of the area towards the margins*. Marginal specimens are almost always distinctly different from those of the centre of the area and, if they are found in disjunct localities (islands, mountains, *etc*.), they have not seldom been described as races or even as local species.

The cline seems to me the first essential step towards the origin of *discontinuous* or *exclusive variability* in which there is a reproductive isolation, either in time or space, causing a segregation of the specific population in partial populations.

The causes of the reproductive isolation are either ecological, geographical, or *cytogenetical*.

Among the *ecological factors* the following may be active:

The partial populations growing in one and the same area may possess different needs (claims) for their *habitat* and occupy different niches (wet or dry soil, light or shade, sand or clay, differences in microclimate, *etc*.).

The partial populations may show *seasonal dimorphism*, that is, flowering in different seasons of the year through which interbreeding is generally prohibited keeping them pure and separated.

The partial populations may be spaced in anthesis daily (for example one race opening flowers in the morning, the other in the afternoon).

Up till now I do not know examples from Malaysia of segregation by differentiation in pollination.

In all cases of ecological segregation the areas of the partial populations are overlapping, as they occur in the same district.

The *geographical segregation* is the most common case. Its pattern is that of an articulated population and there may be more than one articulation which can be either *horizontal* or *altitudinal*. In both cases adjacent partial populations may touch in a narrow zone of transitional forms, or they may be separated in space and are disjunct. In both cases the geographical segregation may or may not coincide with ecological properties.

For brevity's sake I have arranged below the various cases of genotypical variation which may occur and in fig. 5 an idea is given of area patterns resulting from some of these types which I will now proceed to deal with in greater detail. I cannot avoid repeating some data which have been given in a more concise precursory chapter in this Flora (1, p. xliv–l, fig. 33–38).

PATTERNS OF GENOTYPICAL VARIABILITY WITHIN SPECIFIC POPULATIONS

Population	*Occurrence of paramorphs*	*Cause*	*Cause of reproductive isolation*	*Distributional area of paramorphs or partial populations*
A. Continuous	1. Regular	Chance	Occasional	Overlapping
	2. Clinal 3. Marginal	Migration or environment	Distance	Gradual change
B. Dis-continuous	Exclusive	4. Ecological	Habitat (soil, microclimate) Seasonal dimorphism Daily spacing of anthesis Pollinating ag. See p. clxxxix	Overlapping
			Cultigens. See p. cci Aliens. See p. cxcviii	Exclusive
		Geographical	5. Regional 6. Altitudinal 7. Disjunct	Exclusive or disjunct
	Mixed	Cytogenetical	Incompatible chromosome races. See p. ccxi Apomicts. See p. ccxiii	Overlapping

A. POPULATIO CONTINUA

1. Variatio genotypica regularis

Regular (individual, or random) variation is represented by the ± regular (occasional) occurrence of paramorphs. Geographically they are at random distributed and found or may be expected to occur throughout the major part of the continuous area of distribution of the population. The paramorphs do not predominate in a special geographical part of the population, they are not heaped to the exclusion of other paramorphs and do not form a distinct partial population. There is a panmictic population, as a melting-pot of numerous jordanonts and paramorphs which through sexual contact, militating against segregation, appear and disappear (by recombination and disintegration) regularly from generation to generation and from place to place and are, for that reason, found at random. TURRILL (3, p. 8) observed that "in the single species *Silene cucubalus* variations in characters which have been shown to have a genetical basis occur in nearly every organ and these variations occur in unnumbered combinations reaching astronomical figures. They must be taken up by the taxonomist in drawing up his description, not of course, by the giving of millions of varietal names".

"The distribution of paramorphs within the species range raises innumerable problems of interest to the taxonomist, the ecologist, and the geneticist. Extensive field and experimental experience has convinced me that species are far more variable than they are given credit or discredit for in our Floras".

It has appeared that formerly the effect of phenotypic variation has been overestimated; extensive breeding experiments have shown that the number of individual variations within a panmictic population which are genetically bound is very large indeed.

Some *special categories* of genotypic individual variations are:

1. Peloric flowers. If a typically zygomorphic flower, for example an orchid, loses its symmetry and becomes a regular perianth, its 'characters' are lost and its correlation with a species or even genus becomes a matter of speculation rather than identification, though in several cases it has been proved experimentally that the peloric differs from the normal plant by only one Mendelian character. Among Malaysian *Orchidaceae* pelorics have caused considerable confusion in phytographic description as I have shown in greater detail before (1, p. xli). It has appeared that at least 8 genera have been described which are merely peloric forms for species of other genera, and besides there is a much larger number of species which have by error been based on peloric specimens of known species. Some have even not yet been correlated with the normal form of any known orchid species! In *Leguminosae* a peloric *Clitoria* was described (in S. America) as a distinct genus. Among *Compositae* discoid heads may sometimes be regarded as heads of peloric flowers; whether in all cases the discoid forms have been correlated with the proper genera seems uncertain.

2. Other 'teratological', deviating paramorphs (1, p. xlii). If one consults the books by PENZIG and WORSDELL on the subject of teratological forms there appears to be a remarkably large number of parallel deviations, classified under *e.g. proliferation, forking, fusion and fasciation, simplification, suppression, adnation, and laciniation.* It should be admitted that part of these have been caused by biotic factors of the environment and should be classed among phenotypic variations.

But a considerable number is certainly inherited. Furthermore there are several other items, in the number of flower parts, the colour of leaves (*variegation*), *etc.*

Several of these deviations have been used as the basis for describing new species[1] or varieties which they are really not, as these teratological tendencies may occur in any species. *Pandanus variegatus* MIQ. is a variegated cultigen of *P. tectorius* PARK., *Coffea sumatrana* MIQ. is a variegated form of *C. arabica* L., *Boehmeria biloba* MIQ. is a species in which occasionally forked leaves occur. These characters have no significance for specific distinction.

3. Distribution of the sexes (1, p. xliii). In dioecious plants or those with unisexual or polygamous flowers (or those functionally so) specimens with different flowers have often not been recognized as belonging to one species, causing deficiencies in specific delimitation. *Bauhinia castrata* BLCO is such a ♀ form of *B. malabarica.* There is a considerable number of families in which such dimorphous flowers occur and occasionally correlation of specimens of different sex may offer difficulties.

4. Other deviating paramorphs include those cases which cannot be classified among the 3 preceding paragraphs. I mention for example the occurrence in West New Guinea of specimens of *Juncus prismatocarpus* R.BR., a very well known, widely distributed herb (Ceylon & E. Asia to New Zealand) in which the fruit was distinctly different from the average type; all other characters being similar to those of *J. prismatocarpus*, HOOGLAND concluded on their conspecificity (1, p. 214). Many comparable cases of deviating specimens have not been recorded in literature as they were accepted as mere individual variations by revisors. However, it has appeared that if the sheets come from the 'unknown' tropics there is a 'magic' tendency to

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(1) Recently a new monotypic solanaceous genus *Methysticodendron amesiamum* SCHULTES (30) has been described from Peru which deviates from *Brugmansia (= Datura sect. Brugmansia)* in the deeply divided calyx, corolla, and style. To me this appears to represent a remarkable case of adesmy, a tendency which is recorded from various *Solanaceae*. The adesmic *Campanula rotundifolia* has also been proposed as a distinct genus *Depierrea* (35).

evaluate them higher than if they had originated in the home country where they pass unnoticed by common agreement.

It is remarkable that they concern sometimes important structural characters of the genus, or even of the family. In this respect I have already mentioned the case of choripetalous 'sports' of *Campanula rotundifolia* and '*Methysticodendron amesianum*'. An additional example was found and recorded by DE WIT in *Cassia mimosoides* L. in which the flowers contained two separate ovaries, a very rare character in *Leguminosae* and confined to some primitive genera of the *Mimosoideae*. TURRILL recorded (3, p. 59) a 'mutation' of *Silene cucubalus* with sepals often separate to the base, thus breaking down the essential difference between the two subfamilies of the *Caryophyllaceae*.

From 'mass collections' it has appeared that such individual cases are far more numerous than has generally been assumed. Unfortunately little is mostly known about their genetic status. They show the pitfalls of 'specimen-description' to which DE CANDOLLE pointed in his 'Phytographie' (38, p. 52).

2. Variatio genotypica clinalis

According to HUXLEY a *cline* (5) is a population in which the character complex shows a gradual change (gradient) from one end of the population to the other without possibility of indicating taxonomical breaks or demarcations. The extremes of both ends of the cline are distinctly different but are connected by a gradual series of intermediates merging the population into one whole. This may of course occur both in the horizontal direction and in the vertical direction in the case of mountain plants.

The cline should not be confused with graded phenotypical change[1], as it is *per definitionem* a genotypically heterogeneous population.

Clines have been mostly described from animal distribution, but they are equally frequent in the plant kingdom. I point to the variability in flower colour in some *Convolvulaceae* recorded by VAN OOSTSTROOM (1, p. 449, 453) which is apparently gradual and regional and falls obviously under the cline conception.

Clinal variation is often more evident in minor ecological adaptation than in easily expressed morphological terms. Among foresters it is, for example, a widely applied procedure, gained by experience, to use seed for afforestation from well known sources, that is localities comparable in ecology to where it will be sown. It has appeared in practical forestry that in populations in America and Europe of wide latitudinal range, plants raised from seed of high latitude do not grow well under warmer and moister conditions of lower latitude and, reversely, plants raised from seed collected at lower latitude may suffer from frost if planted at high latitude. This clinal ecological segregation within a specific population is not well definable in morphological terms, but is of eminent importance to the practice of forestry, horticulture, and agriculture.

It is, naturally, very difficult to obtain precise detail data on the genetical basis of such an ecological cline, and to check whether it is really a cline, or whether it is after all ecologically a discontinuous population. LANGLET has for example tried to demonstrate the clinal nature of the ecological behaviour of *Pinus sylvestris* in Sweden (6), but TURESSON (7), though admitting the theoretical possibility, found LANGLET's arguments insufficient, and indicated the possibility of two ecological races merged by a wide transitional zone of interbreeding.

3. Variatio genotypica marginalis (fig. 5e)

This is more or less a subtype of the cline, as there is found a more or less gradual change in average composition from the centre towards the marginal part of the distributional area. The centrifugal effect seems to be mainly based on differences of selection pressure (degree of gene exchange between the paramorphs) in the various parts of the area, central and marginal.

In his gene-centre theory VAVILOV has shown (8) that the percentage of dominant characters is largest in the centre of the area of a species whereas the percentages of specimens with recessive characters is gradually increasing towards its marginal area. The marginal area will therefore often locally contain aggregates of specimens with genetic combinations which would have no chance to maintain themselves in the melting pot of the central part of the area.

The general factor *dispersal* or *migration*, explained on p. clxxxiva under the introduction to genotypical variability, must play an exceptionally important role in the marginal differentiation, where the density of the population is generally less than in the centre of the area. This entails the increase in distance between specimens or their aggregates, favouring their genetic isolation, which again supports the process of differentiation by local inbreeding on the frontier of the distributional area.

The existence of marginal differentiation is corroborated in taxonomical practice. Widely distributed species have very often produced aberrant or deviating specimens along their frontiers, sometimes possessing characters which are not or hardly found in the central part of the area. In his study on *Cytisus § Tubocytisus* KERNER (12) gave a map in which a few widely distributed species bear satellite taxa in their marginal area!

The 'direction' or 'course' of the inbreeding process will be partly determined by the environmental conditions in the marginal area.

It is natural that throughout the distributional area of a species the environment acts as a (leaking) sieve to migrating paramorphs, but this will be more effective in the marginal area through the historic progress of area expansion.

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(1) The data of BONNIER which are so often cited in this respect, have as good show-boys proved to be untrustworthy, according to TURRILL (3, p. 56).

B. POPULATIO DISCONTINUA

The clinal and marginal types of population variability can be regarded as the primordial stages from which can be derived the following exclusive, discontinuous, or articulated types, in which the population is broken up into two or more demarcated, partial populations by the continued force of isolation. They represent a further advanced, more stabilized development of the clinal or marginal differentiation. The variability of each partial population is *a priori* smaller than that of the sum of them.

Generally the environment has, by its sieve function, been instrumental in the segregation of the partial populations and as this segregation has obviously originated during the historic phase of progressive diffusion, a general characteristic of a chain of partial populations is, that neighbouring populations will be more akin and similar than those wide apart. The dissimilarity between the latter (extremes) is bridged by various intermediate partial populations acting as stepping stones.

As remarked above each of these stepping stones is (mostly) adapted to a slightly different ecological environment besides being mostly recognizable by morphological differences. These two factors, ecology and morphology, may be found combined to various degrees. In some cases the morphological difference is slight, but there is a distinct difference in ecological preference, in other cases there is a well-marked morphological difference without a clear sign of marked difference in ecological preference.

As to the demarcations themselves, they may be sharp without intermediate specimens in a transition zone blending the adjacent partial populations, or there may be a narrower or broader zone in which the partial populations gradually merge.

It appears also that within one partial population there is a repetition, on a smaller scale, of the same principle of segregation, and that each major partial population can again be divided into smaller partial populations of minor rank. And what has been just advanced for the large populations holds for the minor ones. Bianchi *Jr* could demonstrate (in MS) a hierarchy of racial differentiation within *Mahonia napaulensis sens. lat.*

Within most widely distributed species there is obviously a hierarchical structure of racial differentiation comparable to the differentiation found in the species *Homo sapiens*, which is a convenient illustration of the hierarchical differentiation under discussion.

Turesson acknowledges this infraspecific hierarchy in distinguishing two main classes: *ecotypes*, the smallest racial aggregates or clusters of hereditary variants, and *ecospecies*, representing races of higher taxonomic standing, together forming the *coenospecies* which is obviously equivalent to the linneont.

Taxonomists have, in many cases, found it suitable to distinguish far more than two ranks in the hierarchy of geographical races and have intercalated a number of additional ranks between subspecies and forma, for which they have coined new terms or which are merely indicated by symbols.

In well examined cases, sustained by large-scale experimental and field work, there seems reason to make such distinctions by including in the terminology indications for the concepts of ecology, seasonal dimorphism, *etc.*, because in the classical ranks there is for a partial population merely the term subspecies available. One could add abbreviated additional indications, *e.g. subspecies(ec.)*, *subspecies(alt.)*, *subspecies(disj.)*, *subspecies(reg.)* for respectively ecological, altitudinal, disjunct, and regional subspecies. For a partial population within a subspecies one might introduce the concept sub^{2}species for sub-sub-species, sub^{3}species, for sub-sub-subspecies.

I refrain, myself, from introducing such micro-subspecific distinctions, and want to keep to the classical use of subspecies only, preferring to give wherever desirable comments on the status of the race in an additional note.

The following four main types of discontinuous populations will be treated below: *4. ecologic*, *5. regional*, *6. altitudinal*, *7. disjunct.* Numbers 5–7 are very often caused by ecological factors, but not clearly so in all cases, number 4 is therefore reserved for cases which are distinctly ecologic and in which areas overlap.

4. Populatio discontinua oecologica (fig. 5b)

Ecological races are discontinuous by their biological isolation, but geographically their areas overlap, at least in part. The isolation is caused by the fact that the partial populations occupy different biotopes, and have been sorted out from a panmictic population. Several factors may be involved, each sufficient to stabilize the racial differentiation; in the survey on p. clxxxv I have mentioned as examples soil preference, microclimate, seasonal dimorphism, daily spacing of anthesis, and human cultivation.

A typical case, obviously due to the factor of soil, is for example that in the rosaceous genus *Geum*, of which in Europe are two subspecies (mostly recognized as species) which perfectly exclude each other ecologically: *G. rivale* L. from humic, moist localities and *G. urbanum* L. from drier places. It has been observed both in the field and experimentally by Marsden-Jones (13) that where the environment is intermediate and suitable to both subspecies their differential characters break down by a complete series of intermediates blending them into a whole. He says:—"Genetically they may be considered as varieties of one species, in that they cross freely and produce hybrid swarms in which it is difficult or impossible to find plants showing a pure combination of the characters of either putative parent".

It is clear that, if the entire surface of their area were of an intermediate soil type or biotope no segregation would have taken place, consequently *no taxonomical distinction would have been possible, and the panmictic population (populatio genotypica regularis) would have been recognized by taxonomists as a 'variable species' but anyhow as a taxonomic 'continuum'.*

It is merely by the differentiation of the habitats into two rather distinct types that segregation could take place enabling the taxonomist to distinguish the partial populations. *The mingling (miscibility) in intermediate localities reveals the true subspecific nature of these two entities* which are for reasons of conservative convenience accepted to represent Linnean species in most Floras. This inertia is scientifically erroneous and educationally reprehensible.

A comparable example from Malaysia is that of the flagellariaceous *Hanguana* (*Susum*) *malayanum* of which two subspecies occupy the same area, one confined to dry forest soils, the other to swamps, according to BACKER with occasional intermediates in intermediate localities (1, p. 250).

With these examples at hand two remarks should be made.

First, that in the case of *Geum* the morphological differences between the two subspecies are very distinct; nobody will confuse them. In the case of *Hanguana* characters are less pronounced and herbarium taxonomists have not been so strongly inclined to keep them separate. Abundant material and detail observations both in the field and experimentally are in such cases compulsory to come to the correct interpretation of the state of affairs.

Second, an easy way to track such twins or triplets, *etc.*, of ecological races (taxonomically considered to be closely allied) is to see whether localities and biotopes exclude each other. This should be a warning signal of their presence, though of course not giving conclusive evidence of the subspecific (racial) status, as it may happen that good linneonts are ecologically vicarious, as apparently in Europe for example *Rhododendron hirsutum* (calciphilous) and *Rh. ferrugineum* (calcifugous).

A comparable case of ecologically vicarious twin linneonts in Holland is found in *Thymus*, a genus elaborated by KLOOS (10). According to the maps published by KLOOS the species *T. pulegioides* L. *(syn. T. chamaedrys)* and *T. serpyllum* L. *(syn. T. angustifolius)* neatly exclude each other, the first showing obviously a preference for calcareous soils, the latter being calciphobous. In a few spots they are found together in an intermediate habitat, but the hybrids are sterile and there is no question of hybrid swarms in which they show a tendency towards miscibility. Though exhibiting superficially a vicarious occurrence, due to different soil preferences, comparable to that of the twin *Geums*, their behaviour is essentially different when brought into genetical contact. And if there were available only soils of an intermediate character the *Thymus* species would perfectly maintain their individuality.

Conclusive evidence can only be gained by either detail study in the field or experiments. But it will be good if the taxonomist pays special attention to the value of characters separating ecological twin species.

VON WETTSTEIN has given excellent examples of seasonal-dimorphic racial segregation in *Euphrasia* and *Gentiana* (11) and some other genera in Europe. Whether comparable cases occur in the Malaysian flora is unknown. They should then be found in the semi-arid areas which show seasons; in the rain-forest area they will have had no chance to develop.

A numerically probably small, but interesting category of ecological separation was suggested by GRANT (39) who assumes that in certain cases it may be the flower specificity of pollinating insects which keeps interfertile species apart. He reminds in this respect of *Orchidaceae* in which this agency may be active in keeping subspecies apart and which may at the same time account for the high degree of interfertility of 'species' in this family.

The different pollen vectors and difference in time of anthesis may also be responsible for the ecological isolation of the two *Melandryums* and may account for raciation in *Aquilegia.*[1]

5. Populatio articulata regionalis (fig. 5 d)

In contradistinction to the above-mentioned examples of ecological differentiation which is, except seasonal dimorphism, mostly a consequence of habitat (presumably *mainly soil*), regional differentiation is often a consequence of *climate*, but not necessarily so; in other cases the reason for its differentiation is not quite clearly associated with any environmental factor. Though it should be assumed that the environment has undoubtedly been instrumental in the origin of most races, it is feasible that others have originated by chance dispersal, in which naturally the diaspores carried only a certain part of the total polymorphism of the population, serving as 'genetic material' for the self-stabilizing new race.

The origin of (exclusive) regional racial segregation can easily be derived from either the clinal or the marginal differentiation, from both of which it differs in that a dissociation has taken place marked by a demarcation.

This derivation is not fictitious, as demarcations are found in any degree of distinctness. There is also no fixed place for the demarcation or for the size or taxonomical weight of the partial populations, or for the width of the transition zone separating the races.

The transition zone is characterized by the occurrence of fertile interbreeding between the partial populations resulting in a complete series of transitional specimens.

A Linnean species may contain two (geographi-

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(1) After a careful consideration HOOKER *f.* came to the conclusion that there is, in India, only one remarkable polymorphous linneont, *A. vulgaris.* The reasons for this lumping he explained (40) in a lengthy note.

cal) races[1] or more. In man and animals (*e.g.* birds and butterflies) this articulated specific population is easily discernible and commonly recognized. Specific populations of birds may contain a dozen of such exclusive regional races, their extremes being morphologically sometimes so different that they would be taken for different species if they were not connected by the intergrading series of other races.

It may seem superfluous to remark that *each race in the chain resembles most closely* (*and is intermediate between*) *its two adjacent neighbours*, but this point appears essential to me.

In taxonomic zoology KLEINSCHMIDT has devoted an instructive work (14) to the subject of articulated (regional) specific populations which he named '*Formenkreise*' (form-chains). RENSCH has proposed (15), I think rightly, to change this term into '*Rassenkreise*' (race-chains) and he accepts them also as the equivalent of linneonts or good species (*l.c.* p. 13). KERNER (36) had called the clusters of *radiatim* and *lineatim* connected races, accepted by him as the true species, *Rotten* (platoons). HUXLEY (3, p. 10) calls them *polytypic species*. TURESSON proposed the name *coenospecies*. Still others speak of *compound* or *collective species*. I prefer to call them *linneonts* or *Linnean species*, shortly *species*, the concept prescribed by the rules of nomenclature.

In taxonomic botany the regionally articulated differentiated races have been known and distinguished long ago. I have already mentioned the work of KERNER (12) who did not treat them as subspecies but as species, though indicating that there were two kinds of species 'weitverbreitete Stammarten' and 'lokale Tochterarten' (widely distributed ancestral species and local derivates); he made the acute observation that *the ancestral species and local derivates replaced each other geographically*.

Similar results were obtained in the classic work of VON WETTSTEIN, on the genus *Euphrasia* and *Gentiana § Endotricha* (16), who found groups of closely allied small species excluding each other geographically.

Both KERNER and VON WETTSTEIN *intentionally* arranged *both* the widely distributed species and the narrower exclusive species in the specific rank, that is on the same level, though both clearly indicated that they were, taxonomically, of two sorts, the larger ones the older ancestral species which had produced the younger, narrower defined ones, as DANSER (18) has explained.

Both assumed that they could demonstrate how species *had* evolved as regional segregates which would disperse and in future in their turn become wide species and again a source of new satellites. The crucial word is the italicized word *had*, which introduces a subtle but essential difference in the interpretation. It means that the taxonomical facts have been interpreted to fit a theoretical assumption. Because, as a matter of fact, both KERNER and VON WETTSTEIN admitted that the characters of the exclusive segregate 'species' are of minor value than those of the widely distributed ancestral species *and* that their distribution is vicarious. Taxonomically therefore the first should have been subordinated to the latter as subspecies.[1] The theoretical interpretation could then have been the same, *viz* that they regarded the regional subspecies as species *statu nascendi*. The anticipation of the satellites as species rested on no firm taxonomical ground.

Two distinct ranks are involved, a higher (the assumed ancestral species) and the lower (the young or satellite species). Giving a binomial to both brings ambiguity in classification, as a binomial should be used in its classical Linnean sense.

And this is the crucial point, because the origin of species from exclusive racial differentiation, that is, finally by *isolation*, is still open to discussion. It is often accepted in zoology, but prominent geneticists as BAUR and GOLDSCHMIDT are entirely opposed to this idea. The latter expressed his opinion (19) in this concise way:—"*Geographische Variation ist weder eine Vorstufe noch ein Modell der Artbildungsvorgang*".

However trivial the subtle difference may seem at first sight, it has appeared disastrous in practical taxonomy by the multiplication of binomial names in *Euphrasia;* nobody is any longer capable of realizing which binomials belong to linneonts and which to subspecies. It entailed further that in revisions and descriptions posterior to WETTSTEIN's the same procedure was followed by other workers on the genus. As for unknown reasons *Euphrasia* species are polymorphous and are apt to react to isolation by racial differentiation, scores of partial populations from remote, isolated stations have been described as distinct species.

A much more satisfactory, concise and useful specific and infraspecific hierarchical taxonomy would have been gained if VON WETTSTEIN had not introduced disputable theoretical ideas in practical taxonomy; we would then have been informed about species and their racial development by the simple means of nomenclature.[2]

It must be added here that in phytography no hypotheses and theories should be mixed with

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(1) Unfortunately this concept is used in a quite different (wider) sense in applied botany.

(1) In fact the 'small' species are in recent floras generally treated as subspecies.

(2) If I understand rightly from a review of KOMAROV's principles, explained by him in an essay on specific delimitation in 1940 (*non vidi*), by Dr SHISKIN (37), the present editor of the Flora of the URSS, the procedure of VON WETTSTEIN is followed in that Flora. KOMAROV does not accept the species as a morphological concept but gives it a phylogenetical interpretation. The Flora URSS is thus based on 'Darwinian taxonomy', *i.e.* reflects the natural process of the origin of species by reconstructing the segregation of character complexes. The 'young constant' species, each

factual observation and introduced in descriptions or used for delimitation such as phylogenetical considerations, assumptions on the origin of taxa, *etc.* I will be the last to discourage such deductive, synthetic attempts, but they should be based on the facts and kept clearly separate from these, as DE CANDOLLE pointed out long ago (38, p. 56–59).

* * *

Differences between subspecies may be large or small, many or few, but being essentially partial populations, they 'behave' as specific populations, though the taxonomical weight of the characters is less than that of Linnean populations. TIMOFEEFF-RESSOVSKI (3, p. 100) defines this rightly in saying:—"*Good geographical races differ in a large number of genes* (*from adjacent races*) *most of which cause only very small character-deviations*".

TURESSON has made extensive studies on racial differentiation. He stated (20) that almost all Linnean species show racial differentiation mainly as a response to climate and soil. The majority of his races are regional as he derived his material for study from remote localities of a population. The smallest facies of it he called *ecotypes* which he defined as (transl.) "each random group of closely allied biotypes, which in a certain locality has differentiated from the heterogeneous specific population by the prevailing ecological factors. The linneont represents a large hybridization-complex, parts of which have been secondarily grouped in co-ordinated ecotypes of often very different morphological habit".

He arranged (21) the ecotypes into larger infraspecific units, the *ecospecies* (an assemblage of ecotypes) which, in contrast to the ecotypes, show a distinct geographical replacement. The ecospecies is, therefore, equivalent to a good geographical race, or taxonomical subspecies.

He also arranged the Jordanian *Erophilas* among the ecospecies, as well as races with deviating chromosome number, as these are often morphologically and ecologically distinguishable and occupy a definable area of distribution.

I agree entirely with these views which fit in with taxonomical experience. I also agree that in most cases races are adapted to the local environmental condition. In some cases, this connection is not very distinct. It may be absent, as is demonstrated with the two replacing subspecies of the common tropical littoral plant *Ipomoea pescaprae* which, according to VAN OOSTSTROOM (1, p. 475–477), both occur in Malaysia (one very rare) in exactly the same biotope.

In his monograph of the genus *Evolvulus* VAN OOSTSTROOM (22) has successfully applied the subspecific concept in two ranks, respectively subspecies and variety, the latter, as he told me, in the sense of microsubspecies. BLOEMBERGEN employed it for the genera *Alangium* (23) and *Schima* (24).

In coastal regions inland plants have often racially differentiated a littoral or dune race. An excellent example of that has been described in detail by TURRILL & MARSDEN-JONES (3, p. 63–64) of *Silene cucubalus* and '*S. maritima*'. The latter is the maritime race from exposed situations with condensed habit and pauciflorous inflorescences. "More than a dozen morphological differences, some of which are structural expressions of behaviour differences of selective value, can be enumerated as usually having specific value for diagnostic purposes, yet every one of these is found to 'break down' in some, mostly a few individuals, and this apart from hybridization. Segregation for at least some of the characters approximates a 3:1 ratio. In spite of all breakdowns in single characters, the two species keep essentially distinct, though they have no sterility barrier. Certain characters have a high selective value for certain different habitats in which the species naturally occur". In intermediate situations the two taxa form hybrid swarms and are indistinguishable through their thorough miscibility.

It is a complete mystery to me why in such a clear case of racial differentiation TURRILL accepts the above-mentioned bladder campions as distinct 'species', explaining (32) that merging them as 2 subspecies under one species "would evolve into a classification that could only serve a very limited range of purposes".

The contrary seems to me the case: in merging *S. cucubalus* and *S. maritima* and distinguishing them as subspecies, resp. *S. cucubalus ssp. cucubalus* and *S. cucubalus ssp. maritima*, their nomenclature indicates at once their true status and their relation, and gives exactly the information wanted to anybody who is not acquainted with the Atlantic flora. Ranging them on one footing as species with other *Silenes* makes the whole a heterogeneous assemblage, while ranging them as subspecies approximates a clearer picture of hierarchic taxonomy and fully exposes the available information in the name-giving.

Another argument of weight in favour of the latter procedure is that if we start in raising subspecies to the rank of species, the number of the latter will be multiplied tenfold or more, and this can certainly not serve a useful purpose, as has been explained by CELAKOVSKI (see p. clxxvi a).

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possessing a distributional area of their own, are accepted as distinct species. Closely allied ones are grouped in '*species-series*', which are obviously the equivalent of the polymorphous linneonts, the 'Rotten' of KERNER, and the 'Rassenkreise' of RENSCH.

The consequence of the principle of accepting geographical races as species will necessarily cause an endless number of emendations and will render correlation with adjacent floras difficult or impossible, unless separate keys and descriptions are furnished of the most essential taxa it contains *viz* the 'species-series' corresponding with the linneonts.

Naturally the number of 'species' in the Flora of the URSS, estimated at *c.* 17000, cannot be compared with figures of other Floras which are based on linneonts only.

6. Populatio articulata altitudinalis (fig. 5e)

Much that has been said in the preceding paragraph holds for this type, which refers to racial differentiation in vertical sense, that of altitudinally superposed races.

In the same way as with the regional raciation this type can be easily derived from altitudinal clines. (We must be certain of course that the altitudinal raciation is not phenotypic!)

The origin of a mountain race or ecotype is not difficult to imagine. Let us start with a lowland specific population in which certain combinations (paramorphs) are potentially capable to adapting themselves to a cool climate. This would (likely) be a recessive factor in the lowland. At the base of the mountain or mountains both lowland and potentially such mountain-pre-adapted paramorphs will be present—the latter only occasionally, *cf.* § 1—but this situation will give the latter a chance to 'escape' and reach finally their optimal ecological niche at higher altitude; in this gradual way of sorting out combinations through environment an altitudinal race is born. The new race will gradually 'purify' itself by inbreeding. This is probably an oversimplified picture of what must have taken place in history but contains a plausible explanation of the essence of the process.

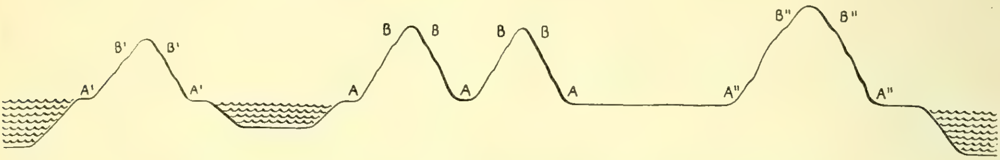

Fig. 6. Scheme of a polymorphous lowland population A, with two regional subspecies A′ and A″, and their derived montane subspecies B, B′, and B″.

This way of origin infers that an altitudinal race *may* have originated in more than one place and at more than one time, *i.e. polytopically*, giving it at the same time a certain degree of variability. Fig. 6.

If the process of altitudinal raciation has taken place not from the same lowland population but from remote partial lowland populations (in fig. 6 A, A′ and A″), the resulting altitudinal ecotypes may differ morphologically and represent several altitudinal races (in fig. 6 B, B′, and B″).

If means of dispersal are sufficient to bridge the gaps between the mountain races B, B′, and B″, it is possible that they will be contaminated through mutual gene exchange, but if their means of dispersal are unable to bridge the gaps between the mountains they will remain genetically isolated.[1]

Theoretically of course polytopic raciation is equally possible in the regional sense, but it will play a special role in altitudinal differentiation because the main factor, temperature, stimulating the racial differentiation of a single species is predominantly the same and the result of its selective effect will be convergent.

Examples of altitudinal raciation are abundant, I mention a few by way of illustration. KERNER gave some examples in *Cytisus* in Europe; MATSUURA (25) studied a dwarf race of *Fritillaria camchatsensis* KER-GAWL. in Japan (differing also in chromosome number). From Java KERN (26) described three distinguishable altitudinally superposed races or subspecies of *Cyperus sanguinolentus*. EXELL (1, p. 539) found a distinct montane subspecies of *Combretum punctatum* BL. in W. Malaysia.

7. Populatio articulata disjuncta (fig. 5a & c)

This is, properly, a variant of types 5 and 6, logically derived from regional and altitudinal replacing races or subspecies, differing in that here the races or subspecies are found spaced (disjunct) from adjacent ones.

Transition zones are consequently lacking. In general these are replaced by some barrier causing the isolation, *e.g.* mountain ranges for lowland plants, lowlands for mountain species, seas for landplants, *etc.*

In many regions of the globe these disjunct occurrences are frequent, and disjunctions are characteristic for island and mountain floras. They are commonly overlooked by botanists who confine their studies to the flora of one island or a very restricted area.

Specially in those cases where the geographical barriers are geologically ancient, these disjunctions are of prominent interest for historic plant geography.

A classical study (taxonomical, genetical, and in the field) on the behaviour of disjunct populations has been in my opinion the work of E. BAUR on *Antirrhinum* § *Antirrhinastrum* (27, 28). About 20 species had been described in this section, most of them local-endemics from SE. Europe and the W. Mediterranean. Their distinction had been the head-ache of taxonomists. BAUR could demonstrate that the representatives of *A. majus s.l.* are split up into local colonies or aggregates (partial populations). The smaller the aggregates, the narrower the polymorphism; increase of polymorphism was found proportional to the size of the colonies. Large aggregates had sometimes segregated them-

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(1) These considerations have been basic to the preparation of my studies on Malaysian mountain plants (9). They have led me to omit in these studies all genera which have representatives in the tropical lowland below 1000 m altitude, and to restrict the study in this way to the purely microtherm genera for which polytopic origin is excluded.

selves into some local facies of minor value. If aggregates were close, contamination of adjacent colonies could be found in places along the borders. There were never two 'species' (as described by taxonomists) together in one colony.

Genetic experiments showed that all representatives were interfertile, F_1 being intermediate, F_2 polymorphous. It appeared further that the small colonies consisted nearly of homozygotous individuals, but the large colonies had many heterozygotous individuals. Finally it appeared that the number of genetic factors involved in the total polymorphism was very much restricted indeed, but could still give a number of habitually very different plants. Taxonomically BAUR accepts but two Linnean species *A. majus* L., consisting of a number of local races or subspecies, and *A. siculum*.

This example shows the difference in the typical behaviour of a disjunct species against one with regional raciation.

The number of possible combinations would be still very large, but BAUR assumes that most of them are not viable in the sense that they are exterminated by selection being not capable of competition; this greatly narrows down the actual number realized in nature.

It appears that among racially differentiated species a disjunct species behaves as an actor; with each new scene he appears in different clothes and make-up (facies of the subspecies) before another *décor* (habitat and ecology), while we cannot observe him changing his clothes. In regionally differentiated species the actor changes his clothes before the public in the transition zones.

The correct specific delimitation of a disjunct species population offers therefore much greater difficulty than the regional subspecies which, if the material is sufficient, will show the transitions.

To attain a satisfactory synthesis of a disjunct species we have to collect circumstantial evidence:

a) By assessing the differential characters through comparison with those of well-established taxa of the same genus.

b) By examining as much material as possible and checking which characters really hold throughout.

c) By comparing regional variability in allied species with a continuous area and trying to realize what picture would evolve if certain parts of this continuum were omitted, *i.e.* 'deductive analogy'.

d) By using, where possible, experimental taxonomical methods.

I admit that in the case of disjunct areas there may remain difference of opinion, but in the majority of cases the circumstantial evidence thus gained will lead to a satisfactory conclusion for assigning specific or infraspecific rank to the disjunct populations.

In the case of *Antirrhinum* one might assume that the disjunctions are at least in part progressive and geologically young or even recent. In many other cases they are ancient. An example of the latter category is for example the *cedar of the Libanon*, which was studied in detail by HOOKER *f.* After a careful study he came to the conclusion that the disjunct populations in Morocco, Algeria, Crete, Cyprus, Libanon, Caucasus, Taurus, Afghanistan, and the Himalayas, have all a different racial facies, some more, others less well pronounced, but that allowing for the distance between the populations and the trivial taxonomical value of these differences, none of them deserves to be classified in the specific rank. In this case it is also very clear that the total area of the cedar is a relict from a former continuous area of distribution which has become disjunct in the course of geological time. It does not require any high degree of extrapolation to imagine that during this very long process the partial populations, surviving in the refuges, and originated from the there prevailing facies of the former ± continuous area, have assumed a local facies through inbreeding and have further undergone the process of prolonged selection (adaptation) following the secular climatic changes which occurred in each locality since the moment(s) of disruption.

As has been remarked before, racial differentiation will be frequent in mountain floras generally and in island floras in particular. And this deserves very careful attention under the archipelagic conditions of the South and West Pacific where large geological disruptions and other changes have undoubtedly taken place in the past.

Within the Malaysian archipelago proper these disjunctions are still relatively not very wide apart, but as soon as populations of Malaysian species are encountered in the Micronesian islands, the Solomons, New Hebrides, Fiji, Samoa, New Zealand, and eventually Polynesia, the density of the partial populations decreases rapidly with simultaneous increase of distances, of prolonged wide isolation, and consequently of taxonomic deviation. Such areas offer the taxonomist great difficulty in specific delimitation, requiring a good background, capacity of synthesis, and regional work, to bring it to a satisfactory conclusion.

Malaysia is the western boundary of a most typical series of disjunctions of subantarctic microtherm plants, of which an example is given in fig. 7 of the cyperaceous *Oreobolus*. There are many dozens of cases of equiformal relict areas.

A typical case of another category is that of *Euphrasia* of which a map has been given in volume one (p. liv). In Malaysia *Euphrasias* occur only above 2100 m on non-volcanic mountains, and form an almost continuous series of stepping stones (as far as they are allowed by topographical conditions) from S. Japan to New Zealand & Fuegia. In a preliminary study DU RIETZ (29) has been able to show that each of these stepping stones possesses a local facies, and that adjacent populations show the greatest similarity. This is justly the state of affairs required by a species segregated into disjunct subspecies.[1] And this is a

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(1) In New Guinea there are some additional good species of *Euphrasia*.

repetition of the segregational tendencies this genus displays in Europe.

Such complete series of stepping stones are naturally rare, as many genera will have been less vigorous or tenacious and adaptable and will not have succeeded in maintaining themselves through the ages on all stepping stones spreading to newly evolving interjacent ones.

Similar tendencies for disjunct segregation are naturally also found in a smaller degree. JACOBS found in the widely distributed malpighiaceous *Aspidopteris timoriensis* (DC.) JUSS. (vol. 5, p. 142, f. 13) in a restricted coherent (archipelagic) area in the W. Pacific specimens differing in indument which character, though trivial taxonomically, has a geographic significance on the frontier of the specific area.

* * *

Plant geography as a check on specific delimitation. In keys to genera and species it is not seldom encountered that authors have found it useful to add an indication of geographical distribution to the morphological characters. This procedure must be strongly discouraged, as it is mixing up two issues of different standing.

In premature or uncritical compilatory regional or revisional censusses keys sometimes start even in dividing species to districts, *e.g.* Asiatic species, African species, *etc.* or, Indian species, Indo-Chinese species, Chinese species, Formosan species, *etc.*

Even if an author has satisfied himself that no species are common to two or more districts or have been entered under two or more districts, the entering of geographical evidence in phytographical keys is to be disapproved on principle.

It tends to defeat morphological distinction and is used consequently mostly in cases where morphological contrasts are feeble or unsatisfactory, as only then there is urgency to use geographical distribution as an additional pseudo-'character'. And for that reason it is not very convincing, and raises suspicion as to the value of the morphological data.

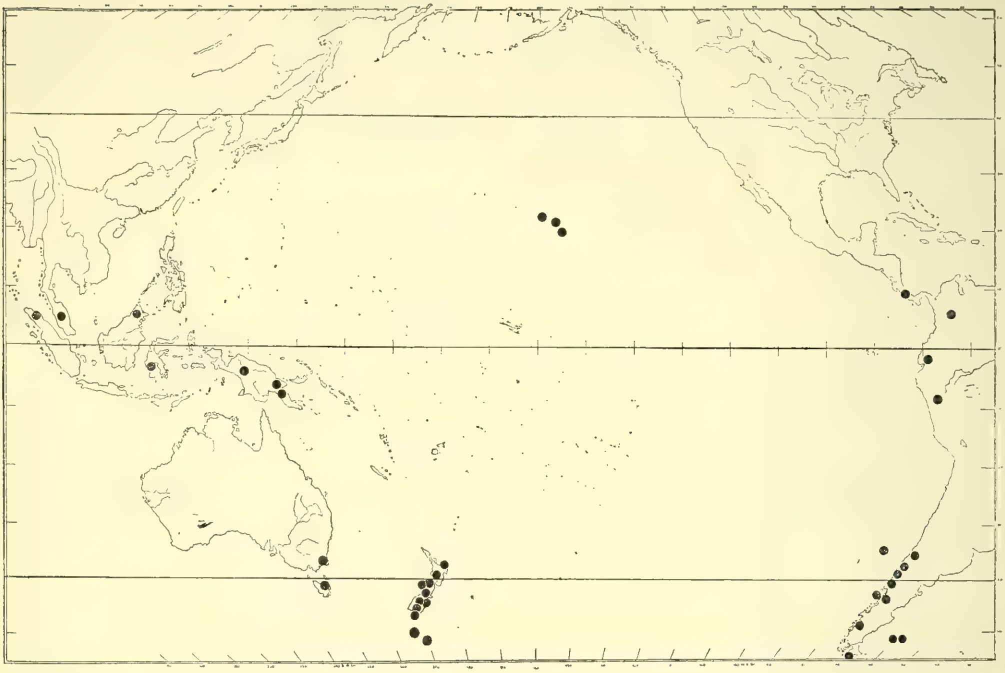

Fig. 7. Area of distribution of *Oreobolus*, a microtherm genus of *Cyperaceae*, in the tropics only on the high, ancient mountains. The number of species is not unanimously agreed on, but is less than 10.

If an author does not stick to sound delimitation on a morphological basis irrespective of geographical distribution, he may easily be misled. Examples to prove this are provided by botanical distinction of mislabelled specimens attributed to wrong countries of origin.

For example MIQUEL described a new species, *Scheuchzeria asiatica*, the second in the genus, on the basis of a specimen said to have been collected in Sumatra. And he actually gave characters for distinguishing it from the holarctic *S. palustris.* He doubtless argued that the Sumatran plants '*could not be conspecific*' with the European species on account of this wide disjunction. Though he, himself, later withdrew the specific distinction, and it has now been proved by the diatom tracer method that the sheets were mislabelled and the actual specimens were collected most probably in Central Europe (33), the fact remains that MIQUEL, for his taxonomical judgement, did not strictly keep to the morphological characters, reserving the plant geographical aspect as a check on the taxonomical work, as should be done. An other example is that of the recording by NELMES (34) of two European *Carices* from Java on the basis of sheets labelled 'Papandajan' collected by RIDLEY. NELMES distinguished them as endemic varieties! We know that among the Java collection of RIDLEY there are many mislabelled plants from different sources (*cf.* vol. 1, p. xxix) and as the species in question have never been recollected by any other botanist in that frequented mountain resort, the circumstantial evidence leads indubitably to accepting them as having been collected in Europe and later mixed by accident with other collections. The too scrutinous examination by NELMES, together with the plant geographically aberrant locality, have led to distinguish taxa which simply do not exist.

These examples show that instead of considering plant distributional data during taxonomical work, geographical considerations should serve as a later check to the phytographical data.

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Concluding this chapter, it has appeared that the pattern of variability displayed by specific populations can have very different aspects.

Setting aside *phenotypic* variability and the *regular* variability (melting pot), our main concern is to consider, for specific delimitation, the tendency of regional differentiation. The *clinal* and *marginal* types will seldom permit drawing demarcations and are consequently not fit for defining infraspecific taxa. The *regional* and *disjunct* types, which are *articulated* populations with or without transition zones between the partial populations, on the other hand are significant for taxonomical distinction on the infraspecific level. If differential characters are very small the races are equivalent to microsubspecies, if they are tolerably important the races are best treated as subspecies.

One might be tempted to treat all distinct disjunct races as vicarious species, but this seems unfair as allowance should be made for the disjunction. The argument that disjunct distinguishable taxa offer no intermediates or transitions seems unreal as Nature itself has prohibited this.

For this reason the taxonomist should give special attention to regional variability and its evaluation in observing for this purpose the four points mentioned before: (*a*) the taxonomical value of the characters concerned, (*b*) the results of a careful checking of their constancy, (*c*) *ditto* of comparing variability in allied continuous species, (*d*) experimental taxonomy.

In itself a **sharp demarcation** *(absence of transitions) of replacing taxa necessitates taxonomic distinction, but the demarcation* **gives no clue to the rank of the taxa,** *unless the complex of differences is so large and further circumstantial evidence (overlapping of areas) so clear that all good taxonomists agree.*

Unfortunately not all taxonomists agree with this thesis. Specially those who seek safety in restricted specific delimitation and are inclined to distinguish small 'homogeneous' species will have objections. They abhor variable species and find that those, who feel in certain cases obliged to accept widely encompassed species, are neglecting the variability patterns and do an injustice to the analysis.

This opinion is, however, entirely erroneous, as I have stressed the necessity to give, where possible and desirable, a concise synthesis of the variability pattern of species, either in notes if it cannot be expressed nomenclaturally (phenotypic, clines, marginal variation), or in distinguishing varieties (non-geographical paramorphs worthy of distinction) or subspecies (regional or disjunct racial differentiation).

There is no reason to suppress anything about variation, *though on the other hand the deductions derived from herbarium material must of necessity be limited and can never enter the field of population analysis.*[1]

An other objection sometimes raised against subordinating racial differentiation on the infraspecific level is a practical issue in that it is admittedly less handy and elegant to have trinomial or even more complicated nomenclatural indications for a certain taxon. But for those who wish to differentiate and in cases where it appears necessary, the infraspecific distinction by name is the single solution.

The slight practical drawback of a trinomial nomenclature (accepting subspecies and varieties) should never dissuade one from making the worthy attempt towards a sound hierarchical synthesis, or stand in the way of a well-founded specific delimitation with subordinated taxa.

The immense gain of the trinomial nomenclature is that it gives a better understanding of mutual hierarchical relations between species and within species immediately recognizable by means of nomenclature.

If in a genus for example 20 species are enumerated they should be of equal rank and not half of them be worthy only of subspecific rank. This

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(1) In certain cases the naming of infraspecific taxa has in my opinion certainly gone too far, as for example in the monograph of *Saxifraga* by IRMSCHER & ENGLER. With this very fine and finest fractioning the taxonomist burdens himself with an increasing responsibility, as distinctness of these taxa decreases with lower rank whereas the chance of intermediates is increasing rapidly. Furthermore it will appear that there are on these fine levels always much more taxa—and intermediates—than assumed by the monographers working on the borderline of population analysis.

For most aims a distinction of species with subspecies and varieties is sufficient.

would destroy the hierarchical structure of taxonomy.

But if I find in a Flora mentioned: *Silene cucubalus* and *S. cucubalus ssp. maritima*, the information supplied by it is clearly that *S. cucubalus* has a littoral race, that this is replacing it, and is miscible with the type race. Contrarily if I find mentioned *S. cucubalus, S. maritima, S. otites, S. conica, etc.*, I assume these are of the same Linnean status, which is a misrepresentation.

De Candolle (38, p. 7) expressed this as follows: —"Confondre certains degrés, par example effacer la distinction des espèces de Linné et des formes qu'il nommait variétés . . . c'est revenir au temps de Tournefort; c'est jeter de la confusion en assimilant des groupes d'une valeur différente".

Huxley (3, p. 36) has rightly concluded:—"*The principle of replacement should, whenever possible, be adopted, thus reducing the number of species while increasing the number of subspecies. Similar principles of ecological or genetic replacement should be reserved for natural groups of the same general nature as species but exhibiting a lower degree of morphological differentiation and/or reproductive isolation*".

As has been said before, botanists working on a restricted area can to some extent be excused: it is clear why they accept sometimes in their area taxa as species which are really races of wider spread species.

But as we know that plants do not keep to political boundaries or local areas, chauvinistic botany, as de Candolle called it (38, p. 13, 53), must be strongly discouraged as it represents a menace towards synthetic attempts, specially in sound specific delimitation.

It is also clear that in very little known or unexplored areas material is sometimes very scarce and extremes have been originally described as species. In the tropics this is still a problem: many species have been, as Merrill expressed himself to me, "optimistically proposed".

It is unclear, however, that there are still professional botanists revising genera, who, after a careful analysis, are not willing or capable to conclude their work and present the result in a satisfactorily framed synthesis.

This is unfortunate as their results will not stand the test of time. They often defend themselves in advancing that the material is not sufficient and that anyhow taxonomic work is tentative in tropical plants. It should be explained here that in the case of replacing and disjunct taxa hardly any or no linking specimens will *ever* be found. Overcautiousness will here not find its recognition or reward in future.

Another category of authors insists intentionally giving binomials to the smallest taxa distinguishable. This procedure is apparently a matter of principle with them. Why they adhere to this undesirable depreciation of universally adopted ranks, seems to be rather a matter of psychology. These same authors will generally also devaluate accepted genera in raising their subgenera or sections to generic rank and follow a similar procedure of splitting for the higher ranks.

There is no advantage in this devaluation, contrarily it brings chaos and by its multiplication of taxa and names causes a detestable confusion, defeating the main principle by which the great Linnaeus made plant taxonomy a branch of botanical science, *viz* that of synthesis.

References:—(*1*) van Steenis, Fl. Mal. I, 4 (1948) xix–xxxix.—(*2*) van Steenis, Bull. Jard. Bot. Gard. Btzg III, 18 (1948) 213–227, fig. 1–2.—(*3*) Huxley (ed.), The New Systematics (1940).—(*4*) Merrill, J. Arn. Arb. 32 (1951) 73–78.—(*5*) Huxley, Nature 142 (1938) 219.—(*6*) Langlet, Svensk. Skogsvärdsför:s Tidskr. 39 (1934).—(*7*) Turesson, Bot. Notiser (1936) 420–437.—(*8*) Vavilov, Z. Ind. Abst. Suppl. 1 (1928).—(*9*) van Steenis, Bull. Jard. Bot. Btzg III, 13 (1934) 135–262, 289–417; 14 (1936) 56–72.—(*10*) Kloos, Ned. Kruidk. Arch. (1925) 226–337.—(*11*) von Wettstein, Ber. Deut. Bot. Ges. 13 (1895) 303–313.—(*12*) Kerner, Die Abhängigkeit der Pflanzengestalt von Klima und Boden (1869) 1–48, map.—(*13*) Marsden-Jones, J. Genet. 23 (1930) 377.—(*14*) Kleinschmidt, Die Formenkreislehre und das Weltwerden des Lebens (1926).—(*15*) Rensch, Das Prinzip geographischer Rassenkreisen und das Problem der Artbildung (1929).—(*16*) von Wettstein, Die Arten der Gattung Gentiana aus der Sektion Endotricha in ihrer entwicklungsgeschichtlicher Zusammenhang (1896).—(*17*) von Wettstein, Grundzüge der geographisch-morphologischen Methode der Pflanzensystematik (1898).—(*18*) Danser, Over de betekenis van de plantengeographie voor de phylogenie en systematiek (1925).—(*19*) Goldschmidt, R., Science n.s. 78 (1933) 539–547.—(*20*) Turesson, Fedde, Rep. 41 (1926) 15–37.—(*21*) Turesson, Hereditas 3 (1922).—(*22*) van Ooststroom, A monograph of the genus Evolvulus (1934).—(*23*) Bloembergen, Bull. Jard. Bot. Btzg III, 16 (1939) 139–235, 10 fig.—(*24*) Bloembergen, Reinwardtia 2 (1952) 133–183, fig. A.-J.—(*25*) Matsuura, J. Fac. Sc. Hokkaido Imp. Univ. V, Bot. 3 (1935) 219–232.—(*26*) Kern, Reinwardtia 3 (1954) 54–59.—(*27*) Backer, Handb. Jav. Theeonkr. (1924) 200.—(*28*) Baur, Z. Ind. Vererb. Abst. 63 (1932) 256–302.—(*29*) du Rietz, Svensk Bot. Tidskr. 25 (1931) 500–542.—(*30*) Schultes, Bot. Mus. Leafl. Harv. Univ. 17 (1955) 1–11, *cum icon.*—(*31*) du Rietz, Svensk Bot. Tidskr. 24 (1930).—(*32*) Turrill, Jahrb. Biol. Inst. Sarajewo 5 (1952) 429.—(*33*) van Steenis, Taxon 5 (1956) 157–158.—(*34*) Nelmes, Reinwardtia 1 (1951) 436–437 (*Carex divulsa* Stokes & *C. pairaei* F. Schultz).—(*35*) Linnaea 16 (1842) 374; *cf.* also Act. Soc. Helv. Sc. Nat. 30 (1845) 75.—(*36*) Kerner, Oesterr. Bot. Z. 15 (1865) 376–377.—(*37*) B.K. Shiskin, Bot. Zurn. 35 (1950) 140–147.—(*38*) A. de Candolle, La phytographie (1880).—(*39*) Grant, Evolution 3 (1949) 82–97; Bot. Rev. 16 (1950) 379–398; El Aliso 2 (1952) 341–360.—(*40*) Hooker *f.* in Hooker *f.* & Thomson, Fl. Indica (1855) 43–46.

4. SPECIFIC POLYMORPHISM AND ADAPTATION CHARACTERS

As has been mentioned before, the degree of polymorphism of a specific population stands, generally, in proportion to the size of its distributional area. This seems to be a causal relation, as potential morphological plasticity (diversity) goes, generally, parallel with ecological plasticity.[1]

It is natural that the environment will act directorially (as an 'adaptational sieve') by the physiographic, edaphic, and biotic conditions it offers.

Whether or not a population can make use of these environmental invitations and will produce fitting species depends of course on the inherent qualities of its genome structure. Specific populations confined to the tropical zone may or may not produce specific or racial combinations with microtherm tolerance.

It has repeatedly been advanced that environmental variation and its secular change has been a distinct stimulus towards the origin of new taxa.[2]

It should be admitted that environmental variety and its secular change is a challenge towards this kind of 'adaptational form-producing variability on the basis of selection', but this influence should not be overestimated, as all depends in last instance on the restrictions ruled by the inherent genome potentialities.

Admitting that a number of families and genera or other taxa have not been challenged by a great variety of environment or by secular changes, it should be realized also that tropical families have had ample challenge in geological time to show their potential capacity, for instance against temperate conditions both in and outside the tropics. A few stray *Zingiberaceae* of the genus *Alpinia* for example have been produced adapted to the subalpine zone up to an altitude of 3400 m, and a few *Schefferas (Aral.)* are even found adapted to the tropical alpine zone at 4000 m, where they make a singular out-of-the-way looking element with their large leaves in the microphyllous dwarf-scrub characteristic for these lofty heights.

This is already suggestive of the fact that the effect of environmental adaptation is very often not recognizable in the outward appearance or morphological characters. Local and racial differentiation in *Mahonia napaulensis* for example was based on minor differences of the length ratio of

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(1) The same observation on specific populations is *mutatis mutandis* applicable to specific differentiation within a genus. Large genera exhibit both a large degree of morphological differentiation and ecological capacities, in that they have produced representatives for a great number of ecological niches. In the genus *Ficus* for example there are epiphytic and terrestrial species, herbaceous and ligneous ones, lianas and trees, both species participating in the substages and in the main canopy; some are cauliflorous others not; the majority belongs to the everwet tropics but representatives are found in seasonal tropics; some are evergreen, others are leaf-shedding; a few occur even in rather arid parts of the subtropics; in the tropics some representatives are adapted specially to swamps, others to craters, to gravel-beds of running streams, *etc.* A similarly large 'adaptability' is found in other large genera as for example *Eugenia*, *Acacia*, *Euphorbia*, *Pandanus*, *etc.;* the structural plan of these genera offers apparently opportunity for the origin of a multitude of viable specific variations.

(2) Stebbins (1) accepts this as one of the most important 'mechanisms' of 'evolution' (in treating aridity). In my opinion it should not be overestimated. The everwet tropics, which have produced by far the largest portion of the morphological diversity of the world's flora, are relatively exceedingly monotonous in climatic conditions and secular changes. Notwithstanding that, they possess a great number of very large families and genera, as the *Araceae*, *Myristicaceae*, *Dipterocarpaceae*, *Orchidaceae*, *Rubiaceae*, *Zingiberaceae*, *Euphorbiaceae*, *Annonaceae*, *Sapotaceae*, *etc.*, *etc.*, several of which are practically confined to these monotonous everwet conditions and have been so in the past. *Annonaceae* and *Myristicaceae* for example belong for their major part even only to a single biotope of the everwet rain-forest, *viz* the substage. But both families are extraordinarily rich in species; *Annonaceae* possess numerous genera and according to Diels (2) all structural diversity potentially possible with extant generic characters have been realized in viable constellations nowadays. *We are forced to the conclusion that such families have had an autonomous structural evolution (in the sense of development of viable combinations) n'en déplaise the monotonous environment.*

Manton (3, p. 283) is of opinion that changes of climate have brought about numerous cases of polyploid species.

Both rather sudden and secular climatic changes (desiccation periods, pluvial periods, ice ages, *etc.*) have certainly been instrumental in the origin of new forms but there is undue neglect of autonomous evolution (change) in the plant kingdom and overestimation of 'adaptation'.

I cannot refrain from the idea long ago worked out by von Naegeli (4) and a few years ago alluded to by myself (5) that under monotonous environmental conditions evolution would also have taken place. Arguments for this can be derived from the marine flora, freshwater plants, and the everwet, tropical rain-forest. It seems plausible to me that the challenge of changing environment has led to orthogenesis in various directions but starting on a matrix of inherent, biochemical autonomous development and that 'adaptation' resulted in and gave impetus to a number of side-issues of a causal pattern with inherent 'stimulant' rather than being the cause or single stimulant itself.

pedicels and bracts, shape of the stipules, number of the jugae, *etc. Scirpus fluitans* L. is comparatively extremely uniform over an enormous area from Europe to Australia, but is in Sumatra replaced by a distinct taxon, in exactly the same biotope, of exactly the same habit, differing only in a few inconspicuous floral characters; for our reasoning it is irrelevant in this respect whether these differences are classified as specific or subspecific, as in both cases there is no sign whatever of the presence of environmental survival value. *Anemone rivularis* HAM., a widely distributed species in SE. Asia, is represented in the same biotope in N. Sumatra with a form differing by distinctly longer petioled leaf-segments, which are mostly sessile in the mainland population. The adaptational value of this marginal variation is difficult to envisage. The widely holarctic distributed *Drosera rotundifolia* L. has been found in a remote, disjunct locality, *viz* mountain peat swamps in New Guinea, under conditions that could exactly be expected. The only differential character of this microsubspecies is the persistence and size of the bracts, a character defeating the idea about adaptational value.

References:—(*1*) STEBBINS, Am. Natur. 86 (1952) 33–44.—(*2*) DIELS, Sitz. Ber. Preuss. Ak. Wiss. Berlin B 11 (1932) 77–85.—(*3*) MANTON, Problems of cytology and evolution in the Pteridophytes (1950).—(*4*) VON NAEGELI, Mechanisch-physiologische Theorie der Abstammungslehre (1884).—(*5*) VAN STEENIS, Mono-moleculair genoom (1951).

5. ANTHROPOGENOUS INFLUENCE IN CONNECTION WITH SPECIFIC DELIMITATION

In a span of time which by our human concepts is long and ancient, but quite recent by the geological time-table, man has, through fire, cattle-breeding, agriculture, transport, war, *etc.*, upset the balance of primitive nature nearly everywhere.

Specially during the last few tens of thousands of years this attack on nature has tremendously increased in intensity, and in many regions, presumably most so in the northern hemisphere, primitive nature has to various degrees been converted anthropogenically into, or replaced by, artificial or semi-artificial vegetation types. As a result, in such places both the primitive fauna and flora have undergone essential changes.

Two new categories of plants have come to the fore or have increased in abundance respectively, *viz* the *cultigens* and *ruderals*, as by-products of human occupation. They live by the grace of man, intentionally or unintentionally. The majority of them have originated by or have undergone selection and are confined to the steadily increasing surface of anthropogenically influenced country.

This chapter will deal with the ruderals, leaving it subject of chapter 6 to survey the cultigens.

Selection operated on both ecological and morphological characters of survival value of the ruderals and adventives.

Such features are for example: wide edaphical and climatical tolerance (eurytopy), a short life-cycle with rapid ripening of seeds, harmonious balance with human methods of transport and rhythm of agricultural methods (weeding, harvesting, winnowing, *etc.*), longevity and structure of diaspores, *etc.*

In comparison with primitive nature enormous surfaces became available for nomad plants (see p. cc), offering opportunity for an enormous increase of individuals and manifestation of paramorphs in the new 'battle-field' for survival, *viz* adaptation to human occupation and competition under anthropogenous circumstances.

A predominant factor in the development ('evolution') of the nomad plants must have been the genetical isolation. They escaped from small populations in primitive nature to become aliens, often in places where no genetic contact was possible with the ancestral population. This *diaspora* may have happened also exceptionally under primitive conditions in cases of long-distance dispersal (which can at least theoretically not be denied).

Aliens may behave as distinct taxa in foreign countries. I described the case of *Turnera ulmifolia* L. in Malaysia (1), two forms of which occur there, *viz T. ulmifolia* L. *sens. str.* and *T. subulata* J.SM. *(syn. T. trioniflora* SIMS*)*. In Malaysia these two taxa behave as good species and differ in many morphological characters and ecological behaviour. They occur cultivated side by side in the Botanic Gardens, Bogor, but remain perfectly constant. Both show a very narrow range of variability in Malaysia. The monographer of the family *Turneraceae*, I. URBAN, considered them to represent varieties of the polymorphous species *T. ulmifolia* L. *sens. lat.* with numerous other forms in the native country, the West Indies (2). And a superficial inspection at Kew of these forms confirmed this opinion: the gap between the two forms, which are so distinct in Java, appears to be filled by all kinds of intermediary forms in the New World tropics. If these intermediary forms had also been introduced into Malaysia, the judgement of the botanist in Java would have been quite different from what it is now. And this shows how a local botanist may err in his estimate when performing local revisional work!

In the case of the *Turneras* just mentioned both Javanese forms can be matched more or less in the West Indian populations. There are a number of worldwide distributed aliens which have, however, never been collected in more or less natural vegetation in their home country.

With the Spanish galleons of the trade route from Acapulco in W. Mexico via Guam to the Philippines, a post-Columbian trans-Pacific line maintained from 1565 to 1815, numerous aliens have been brought to the Philippines. A certain number has established itself; some are still local, other spread widely. According to MERRILL (3) several have never been (exactly) matched by American congeners, *e.g. Kosteletzkya batacensis* (BLCO) F.–VILL., and *Prosopis vidaliana* NAVES.[1] Among them is also *Elephantopus scaber* L., a not very variable, extremely common species which has doubtless been imported from America in post-Columbian time, but is not matched by a native American species; it is said to be now adventive in America itself!

A comparable case is found in Europe with the doubtless man-introduced *Oenotheras;* in Europe several local forms have developed which have never been found in America, according to RENNER (4).

In these cases the fact that the partial populations are morphologically and geographically definable has induced taxonomists to keep the adventive taxon specifically distinct, though it is in the majority of cases basically doubtless a racial derivative of a part of the potential polymorphism of an American species. It owes its origin probably to one or a few paramorphs whose progeny was purified through the effect of isolation giving rise to a rather homogeneous subspecific taxon not easily to be exactly matched in the original population of the ancestral species. Generally the polymorphism of the alien race is far more restricted than that of the species from which it has been derived. Taxonomists applying a narrow species delimitation will naturally keep them as distinct species, a rank which they certainly do not deserve. An example of a widely distributed, common Malaysian ruderal which has never given difficulties for delimitation is *Cyathula prostrata* (L.) BL. The constancy of its characters is in the Philippines locally disturbed by the occurrence of a remarkably narrow-leaved, dwarf form which has been described as a separate species; as the deviation concerns merely vegetative characters BACKER assigned it varietal rank (*cf.* vol. 1, p. 83).

The majority of cereal weeds belong to this group of ruderals and adventives which through their genetical isolation can maintain themselves as constant races in human cultures. They cling to the cereals as fleas to the dog. They are entirely adapted to the life-cycle of the cereal and its management by man, and their characters, ecologically and morphologically, show the traces of the selective effect of their habitat. Therefore their characters show a remarkable parallelism, *inter se* with that of their cultigen host.

THELLUNG has in several studies (5, 6) given an analysis of the characters peculiar and common to segetal races. Of *Polygonum lapathifolium ssp. linicola*, a ruderal confined to flax fields, he mentions for example the rudimentary nature of the articulation of the fruiting pedicel, causing the fruit to be persistent and be harvested together with the flax; besides, the habit of this ruderal *Polygonum* is very slender and resembling that of flax, and its fruits imitate in shape and size those of flax. This combination of characters enables the *Polygonum* to remain a constant segetal companion of flax, fitting with its culture scheme; see also DANSER (7).

Sometimes the seeds of the segetals are larger than those of the primary wild population, imitating those of the cultivated crop. In *Alecterolophus* the primary wild population has marginally winged seeds, but the segetal race lacks the marginal wing and thus fits with the smooth seed of the cultivated plant. It is clear that this segetal has been derived secondarily from the wild population and that only the progeny of specimens with unwinged seed have been able to develop into a segetal race. But it is difficult to trace such specimens in the wild population, where unwinged seeds are distinctly rare!

THELLUNG pointed out (6) that the unintentional selective acivity by man has worked in many cases along parallel lines, both in ruderals and in the cultivated plants themselves. In some cases it seems even that segetal-adapted grasses have gradually replaced the original cereal becoming themselves a cultivated cereal.

It is quite possible that among the exclusively segetal plants some taxa have or deserve the status of a Linnean species for which it is not directly evident what has been their ancestral stock. The latter may be extinct.

Bromus arduennensis is a typical 'endemic' segetal from W. Europe bound to the cultivation of spelt *(Triticum spelta)*; it is rarely found in Belgium, S. Neth. Limburg and N. France. According to CUGNAC (8) *Bromus grossus* belongs in the same category, inhabiting a similar but larger area. *Silene linicola* is a segetal bound to flax cultures, as is the flax parasite *Cuscuta epilinum.* The latter has always been accepted as a good Linnean species; it may have been parasitic on the ancestor of the cultivated flax.

In connection with the Australian flora BENTHAM pointed out long ago "that the geographical station of a waif or colonist imposes variations upon it almost from the moment of its arrival". DE VRIES remarked (9) "that the initial stages of new species will be found most easily in luxuriant alien vegetations".

I have been interested in the problem of the origin of ruderals in connection with the origin of the Malaysian mountain flora (10) and with the vegetation types of Malaysia (11); in this Flora I have formerly touched the subject in a brief way (12).

Some of the ruderals just mentioned may have been native of the primitive flora in which they were probably scarce. They were suppressed by the forest vegetation which left them only opportunity in occasional small habitats (biotopes) which were non-forested by natural causes. With the advent of man these suppressed plants got the chance of their life to extend their range in the anthropogenically opened areas in which they multiplied on

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(1) This has been reduced by some authors to *P. juliflora* DC.

a gigantic scale and could disperse easily far beyond their original home. A small number may have lacked sufficient potentialities to adapt themselves to anthropogenic habitats; those which possessed a wide potential capacity of polymorphism were naturally most successful and were modified into wayside ruderals, segetals, *etc.*, through selection on the basis of tolerance to fit the new environment (scheme and rhythm of cultivated crops).

This process of development of migrating species has not only occurred with the steppe plants of Eurasia, but has also occurred in the tropical forests in which there is an enormous number of potential arboreous ruderals which under primitive conditions occupy the rare open places. They live on the 'margin' of the forest, but act as pioneers of the secondary forest (parang, blukar) wherever the forest shows open gaps, irrelevant of the cause of these gaps. These arboreous ruderals are all heliophilous, generally short-lived, rapid growing species. The anthropogenous destruction has offered them an enormous expansion of the area which fits the ecology of these '*nomad plants*' as I have called them (13).

Besides the above-mentioned shift in nomad plant-populations and origin of infraspecific differentiation within these populations, an other consequence of the anthropogenous opening of the plant cover of the world has been the new contacts between populations which were separated in the balanced primitive vegetation. And this has been obviously instrumental in the formation of good, new species. It is very probable that the origin of *Galeopsis tetrahit* in Europe as an allotetraploid hybrid between *G. pubescens* and *G. speciosa* has been due to, or obviously favoured by, the anthropogenous shifts of the vegetation. The origin of *Spartina townsendii*, presumably a similar allotetraploid hybrid between the American-introduced *S. alterniflora* and the European *S. stricta*, which according to TURRILL (14) answers to every test for a species, belongs in this same class of recently evolved new species.

Recent research has added to circumstantial evidence towards the assumption that this class of very recent new species *(neo-endemics)* is of much larger magnitude than formerly imagined and offers a welcome explanation for the long known fact that several genera show a remarkable polymorphism in anthropogenic vegetation.

North American taxonomists are apparently unanimously of opinion that the destruction of the primitive forests has greatly upset the ecological and genetical balance of the populations of primitive vegetation, shaking and interlacing them, causing great trouble and confusion for the taxonomist who is now often at a loss with their systematic evaluation.

MARIE-VICTORIN wrote (15):—"that it seems then safe to assume that the great development of the genus *Crataegus* in north-eastern America, and particularly in the St Lawrence Valley, is the immediate result of the ecological upset brought in by deforestation and settling of the land. This suggests a very important biological generalization, namely that, under favourable circumstances, a period of two hundred or three hundred years is sufficient to produce in some genera, by mutation or otherwise, a marvellous array of species".

TURRILL (16) wrote on this subject:—"Taxonomic difficulties met with in the Mediterranean flora in certain genera as *Dianthus*, *Silene*, *Thymus*, *Centaurea*, *Asperula*, *Verbascum*, *Veronica*, are due, at least in part, to the opening of new habitats by man through forest destruction, the consequent spread in range of taxa adapted (or pre-adapted) to such habitats, the meeting of taxa previously isolated, and hybridization. Similar situations occur in tropical Africa outside the rain-forest areas". He accepts the recent origin of neo-endemic taxa. See also LÉONARD (22).

A similar state of affairs has been reported from Australia outside the rain-forest. In the former century BENTHAM and F. VON MUELLER have described several hundreds of species in the genus *Eucalyptus*. This colossal array has been supplemented later by MAIDEN, BLAKELY, and others, with again some hundreds. It has appeared, however, that the majority of former species represent good species with distinct areas of distribution, whereas contrarily a great percentage of the later described ones have not been retraced, are often exceedingly local, and represent frequently hybrids or specimens from later heterogeneous generations of their progeny mostly found in partly deforested areas. This is the subject of studies by Mr L. D. PRYOR at Canberra (17). Similar results are obtained with *Eucalyptus* in Tasmania by Mr R. G. BRETT (21). In New Zealand COCKAYNE and H. H. ALLAN, stimulated by LOTSY, have made extensive studies on hybridism in the New Zealand flora. COCKAYNE (18) found hybrids specially conspicuous "where man has altered the balance of nature and where he is bringing together parental species in greater numbers than in primeval New Zealand". ALLAN (19) has been able to demonstrate that a number of recognized species merely represented F_1 hybrids and that in several genera *(e.g. Coprosma, Hebe, Melicope, etc.)* hybrid swarms are found between 'species' which appear entirely miscible. Sometimes partial populations of these progenies have become isolated and the effects of inbreeding after introgression may offer serious difficulties in attempts towards specific delimitation. Recently ALLAN (20) has given a survey of observations on the origin of new forms after disturbance of naturally balanced vegetation.

It is clear that the increasing influence of man on vegetation will be essential for specific delimitation. In certain groups the more or less static, original balance in primitive nature has gone astray and is stimulated towards a new course[1].

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(1) This holds naturally also for the fauna, the opened, new environments permitting free passage of pollinators and stimulating the origin of new pollinators for 'new' plant species. The interaction between the flora and its pollinators is thus reshuffled.

This shift caused by man has not been unique in the history of the plant world. During the course of the geological history of the globe destruction of vegetation with following shifts in vegetation comparable in magnitude must have regularly played havoc with populations. *Regressions* and *transgressions* have been instrumental in transporting populations or reducing them. *Ice ages* have caused enormous latitudinal population shifts in temperate and warm-temperate regions; sometimes components were able to 'escape' along N–S mountain ranges or land connections to lesser latitude. In other cases W–E ranges prohibited migration and floras were consequently crushed by advancing ice masses and became extinct, or some species survived in a few non-glaciated 'nunatak' refuges serving as *foci* for later diffusion at the end of the Ice Age.

Desiccation periods must have had comparable grand-scale migrational effects. *Orogenetic movements* of the earth's crust with following peneplainization must have been big stimulants towards the origin of new taxa or bringing into contact remote ones. Finally, there have been great changes in the *distribution of land and sea* during the course of geological history: some continental areas have obviously crumbled, leaving fragmentary islands with a relict flora as signs of their former existence.

All these phenomena of great magnitude have, during the course of the geological history of the earth, been active towards shifts of species populations. The 'regularities' found in specific segregation and species affinities add often to circumstantial evidence towards a reconstruction of these geological changes.

It can easily be imagined that through new genetical contacts of isolated populations secondary centres of speciation must have been formed by recombination. Partial populations got other aspects through the effects of selection and genetic isolation. In the South Pacific theatre, the crumbling of the ancient subantarctic continent must have been the scene of extinction as well as of speciation, and of tearing apart populations under varying environmental conditions. Not less spectacular must have been the fate of the tropical Gondwana Land populations in the area from Madagascar through the northern part of the Indian Ocean to New Guinea. These shifts are still reflected in the plant-geographical relations of living populations and are no mere academic speculations. The remarkable orderliness found in plant-geographical analysis (equiform and equiecologic areas) furnishes evidence almost amounting to proof of a history as roughly alluded to above.

It is, hence, permissable to assume that specific populations have been subject to environmental change in multifarious ways in geologic history and that the taxonomist must be on the alert to keep these considerations in mind in evaluating taxa in general and species in particular.

References:—(*1*) van Steenis, Trop. Natuur 20 (1931) 227–231, fig. 1–3, see also Fl. Mal. I, 4, p. 236.—(*2*) Urban, Jahrb. Bot. Gard. Berl.-Dahl. 2 (1881) 138–144.—(*3*) Merrill, Philip. J. Sc. 7 (1912) Bot. 145–208.—(*4*) Renner, Flora 131 (1937) 182–226.—(*5*) Thellung, Bot. Jahrb. 53 (1915) Beibl. 116, p. 37–66.—(*6*) Thellung, Veröff. Geobot. Inst. Rübel 3 (1925) 745–762.—(*7*) Danser, Ned. Kruidk. Arch. (1931) 100–125.—(*8*) Cugnac, Bull. Mens. Soc. Sc. Nancy n.s. 9 bis (1938) 121.—(*9*) de Vries, Veröff. Geob. Inst. Rübel 3 (1925) 567–570.—(10) van Steenis, Bull. Jard. Bot. Btzg. III, 13 (1935) 358–385, specially p. 366–369.—(*11*) van Steenis, Tijdschr. Kon. Ned. Aardr. Gen. II, 52 (1935) 188–189.—(*12*) van Steenis, Fl. Mal. I, 4 (1949) xl–xli, lxv–lxvi.—(*13*) van Steenis, Vakbl. Biol. 36 (1956) 165–173.—(*14*) Turrill, Kew Bull. (1932) 46.—(*15*) Marie-Victorin, J. Bot. 68 (1930) 165.—(*16*) Turrill, J. Ecol. 30 (1951) 205–227.—(*17*) Pryor, Proc. Linn. Soc. N.S.W. 75–78 (1950–1953).—(*18*) Cockayne, Act. For. Fenn. 34: 3 (1929) 1–23.—(*19*) Cockayne & Allan, J. Ecol. 15 (1927) 234–277.—(*20*) Allan, Bot. Rev. 3 (1937) 593–615; *ibid.* 15 (1949) 77–105, specially p. 92–94!—(*21*) Brett, Pap. & Proc. R. Soc. Tasmania for 1937 (1938) 75–109, t. 15–17.—(*22*) Léonard, Webbia 11 (1951) 397–401.

6. SPECIFIC DELIMITATION IN CULTIVATED PLANTS

I entirely agree with Turrill (1) who stated that:—"There is of course no sharp line between wild and cultivated plants and no reason for believing that many, perhaps most, of the results obtained with garden plants cannot or do not occur also in the wild. There are, however, certain differences in detail and in emphasis. Isolation and selection are different in kind and degree. Competition is generally greatly reduced. The phenomena of natural selection are absent. Conditions are controlled and kept near optium or, at least, extremes are reduced. Possibilities of hybridization are changed, and either increased or prevented. Diseases and pests are more or less artificially controlled. Barriers between species which are valid in nature may be broken down under conditions of cultivation; mutations may survive which cannot survive in the wild; extremes of plasticity may appear that are greater than those occurring in nature. The use of all facts garnered under such conditions, is, however, different from the 'wild' and they must be used rather by analogy than directly".

We can certainly agree with Tanaka (2) that among cultigens there may be good species; although they have not evolved in nature but have originated artificially, they obviously represent viable combinations within the potentialities of a certain genus. Reversely it should be considered that the ruderals and other species originated through anthropogenous action and bound to human life have evolved in the wild but their majority equally did not form part of primitive nature.

The aim of the taxonomist is in the first place to study natural species and their delimitation. The number of artificial vegetable creations is endless, their origin mostly obscure, and their classification serves other aims than those of the taxonomist. Further, cultigens contain in proportion an exceptionally high percentage of apomicts, hybrids and their progeny, as well as polyploids, and these groups withdraw themselves, both in nature and in cultivation, from the capacity of normal taxonomic classification and satisfactory specific delimitation.

When trying to classify cultivated plants the taxonomist's outlook is no longer unpreoccupied and practice learns that he is generally inclined or forced to yield to practices which would not be acceptable in revisions dealing with wild populations. Practice has definite demands towards efficiency: long formulas for names are undesirable, short formulas, if possible binomial, are preferred, even for clones and pure lines.

This has led to a host of binomials for cultivated plants, though it is clear that they do not deserve specific rank from a taxonomical point of view. *Sorghums* certainly do not deserve the rank of botanical species but dozens have been distinguished in this way.

The raising of varieties and races and other kinds of *convivia*[1] to specific rank for convenience entails naturally a devaluation of the higher ranks; consequently *Sorghum* is treated as a separate genus though it is very doubtful whether it deserves that status. In the *Gramineae*[2], *Orchidaceae*, and some other families containing commercial plants, many subgenera and sections have been raised to generic level, a procedure mostly induced by reasons of convenience, not by scientific urgency.[3]

Besides, the issue of a new specific name has, as O. SCHWARZ (3) rightly remarked, both in agriculture and horticulture not infrequently a commercial significance, a lamentable circumstance prohibiting a free judgement for the specific delimitation.

It is to be regretted that the great human interest specially from laymen in taxonomy (breeders, horticulturists, agriculturists, foresters, and amateur botanists), who insist on a convenient, preferably binomial, name-giving for their plants of whatever source, has in many cases induced taxonomists to yield towards this pressure emanating from applied botany. This yield is principally militating against the basic principles of scientific classification.[1]

It is not for scientific reasons that cultivated rice, *Oryza sativa* L., is kept specifically distinct from *O. fatua* KOEN. from which it is only distinguished by its edibility and the fact that the spikelets do not fall when ripe. Both qualities and eventually others are distinctly due to selection by man who, starting from certain ephemeral variants (paramorphs) occasionally found in nature, has been able to obtain the present cultigens by the process of selection and breeding. The same holds for the origin of many other cereals.

In 1925 THELLUNG (7) has given an interesting account of the origin of cultigen-qualities in ruderals and assumes that in several cases the ancestors of present cereals were originally weeds in fields of cereals later no longer used. By adaptation to management of fields these ancestors underwent the same process of selection and have gradually gained predominance over the ancient cereals. He found a number of man-adapted characters common to these weeds and has shown a comparable parallel, homologous variation in cultigens.

The fact that in most Floras cultigens have often nomenclaturally been assigned to a higher taxonomic rank than they deserve for scientific reasons, is in first instance due to the fact that they appear and remain constantly different from the wild plants.

There are, however, no more scientific reasons to accept specific delimitation between *Oryza sativa* and *Oryza fatua*, than between *Beta maritima* and *Beta vulgaris*, or *Setaria italica* and *Setaria viridis*, or to give specific rank to *Saccharum officinarum*. These are only a few examples out of a multitude which could be advanced.

Domestication of plants has advanced to different degree in different plants: there is a distinct gradation. According to DANSER *Fagopyrum esculentum* differs only slightly from its wild ancestor, and if it could be adapted by breeding to suit

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(1) *Convivium* is the convenient term, with which DANSER (6) defines any partial specific population or group of individuals which is more or less distinguishable (morphologically or ecologically) and maintains itself through isolation (of whatever source). The concept therefore covers all ecotypes, races, *etc.* By definition all convivia of one species are miscible.

(2) In contrast with *Cyperaceae* in which useful plants are scarce.

(3) A similar devaluation of the ranks for convenience serving practical aims is found in the nomenclature of insects, fungi, bacteria, and all other groups which stand in the focus of practical attention.

(1) It should be emphasized that it is not my intention to attempt to dispute the advantages of a simple nomenclature for practical aims; refined distinctions of very small taxa are eminent in many fields of practical research where great issues are at stake for human civilization. My principal aim here is to show that for scientific taxonomy the possession of a binomial does not warrant these small taxa to belong to the specific level. It is also for this reason that recently the general term *cultivar* has been proposed to designate such infraspecific cultigens classified on one artificial level within a species. A comparable term *cultispec* might eventually be adopted to serve to indicate cultigens supposed worthy to be classified on the specific level.

efficient harvesting methods it might well become a first class food plant on poor soils in the northern hemisphere. Unfortunately its genome contains, as far as known, no suitable potentialities for this adaptation.

On the other end of the domestication series there are taxa which, obviously through hybridization, selection, and domestication, have become so widely different from their ancestors, or of which no ancestors can any longer be designated, that they deserve specific[1] or even generic rank, as for example *Zea mais*. THELLUNG (*7*) mentions several examples of this category, *e.g. Ricinus communis*, *Euphorbia lathyrus*, *Capsicum annuum*, *Cucurbita moschata*, *Carthamus tinctorius*, *Sechium edule*.[2]

If they were left to themselves the truly domesticated plants would for the greater part disappear or in some cases through regression return to the ancestral form.

The study of cultigens illustrates again for the taxonomist the unexpectedly wide range of potential variability in certain species which becomes manifest through selection, breeding, isolation, and hybridization. And it should be understood that the development of cultigens, which is directed only to usefulness for man, realizes only a portion of the potential variability reserve. Trends of breeding towards many other goals can be imagined. HUDSON (4) gave a tolerable review of genetics in its application to plant breeding (1937) and its implications on the specificity in cultivated plants.

In nature the same range of variability or polymorphism is potentially present, and doubtless many deviating paramorphs occur occasionally by random chance. It is not a far-fetched idea that such occasional deviations have in many cases been picked and preserved by man and have served as the original stock of domesticated plants. In nature their appearance is ephemeral as they generally lack the robust vitality and agressive characters necessary in the struggle for existence by environmental natural selection.

For the plant breeder and geneticist it is of essential value to have a profound knowledge of the wild population of the species and of its nearest congeners in the native country. Many cultigens have been bred from relatively few individuals or imports and these contain of course only a part of the potentialities of the native panmictic population. Once bred for a long time a cultigen naturally tends to decrease in potential polymorphism and attains a certain stage in which further breeding does not give satisfactory results. Breeders will then turn to the reserve of potentialities in the native country and try to add to the potentialities of the cultigen.

It is worthy to mention the opinion of VAVILOV (1, p. 7, 550), one of the prominent plant breeders and geneticists of this century, on the significance of the study of cultivated plants with regard to specific delimitation. He says:—"that the intensive studies of cultivated plants and their relatives sometimes made it necessary to postulate large, Linnean species. We are coming to the concept of a Linnean species as a definite, discrete, dynamic system differentiated into geographical and ecological types and comprising sometimes an enormous number of varieties".

My former colleague at Bogor, Dr H. J. TOXOPEUS, a geneticist and plant breeder, who studied various tropical plants *(Citrus*, *Derris*, *clove*, *kapok*, *etc.)* which I alluded to in my concise essay on the origin of Malaysian cultigens (5) came to a similar conclusion in accepting a Linnean specific concept. Both Indian-Malaysian kapok and Zanzibar clove have never been (re-)collected from wild populations in their native country, though at least the latter was certainly a post-Columbian introduction; of both the native ancestor is known with certainty. Cultigens share this rapid adaption of a new facies outside the native country with ruderals (see p. cxcix b).

References:—(*1*) TURRILL in Huxley (ed.), The new Systematics (1940) 60–61.—(*2*) TANAKA, Species problem in Citrus. Tokyo 1954.—(*3*) O. SCHWARZ, Monogr. Gatt. Cyclamen, in Fedde, Rep. 58 (1955) 234–283.—(*4*) HUDSON, Biol. Rev. (Cambridge) 12 (1937) 285–319.—(*5*) VAN STEENIS, Fl. Mal. I, 4 (1949) lxvi–lxviii.—(*6*) DANSER, Genetica 11 (1929) 403, 417.—(*7*) THELLUNG, Veröff. Geobot. Inst. Rübel 3 (1925) 745–762.

7. HYBRIDIZATION, MISCIBILITY, AND SPECIFIC DELIMITATION

Taxonomy, experimental taxonomy, and genetics form together the discipline of taxonomy in the wider sense. In this sequence taxonomy proper is mainly concerned with the morphological grouping of organisms starting with the largest groups towards the specific level, while genetics starts at the other end of the line from the smallest hereditary units to the specific level. The field where they touch, is examined through experimental taxonomy by both geneticists and taxonomists, blending taxonomy and genetics into one whole.

Though genetics and experimental taxonomy have in the past mostly been excluded from proper taxonomy, the occurrence of specific hybrids has of old attracted the vivid interest of taxonomic botanists, and has particularly been the focus of attention of those who included field knowledge in their research. The presence or absence of sterile

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(1) A few examples of the Malaysian tropics are plants used in betel chewing: *Areca catechu*, *Piper betle*, & *Uncaria gambir*, further *Artocarpus heterophyllus* (nangka); there are scores of others.

(2) Whether *Ginkgo biloba* and *Tamarindus indica* are domesticated to some degree is unknown; of the latter monsoon tree the native country is uncertain; it grows 'wild' from Africa to Timor.

intermediate hybrids has provided, and still provides, for most a valued additional argument in judging the status of two different taxa.

In this century a considerable interest has been given to the weight which should be given to hybridization and miscibility of taxa, as this has an essential bearing on the concept of specific delimitation, *although it should be admitted at once that it is out of question that all taxa can ever be experimentally examined and tested in this respect.* It is even impossible that all individuals of one specific population can be investigated experimentally. A comparatively minute number of selected individual specimens is assumed to be representative and the results with these are regarded as decisive for the entire population.

Research has mostly been performed on herbaceous plants; besides the total number of taxa is so large and research should be so elaborate to gain trustworthy results that it is an illusion to expect more from this field of work than samplings. These practical limitations entail the danger of coming to conclusions which have not been verified with the bulk of the material and may contain only part of the truth.

I do not intend to give here a complete survey of all opinions, often conflicting, advanced on this subject which is, next to infraspecific variability, the most important facet of this essay. I have merely referred to certain important references representative of certain lines of research or reasoning.

Already in the 18th century taxonomists attached great importance to the breeding true of taxa and this shy beginning of experimental taxonomy has always been considered an argument if it could be examined. JOHN RAY, for example, mentioned of a variety of the broom—a prostrate, hairy form adapted to wind-swept coastal areas—an ecotype now known as *Cytisus scoparius* LINK *var. prostratus*, that it was *distincta propagatio ex semine*, a statement obviously derived from breeding it.

The knowledge about hybrids was gradually accumulating in the 18th century and KÖLREUTER (1733–1806) who made, between 1759 and 1790, a fantastic number of experiments, was convinced that a test to the delimitation of species could be established by means of hybridization experiments. According to the copious compilation by VON GAERTNER (1) he wrote (1777):—"*Plantarum copula hybrida productarum animaliumve summa foecunditas varietates, sterilitas vel summa vel foecunditas infra utriusque parentis modum ac proportionem plus minusve manca ac suppressa speciei indicium est omnium longe certissimum*".

Yet KÖLREUTER mentions fertile hybrids between taxa (*e.g.* of *Dianthus*) which he accepted as good species. Reversely he found that sometimes hybrids between obviously closely related species could be obtained only with great difficulty or not at all:—"*Copulatio mutua infructuosa, quo in plantis veram specierum imaginem agnoscere possis, lapis lydius est*".

The problems of the breeding true and the occurrence of hybrids were considered by LINNAEUS as shown by his experiments on tracing affinity.

In England KNIGHT (2) founded his opinion on extensive experimenting, reaching the general conclusions that fertile hybrids are a sign for conspecificity, that this goes mostly parallel with morphological resemblance, and further that if a specimen is sterile it is likely to be of hybrid origin.

Horticulture and agriculture strongly stimulated work on hybridization and in the first decades of the 19th century a number of Royal Academies offered a prize for essays on the subject.

For many years BERNHARDI (3) tested plants on their capacity for breeding true.

The year 1837 was remarkable in that MARTENS made the first public news about fern hybrids at Brussels; in England HERBERT published his large study on amaryllidaceous plants (4), and VON GAERTNER was awarded the gold medal and prize of the Holland Society for Sciences, Haarlem, for the best essay (5) in the prize question issued 1830 at the instigation of REINWARDT (renewed 1834, belated 1836, fulfilled 1837, with 150 hybrid specimens) titled (transl.):—"What learns experience on the breeding of new species and varieties by means of artificial pollination and what useful and ornamental plants can be made and propagated in this way?" The Netherlands version of VON GAERTNER's book has been followed in 1849 by a very much extended German edition (1) with a full digest of current literature on the subject.

HERBERT was of the opinion that if two plants are able to form a fertile hybrid they should be regarded as conspecific. And that if two species of two different genera are able to hybridize these genera should be regarded as congeneric *(Azalea, Rhodora, Rhododendron)*. All *Cactaceae* should then be regarded as belonging to one genus.

HERBERT's opinion was shared by many other authorities, *e.g.* HENSCHEL, TREVIRANUS, VAN MONS, and A. BRAUN.

In a general sense VON GAERTNER also agrees, but he urges caution in paying too much attention only to morphological resemblance. He points to genera, which are generally accepted to be natural *(Primula, Erica, Linum, Gladiolus)* in which hybridization is limited to groups of species (sections), though he reversely points to the fact that the failure to hybridize is not proof that it is impossible. Admitting that in the majority of cases possibility for hybridization is bound up with morphological resemblance, he still maintains that the essential thing is not the external morphological conformity but the internal 'sexual affinity'. He approaches herewith HERBERT's criterion of 'constitutional affinity'. He points to two species of *Pentstemon* which are very much alike but intersterile ("though DE CANDOLLE accepted them as good species, *viz P. gentianoides* and *P. coccineus* = *hartwegi*"), whereas HERBERT contrarily found that in the genus *Calceolaria* species which are very unlike freely hybridize.

I have enjoyed reading these old, now mostly forgotten books on experimental taxonomy, digesting the ideas they contained, and admiring the immense number of experiments made and their often ingenious methodology.

Darwin naturally devoted a chapter to 'hybridism' in connection with the species concept in his 'Origin of Species' (36). He relied for a great deal on the experiments by Kölreuter, von Gaertner, and Herbert, and is distinctly hesitative in their interpretation. This is not surprising as their experiments were performed with both species and infraspecific taxa and results are therefore often contradictory. On the one hand Darwin recognizes the sterility barrier specially in the native species as the agent keeping them separate, (*l.c.* p. 267–268, 279, 283, 298, 300) and finds "the degree of fertility proportional to their systematic affinity, with varieties interfertile". On the other hand he says in the same chapter (*l.c.* p. 270, 277–278, 281, 299) "that the degree of fertility . . . graduates from zero to perfect fertility", and even finds "specific sterility to be accidental" (*l.c.* p. 283) and that "neither sterility nor fertility affords a clear distinction between species and varieties" (*l.c.* p. 270). This fitted his theory of the divergence of character by natural selection, "the preservation and accumulation of beneficial variations" (*l.c.* p. 133); . . . "thus the small differences distinguishing varieties of the same species steadily tend to increase till they come to equal the greater differences between species of the same genus, or even of distinct genera" (*l.c.* p. 145). Darwin's magnificent synthetic attempt suffered from the lack of genetic knowledge in his time and a lack of appreciation of the essential difference of the concepts hybridization and miscibility. His aim was obviously to explain the origin of species in the sense of linneonts, starting with the paramorphs, via the cline and the subspecies to the species. The general conception nowadays is the reverse: it is the linneont, consisting of an endless number of paramorphs, which gives the cline, the variety, or the subspecies.

The attempt towards a 'New Systematics' in which hybridization, fertile or sterile, was maintained as one of the crucial points in judging specific delimitation, was continued by Focke. His *magnum opus* 'Die Pflanzenmischlinge' (1881) must have been a great stimulant towards experimental work and is still a mine of information.

In an earlier work (6) he defined the species —which he called 'Formenkreis'—by the following 6 criteria the majority of which belongs to experimental taxonomy (transl.):

(1) Complete mutual morphological similarity of all individuals of a 'Formenkreis'.
(2) Presence of constant, distinct, preferably morphological characters by which the individuals of the 'Formenkreis' differ from all other organisms(absence of transitions).
(3) Constancy of these characters in successive generations.
(4) Inconstancy of differences inside the 'Formenkreis' between the individuals of the 'Formenkreis' in successive generations.
(5) Fertile hybridization possibility of all individual specimens within the 'Formenkreis'.
(6) Decreased fertility of eventual progeny derived from crossings between individuals of different 'Formenkreisen'.

He performed experiments with the three well-known *Primulas* which Linnaeus accepted as varieties of one species. He found (7) that *P. elatior* and *P. acaulis* gave perfectly fertile hybrids but that *P. officinalis* gave partial sterility; for that reason he considered the first two more closely allied *inter se* than to the latter. He advanced the idea of the levelling ("nivellierende") effect of free crossings in a panmictic population and was convinced of the reality of the specific concept in nature. Focke then tried to trace the origin of new species and varieties in nature and came unfortunately to study the genus *Rubus* (8).

The unmistakable fact that hybrids between commonly accepted good species are sterile or nearly so has always been a good argument adding to circumstantial evidence for the judgement of specific delimitation.

And this *sterility barrier must necessarily have an essential function in nature to keep species apart and distinguishable as separate taxa where they occur together.*

From this can be derived the generality that if the areas of two allied populations overlap and occur in the same biotope (that is if the populations have the opportunity to hybridize and mix) they must prove their 'individuality'.

The absence of miscibility capacity is obviously exactly the reason of the taxonomic demarcation between these populations. With Herbert and von Gaertner we can say that obviously the physiological morphological structure of the genome of the populations is so different that they must show a sexual repulsion, resulting in non-miscibility.

Danser has shown (9) that, notwithstanding Lotsy's varying opinion on and terminology of the species concept, he has introduced (10) the useful concept of the *syngameon* which approximately covers the Linnean species in a genetical sense. This has served as a start for Danser's later considerations.

It cannot be denied that the syngameon (=panmictic population) is an attractive concept as background for specific delimitation. Within such a population with free fertile hybridization possibilities the characters of the successive generations of individuals behave as in a melting pot, showing a constant change in various combinations (paramorphs) in which it will be impossible for the taxonomist to find any constant demarcations of the rank acceptable for the specific level. There is a compact body of paramorphs representing transitions between extremes and this melting pot is kept intact by segregation and recombination.

If allied but morphologically distinct or definable populations occur together without possibility for fertile interbreeding, however, they keep distinct as two unmixable separate substances in one melting pot.

If a taxonomist finds this situation in nature, he will be inclined to accept the morphological differences as valid.

If the taxa replace each other geographically, however, he feels or should feel less at ease with the weight of distinctive characters. The replacement is a warning signal. He will then have to consider whether the replacement is possibly due to the racial segregation of a polymorphous species, in which races remain distinct only so long as they remain isolated.

With replacing taxa the taxonomist should be specially on the alert and be extremely critical regarding the appreciation of differential characters. If there is opportunity he should make large-scale and prolonged hybridization experiments in order to observe whether the taxa are miscible or not.

In order to test specific delimitation DANSER has made a great number of experiments with *Rumex*, *Polygonum*, *Stachytarpheta*, and other genera. Besides these practical experiments he has given attention to the theoretical concepts involved with the delicate situation round the sterility barrier. He has abandoned LOTSY's *syngameon* and replaced this by a genetical hierarchy of three other more sharply defined concepts, for all individuals between which genetic contact is possible, *making a sharp distinction in degree of genetical contact between possibility to hybridize and miscibility* (11), which again is of such basic importance for possibilities of gene exchange between taxa. These concepts are:

(1) The **convivium,** *defined as each partial population which is, by geographical causes or otherwise, genetically isolated from the other part(s) of the population, with which it is, however, completely miscible* (12, p. 403, 417).

The isolation can be geographical, but it can be caused by difference in flowering season (seasonal dimorphism), by absence of the adequate pollinators, *etc.* Size and 'weight' of convivia may be very different, as all races, subspecies, ecotypes, human cultivations, adventives, and ruderals, are included in it. Convivia originate in nearly all panmictic populations during the primary diffusion as a consequence of selection by the environment. Centrifugal marginal differentiation consists in the origin of convivia. Shockwise dispersal of diaspores is followed by the formation of convivia as the colonies are formed from a limited number of diaspores which carry only part of the potential polymorphism of the population; furthermore the colonies will through local inbreeding and selection tend to homogenize towards a certain local facies (ecotype). The forming of small colonies will of course happen throughout the area of the population, but in places where the new colony is in contact with neighbouring colonies and aggregates, in the centre of the area, the tendency towards gaining a local facies will be rendered impossible through continuous segregation and recombination.

(2) The **commiscuum** *(miscibility community) is the total number of individuals which are connected genetically through miscibility* (11, p. 28, and 12, p. 401). Under miscibility is understood fertile hybridization possibility, while in the progeny, either by crossing or selfing, through segregation and recombination, finally a *complete series of transitions* is formed (panmictic population). It is not necessary that *all* individuals are *directly* connected by miscibility. One commiscuum will comprise generally a great number of convivia, but may consist of one convivium.

The concept of miscibility indicates the existence of other commiscua. Hybrids between individuals of different commiscua are generally sterile and if not so their progeny will *per definitionem* not produce a complete series of transitions. DANSER observed that these nearly sterile inter-commiscual hybrids can in some cases be crossed back with one of the parents and then the progeny gradually gained in fertility but returned to the parent and merged with the parental population. Here appears the local and occasional possibility for transferring characters from one commiscuum to another allied one (gene flow or introgression). The chances for it are not frequent and DANSER assumes this gene flow to be rare.

The commiscuum concept is the essential part of LOTSY's syngameon, but it is narrower and better defined.

DANSER mentions as examples of commiscua: *man, horse, donkey, zebra, each of the species of Rumex § Lapathum* (as far as examined by him), *the 2 species of Antirrhinum § Antirrhinastrum, four species of Stachytarpheta* (11).

(3) The **comparium** *(hybridization community) comprises all individuals which are connected by the possibility of hybridization* (11, p. 29 and 12, p. 400). *The hybrids must be viable, but it is irrelevant whether they are capable of producing sexual organs. All commiscua between which a (sterile) hybrid is found belong to one comparium. Comparia are not miscible.*

DANSER quotes as examples: *man* (who is both a commiscuum and a comparium), the *genus Equus, Antirrhinum section Antirrhinastrum, Rumex section Lapathum* (as fas as he studied it), the *genus Stachytarpheta* (as far as he studied it).

Though the comparium is by no means a less significant concept in itself, it does not seem to have an immediate bearing on specific delimitation and properly falls outside the scope of this essay.

DANSER maintains that in an attempt towards a correlation of the taxa distinguished by taxonomists with these three concepts, *the convivia seem to coincide roughly with infraspecific categories* (subspecies, variety, ecotype, form, *etc.*), that the *commiscua coincide obviously with the large, good, Linnean species* of botanists, and that the *comparia* have the least well-defined correlation with taxonomic categories, sometimes coinciding with genera, sometimes with sections, but in certain families going far beyong the limit of accepted genera, for example in the *Gramineae*, *Orchidaceae*, *Rutaceae*, *etc.*, in which a considerable number of indisputable intergeneric hybrids have come to knowledge.[1]

This conclusion agrees with the generally acknowledged less clear concept of generic delimitation as compared with specific delimitation.

DANSER recommends identifying delimitation of Linnean species with that of commiscua. This is in all probability the best approximation of the Linnean species ever proposed and as we will see this opinion is shared by various prominent geneticists.

Danser's three concepts are specially attractive to the taxonomist as they give content to taxonomic categories by a genetical basis consisting of factors actually at work in nature in the formation of ecotypes, races, and panmictic populations; they account for the results of isolation and as far as the convivium and commiscuum are concerned (less clearly so for the comparium) *they cover to a remarkably high degree the specific and infraspecific taxonomic categories based on morphological comparison. Moreover, they furnish opportunity for the employment of experimental testing methods.*

As has been remarked above the idea of genetical background of taxonomic categories is nothing entirely new. JOHN RAY, the eminent precursor of LINNAEUS already approached the syngameon concept in his criteria for specific delimitation (*cf.* DANSER, 9, p. 216–219) and as has been shown in the brief historic introduction to this chapter the idea of the importance of the sterility barrier has always lingered in the minds of taxonomists as the principal agency responsible for demarcations.

DANSER's concepts are indisputable genetical realities in nature, irrespective whether applied by taxonomists or not. They have not been formed lightly as desk-work but have been the result of prolonged field-work, experimental research, and herbarium studies.

After two decades of experience with testing their applicability to taxonomy, DANSER concluded *that the essence of the large species or linneonts is the panmictic community or commiscuum. If it were possible to test all species experimentally, and identify them as much as possible with commiscua, this would have the great advantage that we could delimit species according to one single principle, a true biological agency acting in nature.*

From his posthumously edited 'Theory of Systematics' (13) I quote in his own words: —"Although the biological meaning of the large species lies in the commiscua, yet the largest species, including the well-known and scrupulously defined ones, are far from being all identical with commiscua. In order to obtain this identity many boundaries of species have to be altered."

"The criterion of the fertility or sterility of hybrids in order to decide whether two taxa must be referred to one or two species could never become a general principle because the data so obtained too often contradict each other."

"It is doubtful whether all systematists are prepared to give up the principle of sharp definition for that of miscibility. We can only say that it would be desirable for systematists to overlook this objection on behalf of the theoretical significance of the conception of species."

"A more serious objection is that so many living beings escape the criterion of miscibility. For example those taxa which have lost their capacity of sexual reproduction. They undoubtedly belong to some species but not to some commiscuum (many *Fungi*, apomicts, *etc.*)".

"We can overcome this difficulty in a large measure by first of all defining the species according to the old principles and subsequently checking them as far as possible."

I am aware that there is, in the matter of definitions and principles, a tendency to see things too much sharply divided in black and white. Criticism is raised at once if the theory or concepts cannot immediately explain or take care of all facts known.

There is no reason for discouragement then in accepting theories or concepts, specially if they are simple and logic. It will be remembered that the MENDELEJEW natural system of elementary chemical elements seemed defeated or at least had to allow exceptions in the actual molecular weights which did not show the simple numbers to be expected. Those who stuck to the theory, trusting the principle of uniformitarianism in nature, appeared after all right, those who kept arguing about the discrepancy were formal and shortsighted, hence wrong.

If we avoid for the moment the question of practical application, a discussion is open towards the intrinsic significance of the sterility barrier. Though it is admitted that this barrier will appear in general *in combination with* a set of morphological characters which can reasonably be considered as denoting specific rank, DANSER himself has, as mentioned briefly before, pointed attention to a few categories which withdraw from the requirements of the commiscuum.

Obligate self-pollinators do not participate in the miscibility-crossing tissue of the commiscuum. It is here irrelevant, that they are possibly few in number.

The same holds for *apomicts* which DANSER assumed to belong to a species but not to a commiscuum (see chapter 8).

The fact that in populations there will always be individual specimens which cannot be crossed with any random individual specimen is of only slight value to the commiscual concept, as it is sufficient if they can be crossed with some other specimen, so that the commiscuum is then still a closed hybridization net, potentially permitting segregation and recombination throughout its tissue. To this category belong the extremes of a series of races within an articulated population between which genetic contact may be possible only via the linking interjacent races.

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(1) Besides it is certain that in these families there are distinct taxonomical difficulties with the generic concept which has led to rather fine splitting which in turn is not very satisfactory as now generic limits appear sometimes to be artificial.

Another, more serious problem is the application of the definition of a commiscuum in practice, as the pertinent testing of the existence of a closed hybridization net, the proof of the definition, is in practice impossible, either pro or con. It is completely illusory to have all specimens of a commiscuum under experimental control.

It follows that it is impossible to design a complete system according to the commiscuum concept in order to compare it with the currently accepted specific delimitation and have an estimate of the advantages it may offer.

Reversely I am fully convinced that through these three clear concepts DANSER has furnished a critical content to a hitherto badly defined field of theoretical taxonomy, and feel that his concepts are giving sense, emphasis, and direction to professional taxonomy against a clear background.

Although DANSER's concepts have for reasons unknown not come into the general use they deserve, I am perfectly convinced that they approach the real biological situation of specific delimitation in nature as closely as can be expected in this matter.

And DANSER is here in the good company of several prominent geneticists. The specific delimitation for example in *Antirrhinum* § *Antirrhinastrum*, which was a head-ache to taxonomists and about which there was not the slightest unanimity of opinion, has been satisfactorily explained by BAUR (14) and, unless it would appear that BAUR's experiments are wrong, no intelligent taxonomist can accept the twenty odd described taxa as good species.

On the basis of his extensive experimental work WINGE (15) equally holds the delimitation of species on the level of linneonts and identical with commiscua. WINGE rightly remarks that not all species of LINNAEUS are linneonts; in his pioneer works LINNAEUS accepted for convenience *Pisum sativum* and *P. arvense* as specifically different. Further he subordinated *Melandrium rubrum* and *M. album* as varieties to one species although they are kept specifically different in most Floras up to the recent time.[1] WINGE adds that cytogeneticists contrarily consider them as one complex for reason of their complete miscibility; he says: (*l.c.* 233–234:—"individuals are specifically different when they are unable to hybridize or when by crossing, they produce more or less sterile progeny".

"Even disregarding the exceptions to this definition, taxonomists would scarcely adopt the specific definition of the geneticist. The latter meets difficulties in plants with different chromosome number *(e.g. Narcissus, Bulbocodium, Potentilla argentea)*, the hybrids of which are always slightly sterile, though nobody doubts their specific identity. The species of the taxonomists are practical".

LAMPRECHT (33) considers that a strictly genetic definition can be given to the species, developing the view of WINGE (15) that all species are characterized by genes which cannot be transferred in interspecific crosses or which behave as lethals. He defines a species as "a unit including all biotypes which differ from all others by at least one common interspecific gene".

MÜNTZING (16) says "that it is typical of species hybrids that they are more or less sterile", and that "by crossing experiments it is possible to clear up the barriers of incompatibility and sterility occurring in nature". He concludes that "if the cross succeeds without difficulty, and the hybrids obtained are quite fertile, the parents must be closely related and must be included in the same species".

TIMOFEEFF-RESSOVSKI (17, p. 91–92) gave as his opinion:—"I believe that we have no reason to doubt the reality of species as natural taxonomic units; but, on the other hand, I doubt whether it is possible to give a general and simple definition of the species, applicable in all the larger groups of organisms. The most general but at the same time cautious definition of a species may perhaps be given as follows:—"a species is a group of individuals that are morphologically and physiologically similar (although comprising a number of groups of the lowest taxonomic category), which has reached an almost complete biological isolation from similar neighbouring groups of individuals inhabiting the same or adjacent territories. Under biological isolation we understand the impossibility or non-occurrence of normal hybridization under natural conditions. There are practical differences in that hardly distinguishable species of *Drosophila* do not interbreed, and on the other hand good species which hybridize".

DOBZHANSKY (18) similarly tries to define specific delimitation by the borderline of fertile interbreeding.

DARLINGTON (17, p. 139) is equally prepared to apply the results of genetical analysis for estimating the significance of delimitation of species and other taxa. He says:—"It is true that the basis of distinction between some species in *Malva* (KRISTOFFERSEN), *Galium*, *Nicotiana*, and *Tulipa*, and even of the subdivision of the genus *Primula* (to mention only a few examples) has proved to be a single-gene difference. When the facts of inheritance are known, such distinction cannot be upheld on ground of either principle or convenience".

HERIBERT NILSSON in his large study on the genus *Salix* (19) shares the opinion of these authors. He describes the species as "ein Genotypen-Kreis (eine Kombinationssphäre), die als Population annäherend konstant ist, weil sie bei Kreuzung mit anderen Spezies inkompatibel oder avital reagiert". Chromosome number or ganiture itself is not sufficient for that claim.

CLAUSEN (31) accepted a "genetic basis for natural systematic units which makes it possible to give a fairly objective classification based upon experiments rather than upon speculation. Species are separated by genetic barriers of various degree and effect; sometimes incomptability is not absolute and there may be a limited amount of exchange of genes".

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[1] Actually LÖVE (32) considers *Melandrium rubrum* and *M. album* as subspecies of *M. dioicum* (L.). COSS. & GERM.

Clausen, Keck, and Hiesey (34) share this view and are prepared to accept only those "internal barriers that are of a genetic-physiologic nature" as species-separating; those, in other words, which prevent the production of offspring even after artificial cross-pollination, or lead to the sterility of any progeny produced. Where such barriers do *not* exist between two forms, they must be considered as belonging to the same species, whatever the taxonomist may have done with them.

As quoted before (p. cciii b), Vavilov joins the opinion of wide delimitation of species as a consequence of genetic investigations.

Among prominent geneticists there seems then to be a rather unanimous approval to accept the sterility barrier, and the miscibility criterion in particular, as an essential for specific delimitation; the scanning of the sterility barrier between taxa is still a very important additional argument in the experimental testing of specific delimitation. And the flux of literature on this subject, specially in England, Sweden, and the U.S.A., proves that this line of research is still in full swing.

Further there is, consequently, among these geneticists, a common approval of the acception of wide, Linnean, specific delimitation.

The reception of the results of genetics and experimental taxonomy by systematists has generally been sympathetic, but there is a distinct reservation in the willingness towards its application. This is partly due to the fact that only few systematists are trained in or are eyewitness of experimental taxonomy or have kept up with the pertinent literature and feel capable of judgement.

Excuses for this inertia are various, in addition to the fact that every change of method or principles will meet inertia towards its adoption in any branch of science, unless the methodology or principle is so clear and the advantage of its application so evident that there is no obstacle against the immediate universal adoption.

Though every taxonomist who is not a pure phytographer of the old-style has welcomed these attempts towards a new systematics, it is equally clear that, first, the experiments refer only to a very limited percentage of cases with regard to the entire plant kingdom and, second, that as has been remarked before, it will, in practice, be impossible to extend experimental taxonomy to the whole plant kingdom, hence to apply experimental taxonomy universally to its classification. This is specially significant for the wealth of tropical plants, the arboreous ones in particular. These must be classified by the normal herbarium methods of α-taxonomy.

Systematists who have performed extensive experimental work agree in giving weight to the sterility barrier in their definitions of specific delimitation.

Turrill who is in this respect in a favourable position gives four criteria for specific delimitation (17, p. 17):—

(1) They have a geographical area.
(2) They are self-perpetuating as taxa.
(3) They are morphologically distinguishable from other related groups.
(4) They normally do not interbreed with related groups, in most cases showing partial or total infertility on crossing with them (though neither the lack of crossing or of fertility is universal).

Turrill adds that *subspecies* resemble species except in point 4 as they show miscibility.

Recently Turrill wrote (20):—that botanists cannot go so far as zoologists in emphasizing sterility as a character separating species and use the fertility-sterility criterion to this extent. "There are often sterility barriers between plant species . . . but so often plants belonging to what must, *for many other purposes*, be distinguished as distinct species can cross together to produce fertile offspring". He mentions *Salix polygena* composed of 8 species of *Salix*, and further *Orchidaceae* in which even generic hybrids produce fertile offspring. "To place all such into one species would make a classification of a very special kind that *could serve only a very limited range of purposes*".

It is to be regretted that Turrill has obviously paid less attention than desirable to Danser's concepts in which a sharp distinction is made between *hybridization possibility* and *miscibility*. The references to *Salix polygena* and the *Orchidaceae* have no bearing on the miscibility criterion. From other studies it appears that Turrill and Marsden-Jones are reluctant to accept this principle. This reluctance is most curious as it emerges naturally from the classical experimental work made by these authors on *Silene cucubalus* and *S. maritima* which T. says (17, p. 64) "behave as good species over most of their range but cross freely to produce intermediate populations in some smallish areas". Moreover, "all diagnostic characters may break down in some, mostly a few, specimens, and this apart from hybridization".

Geum urbanum and *G. rivale* cross freely and produce hybrid swarms according to Marsden-Jones (1930). There is no sterility barrier between these species. These hybrid swarms occur not or only very locally in nature, but more frequent in cultivation. It has also been found in Central Europe that the two *Geums* are distinctly miscible and that in some regions pure colonies are rare.

From these well-studied examples it appears that *in both cases the pairs of 'species' owe their distinctness to the spatiation caused by their different ecology and are a consequence of the sieving effect of ecological conditions offered to them in nature. The hybrid swarms occur in places of intermediate ecology. If nature offered only the intermediate ecological facies in their area of distribution there would be no sharp (racial) segregation and the European Geum*[1] *population would be one (variable) whole.*

It is clear that whereas the intermediate localities are scarce the bulk of the recent population can easily be distinguished.

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(1) It is probable that in *Geum* the miscibility goes far beyond the two mentioned 'species' (30).

With these examples in *Silene* and *Geum* at hand, in which fortunately the situation both in the field and experimentally is exposed to such an admirable degree, it is a mystery to me why TURRILL shrinks from drawing the consequence of admitting racial differentiation in *Geum* and *Silene*. I can only guess at his arguments for this hesitancy from his own words that drawing such consequences would evolve into a classification "*that could serve only a very limited range of purposes*".

I disagree entirely with this conclusion and maintain that *both scientific and practical taxonomy* is served better by accepting these couples of species in *Geum* and *Silene* as each representing one Linnean species.

Scientifically because taxonomy is essentially a hierarchical science and hierarchy is lost if Linnean species and subspecies (*cq.* races) are arranged on one level.

Practically the advantage of distinguishing *G. urbanum spp. urbanum* next to *spp. rivale* and having *Silene cucubalus spp. cucubalus* and *spp. maritima* is that this situation gives more exact information about these taxa than the situation in which they are all treated as species. In the subspecific rank it would be at once clear that there is in both cases geographical replacement and genetical miscibility. The latter criterion is particularly stressed by TURRILL himself as the essential difference of subspecies from species.

The difference, for the morphologist, between the cited cases of *Silene* and *Geum* lies in the fact that, whereas the differential characters in the *Silenes* are rather slight and feeble and mostly concern habit, those between *Geum urbanum* and *G. rivale* are very distinct and showy.

This touches the delicate problem of evaluation of characters to which ALLAN (21) has pointed in remarking:—"that observations on wild and artificial hybrids both show that many quite unexpected pairs do cross or can be crossed". He gave no information on the crucial point whether they are miscible or not.

I refer here also to the 'species' of *Antirrhinum* which show taxonomically quite acceptable distinctions. And I refer to the old observations on the genus *Calceolaria* where it is said that hybridizing or miscibility exists between morphologically quite distinct forms. At least in *Antirrhinum* it has been definitely shown that the number of Mendelian characters involved is not particularly large.

There may seem, as Mr KERN said to me, a morphological controversy in accepting one polymorphous species in *Geum* but keeping the morphologically much more 'uniform' species of *Epilobium* between which there is mostly a strict sterility barrier and no question of hybrid swarms and miscibility.

It has to be accepted that there is no way to give absolute 'measures' of the taxonomical weight for characters. But it is indisputable that if 'hybrid swarms' (*i.e.* a heterozygotic panmictic population of paramorphs) and ecologically intermediate localities were *quantitatively* the commoner in the *Geum* area of distribution and the pure *G. urbanum* and *G. rivale* the less common, it is certain that the judgement would be different from the now prevailing acceptance of two different species. And this same reasoning holds for the two *Silenes*.

Many other cases have been repeatedly referred to in literature for which the rigid application of the sterility barrier concept would seem to lead to unsatisfactory results or at least to a delimitation rather considerably deviating from the one employed now. The genus *Salix* has at least in Europe, such a bad reputation; it seems that the delimitation of certain species which in one country is rather distinct, is blotted out in an other. HERIBERT NILSSON recorded (19) on hybridization, but as far as I can see there are no sufficient experimental data to conclude on the extent of miscibility. The occurrence of hybrids, even fertile, or partly so, is not conclusive, particularly not in anthropogenous country. Judging from the herbarium studies a similar exceptional behaviour was obviously found by DANSER in the loranthaceous genus *Scurrula*. Here too, the abundance in anthropogenous country may be responsible for a seemingly chaotic state of affairs with regard to specific delimitation.

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It is likely that even long isolation of disjunct areas, which doubtless represent parts of former continuous populations, does not reduce interfertility to intersterility.

The genus *Campsis* (*Bign.*) hitherto considered to consist of two distinct species *viz C. grandiflora* LOISEL. in China and *C. radicans* SEEM. in N. America have appeared to be interfertile, producing a heterogenous progeny. The geographical distribution of this couple of species points to a disjunction of the genus as a consequence of the Pleistocene Ice Age and it makes the impression that palaeoclimatical factors have broken up the formerly continuous population into two (later eventually further homogenized) races. Breeding experiments are insufficient to show whether these 'twins' are really miscible.

A similar case is that in *Platanus:* HENRY & FLOOD have shown (22) that the London plane *(P.* x *acerifolia)* is a hybrid of P. *orientalis* (Persia to Balkan) and *P. occidentalis* (belonging to a group of *c.* 6 closely related species in the southern U.S.A. to Mexico). The separation of *P. orientalis* from the New World populations is at least one million years old, but there is still no incompatibility and apparently no mutations have taken place. The hybrid is said to be fairly fertile. Here again there are no sufficient data available to decide on miscibility.

According to Mr STEARN a similar interfertility is found in strongly disjunct species of *Epimedium* (Europe–Japan).

These few examples are sufficient proof of the importance and permanence of interspecific, genetical behaviour after long isolation.

On the one hand it shows that isolation itself is obviously not a factor bringing about essential changes in genetical behaviour. On the other hand it shows how extremely careful a taxonomist should be in handling disjunct taxa: races now apart for a long time have in many cases apparently made part of former continuous areas. A taxonomist should therefore avoid entering geographical arguments for delimiting species.

CHROMOSOME RACES

The examples given hitherto have in general shown the existence of a not unsatisfactory agreement between specific delimitation and the commiscual concept.

A strict application of the miscibility concept may in a number of other cases, however, force the taxonomist towards an undesirable situation of distinguishing taxa which show hardly any or only minute and few morphological differences.

Timofeeff-Ressovski has pointed to certain almost identical races of *Drosophila* which are said to be isolated genetically.

Detail research in plants has in the last decades brought to light the existence of an increasingly large number of species in which the chromosome garniture or number of chromosomes is different in different (mostly polyploid) races. In a case like that of the couple *Nasturtium officinale* and *N. microphyllum* the morphological characters bound up with cytogenetical differences are still acceptable though distinctly small and few. The hybrid is sterile and the species have been observed to occur together in nature in the same biotope.

More dubious are such cases as for example in *Acorus calamus* in which three replacing chromosome races are observed between which the morphological differences are minute, according to Wulff (23). Polyplotypes have been described in *Chelidonium*, *Adoxa moschatellina*, *Cardamine pratensis*, &c.

In *Rumex acetosella* four of such chromosome races are said to occur by Löve (24) each of which would have a geographical area of its own. In *Valeriana officinalis* a dozen of such races have been recorded. According to Kalinska (25) it is polymorphous in various parts of Europe with tetraploid, hexaploid, and octoploid forms, each of which shows again subforms. As far as ascertained they are intersterile.

In her recent brilliant work Miss Manton (26) has mentioned similar cases from several species belonging to various families, in addition of those in Pteridophytes. In *Polypodium vulgare* there seem to be at least three chromosome races in Europe and two in America, but the total number will be certainly higher. Besides it appears that in ferns there occur a considerable number of 'irregularities' in the chromosomal behaviour, with many hybrids and apogamous forms. The chromosome races can, mostly, be recognized morphologically by the expert.

In their work on Ceylon Pteridophytes Manton & Sledge (29, p. 174) state:—"The fact that so many instances of multiple chromosomal types were detected among very small random samples suggests that many more of the so-called species of tropical floras are in fact species-complexes than had previously been thought".

In many cases the chromosome races show a distinct geographical distribution and frequently geographical replacement, comparable to that of races or subspecies.

Though a final scientific proof by experimental methods to show the validity of the genetical isolation can of course never be given, as it falls simply for practical reasons outside any human scheme to take instead of a few samplings all specimens of a population into observation—and nothing can or should be taken for granted if we want to have a strict proof—the circumstantial evidence so far attained points towards the existence within Linnean species of minor chromosome variants which, with a rigid application of the miscibility concept, should be regarded as commiscua, though the morphological differences between them appear to be so slight that they have mostly either been neglected or evaluated on the infraspecific level, except by purely analytic florists as Jordan *c.s.*

It is fairly certain that with still larger population studies the number of such forms will appear to have colossal dimensions.

If it should be agreed to accept these forms as 'species' on one line with normal Linneonts it is clear that a reasonable taxonomy will not be possible and a concise classification of the plant kingdom according to Linnean standards will never be attained. Specific delimitation in plants will then soon reach the deplorably chaotic state to which entomology has degenerated.

The facts brought to light about the microsystematic population structure of Linnean species is of course extremely interesting.

But it is clear that classical taxonomy has to shield its field and concepts against the menace from the side of chromosome fanatics, who appear eager to try selling a Trojan horse to alpha taxonomy.[1]

If it is granted that chromosome races are sexually propagating, morphologically distinguishable entities which are genetically isolated they fit the requirements of specific delimitation of the taxonomist who accepts commiscua to be equiva-

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(1) It is urgent that geneticists and cytotaxonomists have a thorough pre-knowledge and experience in taxonomic methodology and practice. Data on hybridization and cytogenetics should be accompanied with depositing of herbarium specimens for future reference and verification. Names of species and varieties used must have been controlled taxonomically or by taxonomists. For genetical experiments it is not sufficient to accept blindly the name of a sample distributed by a random botanical garden; these are generally wrong or obsolete.

lent to species and the genetical isolation as a keystone of the concept of specific delimitation.

It would place the taxonomist entirely at the mercy of cytogenetics which means again that the taxonomist would loose control over his own standard and would not any longer be able to verify the variation of the characters, *i.c.* the chromosomes, conclusive for distinction. Furthermore it would render impossible the taxonomist's methodology to test as much material as possible, as this would be necessarily out of question in the case of chromosome races.

It should be emphasized that the importance of the chromosome number must not be overrated too much and not be accepted as a character of essentially other and more important value than the external morphological characters.

It is clear that two things are involved here: *chromosome number* and *chromosome quality* (biochemical composition of the genome). The latter is of course the essential thing, but very little is known about it as yet. The former is apparently far less important. In the genus *Carex*, taxonomically a very coherent and natural genus, numbers of chromosomes vary to a high degree with irregular figures, but in other genera or sections the number is found to be very constant. From this follows that, as *with all taxonomic characters, no absolute value can be given to it.*[1] In the case of the chromosome races the *quality* of the chromosomes is obviously very similar whatever their differences in shape and number, as it stands beyond any doubt that the quality manifests itself in the morphological characters or, in other words, the degree of difference between characters reflects and is proportional to the degree of difference between the genome qualities.

There is an exceedingly great morphological similarity between chromosome races within Linnean species and from this it follows that the mere number of chromosomes cannot be a feature indicating an essentially other value than external taxonomical characters. Its value will have to be evaluated (by experience) from group to group. The extreme similarity of the chromosome races indicates that only one or a very few genes can be concerned. Among these is obviously one causing incompatibility.

If we can rely on the data provided by the cytogeneticists the chromosome races are genetically isolated, they withdraw from the rule that incompatibility is always connected with a set of other distinct, morphological differential characters.

The conclusion is that it appears impossible to identify chromosome races with commiscua worthy to be recognized as Linnean species.

Much more should be known about their exact behaviour before a final conclusion can be drawn and as ALLAN says (17, p. 515) the taxonomist should be extremely cautious in accepting simply data from cytogeneticists without reserve. HERIBERT NILSSON is of opinion that chromosome number or garniture is, in itself, not sufficient for specific distinction. FAGERLIND (27) concluded that chromosome races are of infraspecific value and this view will be shared by most qualified taxonomists. Miss MANTON has not given sufficient systematic attention to this question; in her book (26, p. 8) she mentions the chromosome races in *Biscutella* as subspecies, but those of the ferns (*Dryopteris filix-mas l.c.* p. 45 and *Polypodium vulgare l.c.* p. 141) are accepted as species.

NANNFELDT assumes (28) that "as soon as chromosomal races (polyplotypes) are morphologically distinct and thus recognizable to the taxonomist, they had better be regarded as species even if the morphological characters are small".

As far as I know DANSER had, before his premature death, not given a written opinion in this matter, but I am told that in his review of LÖVE's paper on *Rumex acetosella* he strongly rejected the idea of accepting the polyplotypes as Linnean species. TURRILL is also not prepared to accept them simply as species which I infer from his generalization "that the taxonomist has to consider any known facts regarding sterility or fertility, but he has to evaluate them with regard to all other facts of structure and behaviour known for the organisms he is sorting into taxonomic groups or taxa".

In a very detailed experimental and field study on Central European *Galium* EHRENDORFER (35) found Linnean species to be 'Serien' = 'Formenkreisen' of dozens of microspecies ('Kleinarten'), each of which consisting of generally incompatible diploids, tetraploids, octoploids, and multiploids. He showed the possibility of introgressive hybridization (potential gene exchange) between octoploids from different linneonts between which there is exclusively on this chromosome level, obviously only a partial sterility barrier; such transitions occurred generally in disturbed biocoenoses (*cf.* p. cc). This study shows how complex in chromosome detail Linnean populations may be, but also the intrinsic value of the Linnean species.

The following conclusions can be drawn:

If taxa have been sufficiently investigated experimentally, the results should be fully evaluated by taxonomists.

A sharp distinction should be made between hybridization possibility and miscibility; under the latter concept is understood the possibility, either in nature or in cultivation, of obtaining by hybridization, fertile specimens showing an almost complete number of various combinations of the differential characters between the taxa, blending them into one whole without demarcations.

Hybridization itself is, naturally, a manifestation of affinity but falls short of precision for judging delimitation of Linnean species.

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(1) Miss MANTON was so much impressed with the aneuploid chromosomal behaviour in *Isoetes* and *Lycopodium* that she assumed (26, p. 286) "that a species in, for example *Lycopodium*, is really the equivalent of a genus among ferns". This is, in my opinion, an overstatement.

In the majority of cases it is manifest that the commiscual concept, putting miscibility of taxa as a criterion for conspecificity, hence for specific delimitation, is a reasonable approximation of explaining their individuality in nature.

If taxa are distinguishable by a set of clear characters, preferably both vegetative and generative, and hybrids prove to be sterile or substerile and not capable of producing a polymorphous progeny with a more or less complete series of intermediates blending the taxa, the inmiscibility is a substantial argument for accepting them as belonging to one linneont.

In many cases taxa are replacing each other by ecological preference, their segregation through genetical isolation being due to and going parallel with demarcations of the environmental conditions.

If such taxa prove to be miscible, either in nature or by experiments, it is clear that they should be accepted as replacing races and consequently be subordinated as subspecies to one linneont. The argument is that if the environmental conditions were intermediate, suiting both races, there would exist only one panmictic population without racial segregation.

In nature local hybrid swarms may give an indication of the miscibility of the taxa; if the taxa are disjunct, the miscibility can only be proved by experimental taxonomical methods.

Long racial isolation does obviously not diminish the possibility of fertile hybridization between such partial populations.

If taxa are distinguishable by a few minute characters which are considered of minor value in the genus but are intersterile or nearly so through a polyploid or otherwise aberrant chromosome structure, they should be considered of infraspecific rank and be classed as subspecies (genetic polyplotypes or chromosome races).

Though they represent commiscua from the genetical standpoint, they should taxonomically not be arranged on the specific level along with Linnean species as the factor responsible for the incompatibility is not bound with a sufficiently clear and large set of morphological characters.

Their genetic incompatibility prohibits unfortunately to accept a strict application of the principle to equalize Linnean species with commiscua, though this would be—and still is theoretically—the best way of introducing a biological agency responsible for specific demarcation in nature.

From the genetical standpoint the distinction of large, polymorphous species is preferable.

For professional taxonomy the advantage of distinguishing Linnean species is serving the aims of taxonomy by holding to its hierarchical structure; hierarchy is lost if species and races are nomenclaturally ranked on the same level.

For practical taxonomy the advantage of Linnean species with racial taxa subordinated is the information embodied in the nomenclature of such linneonts.

References:—(*1*) von Gaertner, Versuche und Beobachtungen über Bastarderzeugung im Pflanzenreich. Stuttgart (1849) 749 pp.—(*2*) Knight, Philos. Trans. (1799), pt 2, p. 195.—(*3*) Bernhardi, Ueber Begriff der Pflanzenart und seine Anwendung (1834).—(*4*) Herbert, W., On crosses and intermixtures in Vegetables. Amaryllidaceae (1837).—(*5*) von Gaertner, Over de voortteling van bastaardplanten. Een bijdrage tot de kennis van de bevruchting der gewassen (Natuurk. Verh. Holl. Mij Wet. (Haarlem) 24, 1, 1838, 202 pp.).—(*6*) Focke, Jen. Z. Naturw. 9 (1875) repr. 1–65.—(*7*) Focke, Oesterr. Bot. Z. 23 (1873) 46–53, 137–142, 189–194.—(*8*) Focke, Synopsis Ruborum germanicae (1877).—(*9*) Danser, Genetica 6 (1924) 145–220.—(*10*) Lotsy, Arch. Néerl. Sc. Ex. Nat. III B, 3 (1918) 57, 351–353.—(*11*) Danser, Ann. Jard. Bot. Btzg 40 (1929) 25–43.—(*12*) Danser, Genetica 11 (1929) 399–450.—(*13*) Danser, Bibl. Biotheor. 4 (1950) 117–180.—(*14*) Baur, Z. Ind. Abst. 63 (1932) 256–302.—(*15*) Winge, J. Linn. Soc. Lond. sess. 150 (1938) 231–238.—(*16*) Müntzing, Hereditas 24 (1938) 492–504.—(*17*) Huxley (ed.), The New Systematics (1940).—(*18*) Dobzhansky, Genetics and the origin of species (1937).—(*19*) Heribert Nilsson, Lunds Univ. Årsskr. N.F. Bd. 2, 27:4 (1930) 1–96, t. 1–18.—(*20*) Turrill, Rep. Brit. Ass. Adv. Sc. *no* 26 (1950) and Jahrb. Biol. Inst. Sarajewo 5 (1952) 429.—(*21*) Allan, Bot. Rev. 3 (1937) 593–615; *ibid.* 15 (1949) 77–105.—(*22*) Henry & Flood, Proc. R. Irish Ac. B 25 (1919) 9–28.—(*23*) Wulff, Arch. Pharm. 287/59 (1954) 529–541.—(*24*) Löve, Hereditas 30 (1943) 1–136.—(*25*) Kalinska, J. Linn. Soc. (Bot.) 53 (1947) 159–186, t. 5–8.—(*26*) Manton, Problems of cytology and evolution in the Pteridophyta (1950).—(*27*) Fagerlind, Act. Hort. Berg. II, 9 (1937) 195–470.—(*28*) Nannfeldt, Svensk Bot. Tidskr. 32 (1938) 409–534.—(*29*) Manton & Sledge, Phil. Trans. R. Soc. Lond. B 238 (1954) 127–185.—(*30*) Gajewski, Act. Soc. Bot. Polon. 24 (1955) 333.—(*31*) Clausen, Nordiska (19. scandinaviska) Naturf. Helsingfors (1936) 520–523.—(*32*) Löve, Bot. Notiser (1944) 125–213.—(*33*) Lamprecht, Agri-Hort. Gen. 2 (1944) 75–142; *ibid* 3 (1945) 45–60.—(*34*) Clausen, Keck, and Hiesey, Amer. J. Bot. 26 (1939) 103–106.—(*35*) Oest. Bot. Z. 102 (1955) 195–234.—(*36*) Darwin, On the origin of species, ed. 3 (1861).

8. APOMICTS AND SPECIFIC DELIMITATION

In some genera, which have in the past appeared to offer serious obstacles to specific delimitation, it has been found that specimens are asexually reproduced and are *apomicts* (though occasionally some flowers may contain functioning sexual organs).

Individuals of an apomict—being a clone—show naturally a marked constancy, even in minor characters; this constancy is even more clearly expressed than in the more or less homozygotous 'races' (pure lines) of cultigens.

Individuals of an apomict disperse in a similar way as any other sexually propagating allied species and will attain (or have attained) a geographical area. In these respects the apomict behaves as a normal taxon.

The apomict differs from a 'population' of a sexually reproducing taxon, however, in the absence of the normal genotypical variability and *withdraws from the concept of population in the proper sense*, as does any other clone. It is consequently on another footing as compared with the panmictic population and its phaenotypic variability should not be misinterpreted as genotypical polymorphism.

Obviously the apomict withdraws, therefore, also from the concepts of species, subspecies and variety in the taxonomical hierarchy.

A description based on a random assembled collection of numerous specimens of one apomict is essentially the description of one specimen as each apomict is, in nature, represented by essentially one specimen only.

The conclusion is that whereas in taxonomy a species and any other infraspecific taxon is characterized by a certain degree of genotypical variation among the specimens referred to the taxon, the apomict withdraws from the concepts of normal taxonomical standards.

An apomict—being essentially one specimen—can, therefore, not be considered the equivalent of a taxon, although imitating it by possessing a set of major or minor 'characters' and by occupying an area of distribution.[1]

It has appeared that the origin of apomicts is apparently a result of hybridization of a few species: during the segregation taking place in the F2-x heterogeneous progeny a smaller or larger number of genetical combinations, each represented by one individual, have become apomictic. These apomictic individuals have multiplied by asexual reproduction and dispersed themselves.

No taxonomist would be prepared to give a taxonomic status to every single individual (paramorph) of a heterogeneous progeny after a crossing within a panmictic population or between two different commiscua as the characters are ephemeral and will disappear by segregation and recombination. In an apomictic progeny, however, the characters of each individual specimen will be preserved and perpetuated by asexual reproduction if the combination proves to be viable.

In Europe the genus *Taraxacum* is reputedly apomictic. In British *Taraxacum*, TURRILL says (1, p. 59) "apomixis is proved in all tested 'species' and cytological examination suggests hybridization previous to the adoption of apomixis and (possibly) mutation since".

DAHLSTEDT and others have described about 500 'species' of *Taraxacum* from Scandinavia, and the total number in *Taraxacum* may be estimated to be possibly about 1000. This number is of course far less than could (theoretically) be expected from a cross, but it should be taken into consideration that only a small part of them has been actually formed and that a certain number of combinations will not be viable or appear to be less well adapted to competition in nature.

In *Taraxacum* not all apomicts are completely asexual as has been shown by SØRENSEN & GUDJÓNSSON (2) and among the progeny new apomicts may occasionally appear. HERIBERT NILSSON found (3) on 5 sq.m not less than 20 apomicts together. As they reproduce asexually they are genetically perfectly isolated (agamospermy). The majority is triploid.

HERIBERT NILSSON *l.c.* says "dass es für die Benennung der Taraxacums unrichtig wäre, ja wiedersinnig, eine Bezeichnung die auf 'Art' oder 'Spezies' hinzielt, zu benutzen. Spezies bedeutet ja in der Systematik eine Population, einen Variationskreis, eine Kombinationsphäre, oft unzähliger Varianten. Ein 'Mikrospezies' von Taraxacum ist ein invariabeler Typus, ganz starr, eine Kombination innerhalb einer grösseren Population". H.N. is inclined to evaluate the few subgenera distinguished by DAHLSTEDT in *Taraxacum* as equivalent with what could have the same taxonomic value as species in sexually reproduced plants.

H.N. proposes to call them 'microtypes' as the smallest individual variants in the apomictic 'population' of the species *Taraxacum officinale*.

It is clear that the apomicts belong to an essentially different category of taxa as compared with sexually reproducing populations. TURESSON called them 'agamospecies'. This does not solve the problem of their evaluation.

In the genus *Hieracium* there seem to be more species involved than in *Taraxacum* and the structure is here still more complicated by the partial apomixis of many 'species', and the degree of the morphological differences in this genus is giving the illusion of an intricate but regular, hierarchic pattern of variation. An estimate in *Hieracium* for the equivalent of a species in sexually reproducing plants will be extremely difficult. In the current system of the genus sexually reproducing species, apomicts, and partial apomicts, are treated together. It would be advisable to bring some clarity in the specific delimitation by studying principally the non-apomictic species and fix their affinities and to classify the apomicts separately, a procedure similar to that followed for the imperfect fungi. Satisfactory taxonomical results will not be attained without experimental and karyological research.

Nomenclaturally apomicts should be earmarked as such, similarly as has been done for hybrids by the × sign and for cultigens by the indication 'cultivar'. Instead of being proceeded by '*var.*' or '*subsp.*' the epithet of apomicts might be preceded by '*apom.*', a neutral term leaving open the taxonomical rank and evaluation.

The study of apomicts was extremely intriguing to taxonomists before it was known why the normal taxonomical concepts failed to be reasonably applicable to genera as *Taraxacum* and *Hieracium*.

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(1) It is not clear why DU RIETZ (7) in one paper classified apomicts as clones (*l.c.* p. 338) and further on (*l.c.* p. 362) as (asexual) species.

Now we understand the factors through which these difficulties have been caused, it must be considered whether similar difficulties of specific delimitation in other genera may be due to the same phenomenon.

Apomicts have been found in many other genera, *e.g.* in *Alchemilla*, *Poa*, *Ranunculus*, *Rosa*, *Rubus*, *etc.*, some which are notorious for their playing havoc with normal taxonomic standards of classification.

Botanists engaged with taxonomical studies of tropical plants rarely have facilities of doing experimental work and rely on dried materials. Consequently they are unable to observe whether taxa are apomictic.

As it is not a far-fetched idea that apomixis will also occur in tropical plants, it is essential that observations and experiments should be made *in situ* (with karyological control) in a number of tropical genera which are notorious for their colossal, solid blocks of species, many of which show an undesirably low degree of good morphological characteristics. In this connection I have in mind genera as for example *Eugenia (incl. Syzygium)*, *Peperomia*, *Ophiorrhiza*, *Psychotria*, *Dysoxylum*, *Aglaia*, *Ardisia*, and various others. Such research should involve as many species as possible, as in these genera sexually and asexually reproducing species may occur side by side. There are some provisional data pointing towards a possible occurrence of apomictic species in *Eugenia* and *Citrus* (notably some cultigens).

In the list compiled by STEBBINS (8) tropical plants are particularly poorly represented. There is, possibly, a wide field for research here which should be encouraged to explore.

According to Dr FAGERLIND (*in litt.*) there are no definite signs of abundant apomixis in tropical plants. He found it in *Wikstroemia* (4), *Balanophora globosa* (5), and in *Elatostema spp.* (6), but in several species of *Peperomia*, *Gouldia*, *Psychotria*, *Bidens*, *Metrosideros*, *Ophiorrhiza*, and *Randia* there was no trace of agamospermy.

The fact that apomicts must be classified in a special category along with, but separate from, sexually reproducing populations, does naturally not imply that they would have no value for purposes of inventory, for plant ecology and for plant geography, although the possibility of polytopic origin in partial apomicts deprives them of some of their value in the latter discipline.

It has been most unfortunate that some prominent botanists have devoted a considerable time of their life to the riddle of the apomicts in which they expected to find a thread leading to the problem of speciation.

Botanists adhering to a moderate to large species concept have and will have of course less difficulties in classifying these groups with the normal taxonomical standards than those who cling to a very fine splitting. For the latter there will be no end to describing new species as the number of paramorphs which may be 'coagulated' into 'constant species' can be of course exceedingly large.

Conclusion:—All specimens of one apomict and all other clones together agree genetically and taxonomically with some one individual specimen (paramorph) of a sexually propagating population. Genetically they do not represent a true population; it is merely an imitation of it.

Though an apomict perpetuates, by asexual reproduction, its characters on successive generations, and attains an area of distribution by normal methods of dispersal, it is clear that apomicts belong, taxonomically, to an essentially different category as compared with taxa consisting of sexually propagating populations.

Taxa are per definitionem provided with a higher or lesser degree of variability (polymorphism); by the absence of this characteristic apomicts withdraw from normal taxonomy. Their description and distinction is essentially comparable to that of one specimen.

In a genus containing both normal taxa and apomicts, the latter should be arranged in a specially appended category.

Apomicts should, in the genus to which they belong, be earmarked by the indication 'apom.' preceding their epithet.

It has appeared that cytological examinations suggest for the origin of apomicts hybridization previous to the adoption of apomixis by segregates in the $F_{2\text{-}x}$ generations.

It is probable that apomixis occurs in the native flora of the tropics and it is of manifest importance that cytological research be performed in situ, preferably in some large genera which are likely to contain apomictic species.

The study of apomicts is of course not discouraged; they have a pertinent value for inventories, for plant ecology and plant geography, but the solving of the riddle of the apomicts has made it abundantly clear that they have hardly any value for the study of the taxonomical structure of genera and their specific differentiation. As their number may run in one genus into the hundreds or even thousands they will give an entirely wrong picture of the size and differentiation of a genus.

References:—(*1*) HUXLEY (ed.), The New Systematics (1940).—(*2*) SØRENSEN & GUDJÓNSSON, Kongel. Dansk. Vidensk. Selsk., Biol. Skrift. 4^2 (1946).—(*3*) HERIBERT NILSSON, Hereditas 33 (1947) 119–142.—(*4*) Hereditas 26 (1940) 23–50. —(*5*) *cf.* Svensk Bot. Tidskr. 39 (1945) 65–82.—(*6*) Kungl. Svensk. Vet. Ak. Handl. III, 21 (1944) 1–130, 21 fig.—(*7*) Svensk Bot. Tidskr. 24 (1930) 333–428.—(*8*) STEBBINS, Bot. Rev. 7 (1941) 507–542.

9. PRACTICAL TAXONOMY

In small countries or parts of these, where the taxonomist has abundant material available, and has ample opportunity to check data in the field, specific delimitation generally offers few difficulties, genera with apomicts excepted.

This is, in part, due to the fact that in proportion to a smaller area, species and other taxa seem to be better demarcated. The local floristic botanist actually observes the populations only in their local facies. Consequently he should realize that his studies will lead only to a local interpretation or evaluation of the polymorphism of entire populations. This is sometimes insufficiently acknowledged by local students who are accustomed to a one-sided notion of each species.

These two factors make it extremely difficult to perform useful taxonomical work of permanent value by the local botanist in the tropics where in general large, regional Floras are not available to give them a solid footing. Local Floras in the tropics often create more difficulties than they solve.

The local taxonomist and floristic botanist possesses naturally the most detailed knowledge of the local flora, but he will be inclined to assign a higher rank to taxa than the monographer of the group who is in a position to examine taxa from wider distance and place these in better proportion with those closest akin. This enables the latter to make a better evaluation of the variability patterns of species.

In other respects the monographer is at disadvantage as compared with the local botanist as, first, he can not hope to be ever in command of the detail knowledge of the latter and second, it will, even for averagely large groups, be practically almost impossible to have personal access to all material from official and private herbaria. With the colossal increase of accumulated material in the past century the sheets needed for exhaustive monographic works become so numerous, that money for dispatch, space for storing, and specially time for going through endless series of specimens is often not available.

In order to gain a harmonious development of his work, the monographer will have to keep to the golden rule to work step by step "from the large to the small".

Firstly, he will have to start in acquiring knowledge about the 'structure' of the family to which the genus at hand belongs. This is often unclear in tropical floras, in contrast to temperate floras on the northern hemispere where the lack of unanimity in placing genera is a rare exception.

Secondly, he will have to give close attention to the definition of the genus at hand and its demarcation from other genera. This looks very simple but in practice it appears that authors not infrequently include family characters in generic diagnoses and have obviously no sharp notion of the generic characters.

After the revision of the species is finished, generic characters must be rechecked with all species, and eventually emended.

Thirdly, the monographer will have to consider which characters have served or may serve for subdividing the genus into subgenera, sections, *etc.* This preliminary distinction of infrageneric taxa will have to be verified during the preliminary sorting of the species.

Fourthly, the most important task is the sorting and distinction of the species. At this stage of the work, the revisor should be familiar (by preliminary study of the literature and of the specimens) with the standard characters which have been used in keys or found useful in descriptions in the past, giving him an idea of the 'variation pattern' of the genus and the relative value assigned to characters and their complexes. This pre-knowledge should be handled with care and criticism; the greatest merit is to improve the evaluation standard and to find additional new characters useful for specific distinction.

In tropical taxonomy, where species have in many cases been described in a haphazard way and where phytographers have often shown a great haste in publishing accounts of local collections without the background of revisional work, the standard for subdivisions of genera and specially the standard for specific delimitation must often be built up from the bottom.

The search for such a standard for larger tropical genera is often not easy, as material is frequently deficient and new desirable data are generally difficult to obtain at short notice. And these new data are often of vital interest, as monographers or revisors not seldom detect new valuable characters for specific or infrageneric distinction which have been barely noticed in earlier descriptions.[1]

Besides the necessity of attaining a reasonably acceptable correlation under these unfavourable or rather primitive conditions, there is the necessity of designing a picture of the degree of specific variability. The success of this attempt to extract a useful frame from inadequate data will depend on the standing of prior works, but to no minor degree on the experience of the revisor, his power of observation and deduction, his personal gift for

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(1) Dr BACKER found for example that the detailed structure of stigma and stamens is of essential importance for the infrageneric subdivision of the unrevised genus *Fagraea*. Of many species material is lost and of others difficult to obtain, and the characters wanted have mostly been omitted from the descriptions.

The structure of stigma and stamens is of course not an irrelevant 'detail'; structure never is.

In this essay 'detail' has mostly been understood in the sense of meaning slight differences in sizes or numbers, not shape and structure. *Varietates levissimae non curat Botanicus* (LINNAEUS, Phil. Bot. 310).

recognizing hierarchic levels, and a sense for making use of biological, ecological and plant-geographical evidence for checking the morphological data. All monographers and revisors, specially in tropical floras, are forced to judge the inadequate, randomly collected material in their hands by a subtle inter- and extrapolation in the evaluation of the observed and expected variability or polymorphism in order to attain a specific delimitation which will hold for the future.

Those taxonomists who are strongly orientated to the analytical aspect are naturally very much impressed by details and easily come under the spell of 'characters' of each single specimen. This hyperperfection brings along the danger of their not seeing the wood for the trees and they will have great difficulty in reaching a semi-permanent synthesis. The overestimation of detail, due to painfully thorough analysis not followed by synthesis, does not yield a useful result as no allowance is made for expected variability of future specimens. And only such an allowance, if wisely entered in the synthesis, can render 'hardness' and permanency to revisional work.

It seems at first sight unwarranted and undesirable to assign a greater degree of variability to species than can be observed *de facto*. But in the majority of cases in tropical floras the number of specimens at hand is a mere fraction, or even less, of the total number of specimens in existence. And the general (logical) experience is that increase of specimens brings along increase of variability, hence of the necessity of wider specific delimitation.

Recently J. Lewis, in a paper on African *Cassipourea* (1), has pointed out the undesirability of classifying plants merely on the characters of a few random collected specimens. He has also well explained how in such a case circumstantial evidence can be gained for making a conclusion.

From keys it can often be inferred that the responsible author has met considerable difficulty in framing the differences between the contrasted species and has, in absence of finding good structural differences, apparently been reluctant to accept them as conspecific, by taking refuge in *sizes*. Generally these figures prove later to be of fictitious value and merely the consequence of the accidental individual properties of the specimens the author had in hand. Experience has corroborated the generality that differences in size, unless extraordinarily clear and wide, are exceedingly untrustworthy if not accompanied by structural differences. This is specially true for measurements derived from vegetative organs which often show a surprising degree of plasticity.

Those who take in despair to mere measurements or qualities which are likely to be individual variations, often do not seem to realize that they enforce on themselves the responsibility for the reliability of these futile 'characters'.

And this militates against the golden rule of good phytography reading: *Do not commit yourself.*

Sometimes they excuse their inability to overcome their (emotional) reluctance to make a firm synthesis by declaring their work to be necessarily of a 'provisional' nature through absence of ample series of good specimens. I can only strongly warn against such practice: it seems to be preferable that such provisional work, by which the crucial questions are not solved and nothing is gained, should remain in manuscript until the desired material is available.

Such 'provisional' work has namely proved to bring disastrous confusion, specially in monographs of large genera, where overestimation of details of individual specimens has led to a host of new species names based on single collections. And it is specially these single collections which are so difficult to estimate; they should be given extra care for the clearest distinction by structural characters.

The great responsibility of monographers appears exceedingly important as later authors are naturally always influenced by the work of their predecessors and will generally be inclined to 'follow' a monographer's work. One stands *a priori* sympathetic with efforts of monographic character though one should never trust them blankly at first sight. Their value will become evident only after having practised with them.

Only insiders can understand the great importance of useful monographs with a balanced, well-defined concept of specific delimitation. Once such a satisfactory monograph or revision has been made, its value is recognized by future workers and kept as a basic frame. Later work with the same genus will then remain orderly and its hard text will prevent hurried work and rash description of novelties.

In contrast, a monograph or revision with a hesitative or provisional character, which is obviously premature, creates or facilitates a phytographic progeny of a similar hesitative or provisional kind. The lack of a well balanced and seriously considered standard for specific delimitation—generally too narrow, sometimes degenerated into specimen description—easily induces later none too critical authors with ambitions or immediate need to name specimens to follow the example and fall into step with the monographer, which results in adding to the confusion rather than to solve something. Critical authors will of course refrain from naming specimens in such maltreated genera.

The announced lack of backbone in the ticklish field of specific delimitation is unfortunately a character of the majority of the monographs published in the 'Pflanzenreich' during the last fifty years, with a few laudable exceptions. This lamentable situation is caused partly by the great haste in which the earlier volumes have been produced; partly it is caused by the fact that the authors for the same reason restricted their material to that represented at Berlin. But the *main reason is* that the authors, among whom there were a surprising number of non-professional taxonomists, have obviously not realized the responsibility of such important tasks.

It is true that the composition of world monographs may assume alarming dimensions, if authors aim at completeness. A monograph of a medium-sized family will require a life-work under present conditions as practically all taxonomists can perform such work only in addition to official and routine work. And there is a tendency among qualified taxonomists not to undertake such tasks, which entail borrowing large amounts of material and necessitate the examination and ticketing of an immense number of sheets to attain precision for both delimitation of taxa and geographical distribution. This strife for exhaustive work and completeness in minute details is certainly a disheartening prospect. The size of such top-heavy monographs could be certainly very much reduced if lengthy accounts of distributional data, irrelevant references in the synonymy, and collecting numbers were omitted. If monographers have ticketed the specimens in many herbaria it appears superfluous to have them again recorded in print, and, if so desired, a very condensed form will suffice. Such concise monographs would gain in surveyability, would be less expensive to print, would cost less time to write up, but still contain the vital information required.

In a classic essay Bentham (2), whose monographic attempts have never been surpassed in size or thoroughness, has at the end of his life, in his meticulously elegant way, indicated the lines along which monographic work should be performed. From this essay which should be studied, and studied again, by every taxonomist aiming at taxonomic work, I quote the following passages:—

"That the main object of systematic botany is not the finding out the name of a plant, but the determining its relations and affinities, the making us thoroughly acquainted with its resemblances and differences, with those properties which it possessed in common with others or which were peculiar to itself, whether these properties consisted in outward form, inner structure, physical constitution, or practicable applicability to use, all of which had to be taken into account in the formation of orders, genera, and their subdivisions".

"The grade of plant-race to which the specific name and diagnosis should be attached, would be the species in the Linnean sense, which, though not susceptible of a strict definition, is pretty generally understood amongst botanists, whether they may designate it as a true species, a Linnean, or a compound species".

"As the number of species increased, greater extension was habitually given to both diagnosis and description, till they became unwieldy for use, without some short indication of the most striking points to be attended to. This has been done in two ways, either by prefixing to the group of species described a tabular clavis or a short conspectus of the contrasted characters to which attention is specially called, or by italicizing them in the long diagnosis. The former course entails often the useless repetition of the same characters three times over, in the clavis, in the diagnosis, and in the description; the latter, seeing that the italicized words are usually adjectives, often occasions confusion and loss of time in searching for the substantives to which they belong".

"In all we want a short indication of the most prominent contrasted characters for approximate or preliminary determination, prefixed to the detailed description for subsequent verification".

"The diagnoses to be useful should be short. We cannot now restrict them to the twelve-word law of Linnaeus, but a twelve-line ablative diagnosis is an absolute nuisance, except for full descriptions needed for new taxa".

"It should always be borne in mind by the monographist that the great test of the quality of a descriptive work lies in short descriptions, diagnosis, and conspectus or clavis. Any tyro with a little practice can draw up long descriptions of *specimens*, fairly detailing every organ; but the selecting the characters necessary to give a good idea of a *species* in a short description requires a thorough knowledge of the subject and a methodical mind".

"Still more difficult is it to prepare a good clavis. After half a century of experience in using as well as in making these keys, I find that I have failed in some of those on which I had spent the greatest pain; and in some floras I have met with tabular keys which are in many respects rather impediments than aids to the determination of plants. At the same time a successful clavis or contrasted conspectus is an excellent test of the quality of a method—of the appropriate grouping into genera, sections, and species".

"The preparation of a revision or monograph is still recognized as the best exercise for the young botanist".

If the points stipulated by Bentham have not been sufficiently taken into consideration in a monograph or revision, and its author has lost himself in a swamp of details resulting in very long and elaborate descriptions, it is self-evident that additional material will always deviate in some characters from the description, the chance for this being proportional to the degree in which detail was entered in it.

It is a matter of psychology how such a monograph is received and used.

Hasty successors will then conclude that their specimens represent something new and will follow the tendency and add a new similar description assuming having found a new taxon.

Uncritical, slavish successors will do the same, being impressed by 'thoroughness' of the monograph and assuming it to be final they will follow its detail cadence as a matter of routine.

The disinterested critical taxonomist will try to gain an insight in the principles followed in the monograph; he will study and dissect the keys and descriptions and will try to identify specimens with it. In many cases he will meet difficulties to find his way with the elaborate descriptions. If he is a tolerant person he will lay the monograph aside with a sigh of dissatisfaction and conclude that he either lacks enough intelligence to grasp the author's observations and intentions or that the group in question contains great difficulty in specific delimitation requiring long study to be familiar with it. He will either send his specimens to the monographer, leaving him the responsibility for naming, or he may decide to leave the specimens unnamed.

The less tolerant person, however, will thoroughly dig himself into the monograph; it will rouse his indignation and his disappointment will induce him to throw the book away in grumbling—again one who has not studied the work of the masters and is therefore not in command of the profession; again a book which creates difficulties instead of solving them.

The aftermath of such pseudo-monographs is either to bring its author into disrepute or the genus or family respectively. Non-systematists derive from such works even a repugnance towards the whole of taxonomy as a branch of science. Specially the latter conclusion is most unfortunate.

Monographs must be useful and monographers should have the responsibility for this clearly in mind. Good monographs are the only means of bringing progress; this holds for the past and holds for the present and future. They must be constructive and solve problems. Taxonomy is not in need of mere compilations without creative spirit; there is no sense in publishing such works.

The question may be raised whether there are no difficult groups of which no sound or satisfactory monograph is possible and where specific delimitation is problematic. I admit that some groups, for example the apogamous ones and cultigens, withdraw from normal taxonomic methodology. And further it is certainly true that species in some genera are more difficult to classify than those of other genera.

But I have come to the definite conclusion, based on a long experience, that the majority of 'difficult groups' are not so intended or created in nature, but that the difficulties have been created by the monographers.

Circumstantial evidence in favour of this thesis is that, if the fault lay in the groups, it would be hard to understand why there should often be such a marked difference in clearness of classification for the same group between one Flora or monograph and another; if the group was difficult, it should be unmanageable in all Floras or monographs.

Further evidence can be drawn from the fact that great taxonomists, for instance J. E. SMITH, ROBERT BROWN, JOSEPH DALTON HOOKER, GEORGE BENTHAM, J. MUELLER-ARG., WEDDELL, DE CANDOLLE, JOHN LINDLEY, OTTO STAPF, LUDWIG DIELS, and others, who have worked in nearly every group of the vegetable kingdom, have all produced 'hard' or useful work standing the test of time; in a considerable number of cases the modern critical taxonomist has finally to return to their concepts.

It is for these reasons of the greatest value to study the works of these Makers of Botany to learn their methodology and considerations. Both BENTHAM (2) and HOOKER (3, 4) have explained the principles of taxonomic work about a century ago. These essays have lost nothing of their didactic importance and should be read and reread by all modern taxonomists.

The essential character of their work, as I see it, is the conciseness by which the essence is embodied in diagnostic synthesis, besides their fine notion for the evaluation of hierarchic relations among botanical characters used for specific delimitation, their keeping to good, diagnostic, structural characters with omission of unreliable detail and size characters, resulting in a generally rather wide specific delimitation. Through wisdom and common sense, gained by acute critical observation and disinterested experience, they have succeeded in attaining a remarkably final specific delimitation on the basis of few materials.

There is not the slightest indication that they have neglected to observe details of individual specimens, but they have succeeded in extracting from the array of observations the essential ones leaving aside individual variations and those of minor taxonomical value: *l'art de décrire*.

In certain instances they found it necessary to distinguish infraspecific taxa, varieties and forms, notably in cases where minor characters possessed obviously geographical significance. In other instances they added in brief notes critical observations on infraspecific variability and discussed demarcation against allied species.

Generally they did not commit themselves further than the species, however, and refrained from entering on a more detailed analysis of the species population.

This subtle handling of specific delimitation, with refraint from such detail, for the evaluation of which herbarium material is not sufficient, has resulted in exceedingly valuable work which it is still a pleasure to use.

I cannot conceal certain feelings of disappointment, that this elegant and wise methodology has received, in this century, less attention than it deserves in my opinion and has been employed to a lesser degree than it should have been.

Certain taxonomists assume that it is antiquated and that modern taxonomy requires so-called *precision*. Others advance the argument that taxonomists of the former century naturally had to be more concise because of the scarcity of material which forced them to be cautious, but that this is not any longer justified at the present day, now collections have so much increased. Consequently they still record all details in elaborate descriptions, counting and measuring every organ and character, independent of its diagnostic value, leaving it to the user to sort these 'characters' hierarchically.

The analytically inclined taxonomists using this conscientious, exhaustive way have obviously also in view greater *objectivity*. They are insufficiently aware that it is just these details which are so dangerous and devoid of diagnostic value, easily leading to the quicksands of specimen diagnosis. It is namely an illusion that by keeping to mere facts one can avoid the responsibility for judgement of constancy of the details. By entering them in a description one *a fortiori* accepts this responsibility. Therefore the automatic recording of details where they are redundant defeats the aim envisaged by so-called precision and objectivity and spoils the quintessence of the art of phytography.

Through the slavish recording of details they have a strong tendency for accepting either narrow specific delimitation or to take refuge in an (often) ridiculous number of infraspecific taxa, as otherwise the details cannot be squared with taxonomical distinction. This tendency to splitting may lead—specially in polymorphous species—to population analysis, a discipline which cannot be undertaken successfully on the basis of herbarium specimens.

Those working along these lines realize to a certain extent the inadequacy of avoiding difficulties by swamping them in details of doubtful value, and they shield themselves not infrequently behind the deceptive argument alluded to before that all work performed on (tropical) plants is preliminary and that it should be preferable to start with a narrow specific delimitation which would eventually facilitate reaching broader concepts when more abundant material might show the complete series of intermediates linking the microspecies.

The trend of mind that taxonomic revisions of tropical plants are always of a provisional character has a laming effect on the striving towards critical subfinal work, minimizing such efforts.

I admit that inadequacy of material occurs more often with tropical plants than with temperate. In cases where a satisfactory conclusion cannot be reached on that account, it should either be clearly stated by the author to be so or specimens representing doubtful novelties should preferably be left unnamed and omitted. Inadequacy of material cannot be counterbalanced by carefulness of detailed (specimen) description.

Other strong objections against this pseudo-carefulness are twofold. Firstly, it should be remembered that taxonomists naturally have *a priori* respect for the written word: *verba volant, scripta manent!* There is a distinct inertia to emend, to drop what has been distinguished before, and a reluctance to merge what others found distinct.

Secondly, it is not realized that in geographically differentiated populations the expected complete series of intermediary specimens will rarely be obtained, because geographical races are exclusive by definition. In the case of disjunct races they are even non-existent. The result is that all races, notably the disjunct ones, which have been described with pseudo-carefulness provisionally as species will remain permanently on that level.

It has sometimes been advanced that the distinguishing of large, variable species—and many linneonts are of that kind—shows lack of precision. It should be borne in mind that the exact or satisfactory delimitation of such variable species costs a great amount of labour and careful consideration. In contrast diagnoses of narrowly encompassed taxa are very easy to draw and specimen description is mechanical work merely requiring analytic qualities.

An instructive example of the ridiculous conclusions reached by working along the line of 'precision' is expressed in the revision of the genus *Lespedeza* by SCHINDLER (5). I refer to this example because the author clearly states his reasoning and trend of thought. He gives exceedingly detailed descriptions of a complex of so-called closely allied Siberian-East Asiatic 'species' among which *L. juncea* L. *f.* is the oldest described. After having found out that *L. juncea* and *L. inshanica* "oft kaum zu unterscheiden sind" he proceeds to give the following remarkable comment (5, p. 606):—"Dieser abweichende Habitus besonders hat mich veranlasst, die beiden Arten zu trennen, wenn ich mir auch bewusst bin, dass die Underscheide in den Blüten ganz verschwindend und in den Früchten sehr gering sind. Es kommt noch ein Unterschied hinzu, der sich in den Diagnosen kaum zum Ausdruck bringen liess, nämlich, dass in gutentwickelten Exemplaren von *L. juncea* die Trauben meist lang gestielt sind, was bei *L. inshanica* niemals vorkommt, auch nicht in sehr reich entwickelten Exemplaren. Wollte man aber die, wenn auch geringen, Unterschiede in der Frucht vernachlässigen, so könnte man andererseits auch *L. caraganae* nicht aufrechterhalten, da auch hier die Unterschiede nicht viel bedeutender sind. Diese Art nähert sich aber sehr der *L. sericea*, besonders deren nördlicher Form. Die Folge wäre, dass man dann auch *L. sericea* und die mit ihr wieder verwandten *L. variegata* und *L. elegans* einbeziehen müsste und dabei zu ganz unmöglichen Resultate kommen würde. *Alle diese Arten gehen fast unmerklich ineinander über, was ja nur natürlich ist, aber derart verschiedene Formen wie die sibirische L. juncea und L. elegans aus Kashmir zu einer Art zusammenzuziehen, widerspricht völlig dem uns geläufigen Artbegriff*".[1] (transl. of italics: All these species are grading imperceptibly, which is natural, but to refer such different forms as the Siberian *L. juncea* and the Cashmerian *L. elegans* to one species is opposed to our concept of specific delimitation).

It is clear that the species mentioned represent grading geographical variations of one widely distributed Asiatic-Malaysian Linnean population. Why this synthesis would lead to an absurd conclusion ("ganz unmögliche Resultate") is a complete mystery. The only absurd conclusion is that of SCHINDLER himself, *viz* that he is able to describe and to keep species apart which grade imperceptibly and to which he finds it, consequently, impossible to give a key. He had plenty of material at his disposition and it is clearly because of his methodology and reasoning that after a meticulous analysis he did not reach the same synthesis of one geographically differentiated specific population (*L. juncea* L. *f.*) which had earlier been made by MAXIMOVICZ, BENTHAM, and HEMSLEY, and which I have recently accepted (6).

The result of such methodology or reasoning,

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(1) *Italics* mine.

culminating in the conclusion that species merge imperceptibly, militates against the first principle of taxonomy, *viz* to trace demarcations in general and to define species. Further it renders the work useless for others because if the monographer cannot delimitate his species and is unable to give a key, how can others have any hope to do so? Within sight of the harbour the vessel *Lespedeza* ran ashore.

From this example it can be seen that prejudice about specific variability prevents unbiassed approach to synthesis and, therefore, clear specific delimitation.

A strong objection to this methodology is of course the comparison of extremes, *in casu* those from Siberia and Cashmere. This is always unfair and unpremissible, specially if, as in the case of *Lespedeza*, the extremes are connected by a complete series of grading races. If comparisons are made, the specimens from Siberia should be compared with those of Mongolia, these in turn with those of North China, these with those of South China, and so on.

If SCHINDLER had not so fully commented on the situation—and in many similar cases their authors do not—those who used this 'monograph' might have come to the conclusion that *Lespedeza* was a difficult genus.

It has been the opinion of BENTHAM that the inability to give a key to the species is itself always a sure warning signal of the absence of a sound synthesis and I believe this is unanimously agreed by all good taxonomists. A key represents the proof of the pudding, because the author of the group is challenged to crystallize the essence of his work in it and to show in which way he has found the hierarchical value of differential characters. If authors want to give longish specific descriptions the diagnostic characters should either be printed in italics or be summarized concisely in a differential diagnosis preceding the description.

Inadequate material.—Besides the cases, similar to that just dissected, in which an author remains stuck in his analysis, though his material and factual information is adequate, there are other cases where authors, who are equally conscientious analytically, are faced with the fact that they have to reach a conclusion on the basis of inadequate material consisting of a few random collections made wide apart.

The intermediates may be absent by lack of exploration or will never be found if the intervening spaces are unsuitable for them (disjunct populations).

Authors working with such problems may, even while not inclined to follow SCHINDLER's example of keeping apart 'species' which are connected by a full series of intermediates, just stick to the facts and be unwilling or unable to evaluate details and give allowance for variability in reaching their conclusion. They feel uncertain on the basis of inadequate facts, and do not like to run ahead. They do not trust their experience in other groups—and this is admittedly a good excuse for beginners—and besides they are not inclined to consider and reconsider, again and again, the value of the characters derived from few random individual specimens. They are too easily satisfied to labour on to the 'hard species' standing the test of time, and they know it. Consequently they regard their work of a preliminary nature. If such persons have to work on groups in which specific delimitation is decidedly difficult, for example genera confined to mountains or floras broken up by archipelagic conditions where very often intermediary forms are non-existent and many species show an intense racial development, authors basing themselves only on the bare, observable facts of discontinuity of characters will never be able to reach a constructive synthesis, though their work will be of a decidedly better quality than that of the SCHINDLER type. Both types of work belong, however, to the category of 'pseudo-monographic' work.

Descriptions from random collections.—Up till now I have restricted myself to considerations concerning the methodology and practical execution of taxonomic work, either revisional or monographic or submonographic for a regional Flora.

In many cases, though, taxonomists are working *floristically*. They receive a random collection which has to be named. In this collection a large number of families and genera is represented. Their principal aim is to give a name to the specimens. The first thing is to arrange them roughly into families and, as far as possible, to sort them into genera. Such a task can only be performed if the botanist is rather thoroughly acquainted with the entire flora of the area concerned.

The specific identification of the specimens is a challenge to an exceedingly profound detailed knowledge. Critical naming can only be performed against a firm background of reliable Floras, monographs and revisions of families and genera and a well-named large herbarium for checking.

These two essential requirements necessary for trustworthy floristic work are absent in Malaysia, where the literary background consists of hardly any trustworthy Flora, of a number of obsolete or unsatisfactory world monographs, a number of uncritical, compilatory enumerations, and a surprisingly small number of useful regional revisions. Critically named collections are not concentrated in one single herbarium.

This situation—which is precisely the reason why the present work is undertaken—means that the majority of families and genera confront the floristic botanist with a scientific vacuum. If he is a wise man he refrains from haphazard naming, whatever press is exerted on him. He can easily defend his attitude by sound scientific arguments. If he is hurried or ambitious, however, he accepts the challenge and throws himself into the abyss never to come out unscathed.

His working method will be the following. After the preliminary sorting, he will entrust some monographers with a certain genus or family but the bulk will remain his own job. For each family he will familiarize himself superficially with what characters to use and look at. He will try to check descriptions, preferably from those species which are already described from or recorded from the place where the present collection is made. He will—if this is at his disposition—check in his Herbarium with the material available there. But it is clear that in this way only a very inadequate naming will be reached and most specific epithets will be tentative and will have to be preceded on the label with *cf.* (compare). There will be no time for getting thoroughly acquainted with the species of each genus as this would in each case lead to a regional revision, let alone to extend his comparison with species described from adjacent regions. The latter tempting procedure would lead to submonographic work requiring still more time and defeating his aim for rapid naming of the collection within a reasonable time. Any number which can not be found along this superficial way is described as new for science.

The result of this floristic work has manyfold disadvantages if it is published. Firstly, it is hardly to be called scientific, for it is haphazard guess work. Secondly, it may lead to grave errors where the preliminary assigning to a family has been wrong, as this may lead easily to creation of new, fictitious genera. Thirdly, precious time of the botanist is lost instead of being spent on creative work. Fourthly, any conclusions of a general nature, evolutionnary or plant-geographical (conclusions on endemism %, *etc.*), based on such uncritical enumerations or records are worthless. In short more work is created and the Augean stables are replenished.

In Malaysia this practice has unfortunately been employed for a considerable period by Ridley, Elmer, and Merrill, the latter being decidedly the most critical of the three.[1] If these authors had spent their time on critical revisional work, we would have been much further towards gaining reliable basic knowledge. Even very cautious workers, as Henderson for example, who worked along this local way at Singapore, could not avoid duplication. He described for example a *Loranthus pekanensis n.sp.*, which was certainly up till then not collected in Malaya. In the revision of the family by Danser, however, it appeared already to possess two other names and be a common plant in Borneo (7). In order to find this out Henderson would have been faced with a complete revision of the family *Loranthaceae* which was, at that time, in Malaysia in utter disorder, generically and specifically.

The high degree of local endemism credited to the Philippine flora rests solely on the basis of these 'paper' species which may appear from the following table in which the number of species of Merrill's 'Enumeration' are compared with that after careful revisions for the Flora Malesiana with the novelties not mentioned separately:

Family or genus revised	Number of species in Merrill's En. Philip. 1923–1926			Number of species after revision		
	Non-Endemic	*Endemic*	%	*Non-Endemic*	*Endemic*	%
Alangium (1939)	3	3	50	5	1	17
Amaranthaceae (1949)	21	1	5	20	0	0
Burmanniaceae (1948)	2	1	33	2	1	33
Burseraceae (1956)	3	54	95	11	5	31
Caprifoliaceae (1951)	4	7	63	4	3	43
Carex (1951).	17	10	37	19	10	33
Dichapetalum (1956)	2	11	85	2	2	50
Dillenia (1951)	2	13	87	2	11	85
Loranthaceae (1935)	9	92	91	17	69	80
Pentaphragma (1953)	0	5	100	2	2	50
Pittosporum (1956)	1	13	93	5	1	16
Scaevola (1953)	3	4	57	3	0	0
Triuridaceae (1938)	1	1	50	3	6	66
Umbelliferae (1949).	9	3	25	10	0	0

Similar figures can be obtained from New Guinea and other islands. *No flora of a single island or island group within Malaysia can be studied satisfactorily without having consulted earlier descriptions of species from the surrounding islands or island groups for correlation.*

It is remarkable that only in recent years the importance for this correlation is visualized in the area and that rash description and recording of collections is gradually abandoned. The Flora Malesiana project is a stimulant to canalize the efforts towards healthy creative work for the benefit of all concerned. It is a most gratifying thought that the present staff of the Singapore Botanic Gardens is finally impressed by this thorough scientific experience and I can only hope that other institutes will follow this blessed

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(1) As a matter of fact Merrill was fully aware of this and told me personally that many of his species had been "optimistically proposed".

collaboration which has been employed for some decades by the Herbarium Bogoriense.

The dealing with new collections must remain a matter of routine merely for permitting specimens to be inserted in the herbarium. The majority of new collections is, after preliminary naming, stored in the respective families and genera where it remains until a revision of a genus or family is undertaken. All time should be spent and efforts concentrated on revisional work. Publication of interesting records must be reduced to fully reliable, exceptional cases studied with extreme caution.

In conclusion it is stressed that the reliability of specific delimitation is a matter proportional to its usefulness.

In practice it has been found that a comparatively wide specific concept, based on a complex of good structural characters, has yielded the most permanent results.

Revisions without a simple, clear key bear testimony of provisional or superficial specific delimitation.

Where in the tropics or subtropics there is no classical general Flora as a reliable background, local work and floristic recording of random collections is strongly discouraged; it is regarded as a waste of time.

All efforts should be directed towards real taxonomic revisions, regional, and monographical work, in which species and their interrelationships are studied irrespective of political boundaries.

All taxonomists in the tropics should have studied and thoroughly digested the general essays written by BENTHAM *and* HOOKER, *referred to above, which should be a guide to their work.*

References:—(*1*) LEWIS, Taxon 4 (1955) 73–77. —(*2*) BENTHAM, Recent progress and present state of systematic botany (Rep. Brit. Ass. Adv. Sc. for 1874, 27–54, 1874).—(*3*) HOOKER *f.*, Introductory essay to the Flora of New Zealand (1853) i–xxxiii. —(*4*) HOOKER *f.*, Introductory essay (Fl. Ind. 1855, 1–44).—(*5*) SCHINDLER, Bot. Jahrb. 49 (1913).—(*6*) VAN STEENIS, Nova Guinea *n.s.* 6 (1955) 280.—(*7*) DANSER, Bull. Jard. Bot. Btzg III, 11 (1931) 326–327.

10. CONCLUSION AND THESES

The considerations in this essay on specific delimitation are not intended to represent an appeal for a new botanical crusade. The crusade for establishing taxonomic botany on the firm ground of sound specific delimitation was performed successfully long ago by LINNAEUS, BROWN, BENTHAM and HOOKER, and others.

A long experience both in the field and in the herbarium has convinced me of the prime importance and finality of the principles laid down by the Masters of taxonomic botany.

It appears useful, while botanical research is in rapid progess and new disciplines are constantly added, to verify the doctrines and to explain the principles for specific delimitation followed in this Flora.

It has appeared that genetics, experimental taxonomy, and cytogenetics have added much to a better understanding of the structure of interspecific affinities and have permitted an insight into the infraspecific complexity of many specific populations, their geographical, ecological, and karyological differentiation, interspecific and intraspecific hybridization and sterility barriers, the origin of ruderals, cultigens, and apomictic forms.

It has further appeared unmistakable that at least in allopolyploidy one mechanism has been found for the origin of new Linnean species.

This more detailed knowledge has affirmed the sound basis of classical taxonomy as applied by those who were master of the art of botanical description.

It has appeared that among species—genetically representing populations and consequently offering a certain degree of polymorphism—there may be a distinct tendency to segregate into two or more infraspecific taxa which may, or may not, be bound to ecological preference by survival value. Such a tendency has naturally led to a hierarchic pattern of ecological variability expressed in racial differentiation from the subspecific rank down to the smallest entities or ecotypes with proportional degree of morphological distinction.

In other species populations this tendency towards ecological differentiation is low; consequently it bears the aspect of a more or less homogeneous or at most clinal polymorphism not geographically defined.

In still other species there is a low degree of morphological variability and such species retain their characters throughout their area.

In the past the polymorphism of species in Malaysia has in the absence of phytographical correlation led to the description of a considerable number of species being based on races, ecotypes and other infraspecific deviations. Local floristic work has at least in Malaysia added to an almost frightening degree to the distinction of paper species.

Consequently the critical, revisional work for the Flora Malesiana must consist of greatly reducing the number of species, while adding a few manifestly new ones found by recent exploration.

The degree of reduction varies from genus to genus, but may occasionally attain considerable dimensions, for example in *Scaevola* § *Enantiophyllum*, of which 14 species had been described and which have been together accepted in this Flora as representing one linneont only.

The keeping to the *motto* under which this Flora Malesiana is executed, *viz the endeavour to determine how few, not how many species, are comprised in it,* is intended to attain a really trustworthy, permanent frame work of a general Flora containing keys which work and diagnoses which fit.

In my capacity of general editor I feel responsible for its phytographic style which I have explained in this essay.

Both for readers and collaborators I have condensed the conclusions into the following

RULES AND RECOMMENDATIONS FOR PLANT TAXONOMIC WORK

(1) It is a universally acknowledged experience that the structure of living matter is discontinuous in various degree and that its classification necessitates a hierarchical system in order to understand its morphological differentiation and systematical arrangement.

(2) The hierarchy is attained by the proportional degree of appreciation of the value of morphological characters and their complexes. In any hierarchic classification there is, therefore, increasing diversity in ascending and increasing homogeneity in descending.

(3) Classification is basic to science, and plant taxonomy to every branch of botany, pure and applied.

(4) Consequently the plant taxonomist should recognize his unique responsibility for botanical knowledge.

(5) The main object of systematic botany is not the finding out of the name of a plant, but the determining its relations and affinities, the making us thoroughly acquainted with its resemblances and differences, with those properties it possesses in common with others or which are peculiar to itself, whether these properties consist in outward form, inner structure, physical constitution, or practical applicability to use, all of which has to be taken into account in the formation of orders, genera, and their subdivisions (BENTHAM).

(6) Practical taxonomic work should confine itself to factual observation and not be hybridized with theoretical considerations on origin of species and genera or supposed phylogenetical relations.

Such hypothetical deductions are not discouraged but should be kept clearly separate from the facts observed and not be introduced in their evaluation.

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(7) Experience is of course an important factor facilitating and speeding up the gaining of good results. That taxonomy can (only) be executed on the basis of intuition is a myth, unless this be understood as sublimated experience.

(8) Work from the general to the detail, keeping in mind the hierarchic order and try to find out what detail is trustworthy for distinction.

(9) It is important to observe all distinguishable taxa and their demarcation, but it is still more important and often far more difficult to assign them to their proper hierarchic level.

(10) A sense for synthesis is indispensable for good taxonomy and is at least of equal value to the preceding analysis.

(11) The mere fact that taxa can be distinguished furnishes itself no argument for their position and rank.

(12) In broad outline only one acceptable specific delimitation can be attained by good taxonomists in each genus.

(13) It should be borne in mind that data derived from refined morphological methods (anatomy, palynology, cytogenetics, *etc.*) cannot be *solely* decisive for judging the status of taxa; preferably all should be taken into account.

(14) Good genera, species, and subspecies are characterized by a set or combination of different (independent) morphological characters (with generally additional ecological features). These taxa are in keys often contrasted by means of one character merely for the purpose of convenience or brevity. If the contrasted genera or taxa of lower rank are really different in *one* character only, the separation will mostly prove to be artificial.

(15) Regardless of nomenclatural appreciation, the Linnean concepts of species and to a slightly less degree that of genus will always remain the most essential levels of botanical classification.
The tendency to devaluate the ranks by one level, *i.e.* the raising of all subspecies to species all species to series, all sections to subgenera, all subgenera to genera, *etc.*, is strongly discouraged. It has no sense if the mutual position of the taxa does not change.

(16) Infraspecific taxa should be well distinguishable by morphological characters though, with subspecies, allowance may be made for intermediary specimens in transitional zones. Marginal and other clinal variation should be explained, but not by name giving.

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(17) Experience has shown that a critical revision, monograph, or regional Flora gains in permanent value in proportion to the amount of critical labour spent on it.

(18) The intrinsic quality of monographs and revisions is proportional to their usefulness which is a reasonable check on the personal element in the appreciation of characters. Consequently authors should pay the highest attention to this aspect of their work.

(19) Diagnoses to be useful should be short.
If detailed descriptions are desired they should be preceded by such a diagnosis containing the more prominent characters contrasting the species against its allies.
A successful clavis or contrasted conspectus is an excellent test of the quality of a method.
The preparation of a revision or monograph is still recognized as the best exercise for the young botanist (BENTHAM).

(20) It is advisable to start keys with reliable vegetative characters to facilitate identification of all specimens. As these characters are generally less sharp and stable than those of the sexual organs, they should in case of doubt never supersede the latter, even if this would cause inconvenience when using the key.

(21) In contrasting differential characters it should be avoided to use measurements of organs in case they show a tendency to overlap unless they are preceded by differences in shape and structure which are generally superior.

(22) As a general principle Linnean species of flowering plants cannot be distinguished specifically on the basis of vegetative characters only; there should be additional differential generative (reproductive) characters.

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(23) The use of geographical or ecological data to support morphological characters of doubtful value is strongly discouraged.
These data must be reserved as a later check on the attained morphological distinction which should remain the basis of taxonomy.

* * *

(24) It should be realized that the importance of the type specimen of a taxon rests on its (nomenclatural) administrative significance as that element to which the name of the taxon is permanently attached. It need not to represent the 'average', 'most typical' or the most 'characteristic' facies of the taxon. Taxonomically it does not possess more value than any other random collection.

(25) In making a revision the primary task is to sort the material into specific (and infraspecific) groups and then to describe these taxa, the last phase being the fixing of the correct name and its synonyms in which the importance of the identity of the type specimens becomes evident.

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(26) Tropical species are sometimes regarded as less variable than those from temperate countries by botanists who have never been in the tropics. Consequently details of individual specimens are often overestimated, specially if material is scarce.

This is a fiction: species of tropical plants show on the average no less variability in their sexual organs than those from other countries, sometimes exhibiting a marked degree of flower dimorphism.

In addition they show sometimes a remarkable vegetative variability (partly phenotypic), notably in woody plants and climbers.

(27) It is unphilosophical if taxonomic studies on tropical plants are undertaken with the preoccupied thought that this work is only provisional. This objectionable idea minimizes efforts to attain superior work and stimulates hasty and uncritical, compilatory work.

(28) Without the background of a critical general Flora it is in tropical countries impossible to gain satisfactory permanency of critical knowledge on delimitation of taxa, their area of distribution, variability, and consequently their names and synonyms.

(29) In tropical countries the writing of specialized local Floras is discouraged in absence of a critical, regional Flora which should have priority.

(30) Taxonomists working with tropical plants should as much as possible try to restrict the time spent on floristic botanical work (accurate naming of sheets of random collections) and focus their attention on creative attempts towards revisional or monographic work irrespective of political boundaries. This is the only efficient way towards progress in tropical taxonomy.

* * *

(31) Among the taxonomic ranks the Linnean species has appeared the most essential, useful, and objective taxon. Though not susceptible of a strict definition, its status is pretty well understood among botanists and geneticists, whether they may designate it as a true species, a Linnean, or a compound species (BENTHAM).

(32) The thesis of LINNAEUS that the taxonomist should not be much concerned about the slight variations ('*varietates levissimae*') is still a generalization of value to the tropical taxonomist.

(33) A discreet lumping does not mean throwing taxa together from laziness or superficiality but should contrarily be the result of careful consideration and evaluation of details in order to reach a justified hierarchy of relationships.

Taxonomy is not served by catalogues of taxa disregarding this principle. See also § 38.

(34) If material permits, it is of the highest interest to gain a rought insight into the infraspecific pattern of variability, whether it be grading (a cline) or differentiated into geographical or ecological races. See also § 57–61.

(35) A thorough population analysis, however, falls outside the capacity of the herbarium botanist.

(36) A taxonomist should endeavour to determine how *few*, not how *many*, species can be distinguished in his synthesis.

(37) The principle of geographical replacement should, whenever possible, be adopted, thus reducing the number of species while increasing the number of subspecies. Similar principles of ecological or genetic replacement should also be adopted as knowledge increases (HUXLEY).

(38) The variability of species is generally found to increase in proportion to the size of their area. Therefore our knowledge of this variability increases proportionally to the number of specimens available for study and appears always larger than originally assumed.

(39) The variability often shows extremes in the marginal area due to isolation and heaping of recessive characters, often leading to satellite convivia which may deserve subspecific rank.

(40) It follows that it is wise if a greater degree of variability is assigned *ab initio* by not attaching too much value to details which are liable to greater variation than structural characters and which can be expected to have no diagnostic value.

(41) In proportion to the amount of detailed characters entered into a botanical description the responsibility for the constancy of such trivial characters increases with decreasing chance of their permanent value.

Never commit yourself unnecessarily.

(42) The overestimation of infraspecific taxa as species has the unfavourable result that the hierarchic relations, reflecting the affinities within a genus, are misrepresented, militating against the primary aim of classification to have a balanced hierarchy.

(43) The ambition to designate the smallest taxa with a binomial bears testimony of ignorance of both theoretical knowledge and judgement, absence of sense for synthesis, and contempt for the work of our illustrious predecessors.

(44) If a taxonomist finds great difficulty in delimiting species, he should carefully verify his standard, before considering the possibility of irregularities inherent to the group (apomicts, *etc.*) or due to environmental conditions (destroyed areas, *etc.*).

(45) Wherever applied botany should require fine distinctions for its own pursuits, an auxiliary nomenclature should be invented. It is not served by an unsolicited overestimation of taxa in scientific taxonomy.

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(46) Allied good species have in general geographical areas which partly overlap, proving their individuality in the area they have in common.

(47) If two taxa, which might by morphological characters deserve the specific rank, are replacing one another geographically or ecologically, the taxonomist should be careful to explain why he accepts them as distinct species or subspecies. See also § 37.

(48) Local-endemic species must always be regarded with caution. They lose their local endemic character as soon as they are found elsewhere and lose also their status of species if they can be correlated as extremes to wider distributed species.

(49) For allied disjunct taxa which, by their morphological characters, could be distinguished as species, experimental taxonomy can provide useful data for the criteria of putative hybridization and miscibility, which may be important for the interpretation of their status.

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(50) If it appears that in nature or in cultivation two taxa, which replace each other geographically or ecologically, are not only capable of fertile hybridization but are miscible (producing in the $F_{2\text{-}x}$ a complete series of intermediates blending them), it is clear that the taxa deserve the rank of subspecies replacing one another by virtue of geographical or ecological distribution.

(51) If it has repeatedly been observed in different places that two taxa, possessing morphological characters entitling them to specific rank, have produced sterile or nearly sterile hybrids, the progeny of which does not point to miscibility, these taxa should be accepted as good species.

(52) If a specific population consists of a number of colony-wise distributed partial populations, each colony will have its own facies. BAUR's study on *Antirrhinum* is an eminent introduction to the study of this type of segregation.

(53) Species of island and mountain floras seem to behave frequently in this way; the absence of intermediary specimens between the colonies is often a serious obstacle to their evaluation for a satisfactory synthesis.

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(54) Data on number of chromosomes and their garniture and their pertaining to special taxa are an interesting outcome of cytogenetics, but should be evaluated by the taxonomist with great caution as he will generally not be acquainted or provided with data serving to illustrate their variability and constancy over entire populations.

(55) Such taxa should be treated either as species or subspecies by the standard of their morphological characters, if they are shown to be incompatible.

(56) *Apomicts* withdraw from the normal methodology of hierarchic taxonomy; taxonomically the 'population' of each apomict is comparable to one specimen of a panmictic population. It is recommended to earmark them by a special signum '*apom.*'.

* * *

(57) 'The New Systematics' is an admirable guide to the different patterns of polymorphism of populations.

(58) The distinction and description of well-defined infraspecific taxa can only be appreciated. A population analysis is, however, beyond the capacity of herbarium methodology.

(59) The rank of *subspecies* should be reserved for and confined to replacing partial populations *i.e.* natural groups of the same general nature as species but exhibiting a lower degree of morphological differentiation and/or reproductive isolation and for morphologically slightly distinct polyplotypes.

(60) The rank of a *variety* should be used for infraspecific, distinguishable taxa, which show no replacement, and for other groups of genetically deviating paramorphs.

(61) The rank of a *forma* should be confined to slight variations (paramorphs) assumed to have a genetical basis.

(62) *Phenotypic* modifications may be designated by an epithet preceded by *modif.* (*modificatio*). This epithet has no nomenclatural status as a modification belongs to a taxon, but is not a separate taxon itself.

(63) If in a revision some specimens cannot be placed and are 'suspicious', their presence should be announced in critical notes. There is no reason to conceal anything about such specimens, but it is distinctly discouraged to name any deviation and burden literature with 'optimistically proposed' species.

(64) It is equally discouraged to recognize or describe a species or other taxon on inadequate material; this has led in the past to a host of obsolete entities and paper species, sometimes assigned to wrong families and genera, which prove to lead a tenacious life in literature. Science is not served by dubious products of impatient ambition.

There is no sense in the naming of doubtful, inadequate or sterile herbarium specimens.

(65) Try to restrict the number of new names and new combinations to the bare necessity.

* * *

(66) The study of the essays on specific delimitation and taxonomical methodology by BENTHAM and HOOKER, The New Systematics (HUXLEY ed.), and the Theory of Systematics by DANSER are recommended to gain a theoretical background in the methodology and results of taxonomy.

(67) Nothing has as yet appeared to replace, on any large scale, the principles of orthodox taxonomic schemes on the seed-bearing plants; the hierarchical system shows little of decline or fall (TURRILL).

(68) Experimental taxonomy has in many respects admirably deepened our insight and generally corroborated the factual data of alpha taxonomy.

(69) Phytography requires, besides a love and esteem for the métier, a memory for forms, great patience and care, a never ending self-criticism, continuous concentrated observation of details, a great tenacity for mastering the facts, as well as a balanced and unprejudiced outlook.

(70) Be always prepared to solicit disinterested criticism from experienced colleagues whose work you admire.

Try to conquer a natural, human dislike and inertia to eventual drastic improvements and emendations in agreement with your responsibility explained in § 3–4.

C. G. G. J. VAN STEENIS.

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MALAYSIAN PLANT COLLECTORS AND COLLECTIONS

SUPPLEMENT I

BY

M. J. VAN STEENIS-KRUSEMAN

GENERAL PART

CHAPTER I

i. LIST OF WORKS PRINCIPALLY CONTAINING ILLUSTRATIONS OF MALAYSIAN PLANTS, AND OF COLLECTIONS OF DRAWINGS AND PHOTOGRAPHS

Cyclopaedia p. xxx–xxxiii add:

1. Illustrated works.

HENDERSON, M. R., *Malayan Wild Flowers.* 1. Dicotyledons (Mal.Nat.J. 4, 1949, p. 1–181; *ibid.* 6, 1950, p. 182–399; *ibid.* 1952, p. 400–472, fig. 1–424); 2. Monocotyledons. Kuala Lumpur (1954) p. 1–357, fig. 1–201.

Line-drawings of selected herbaceous plants from Malaya.

2. Collections of non-published drawings and photographs.

RAFFLES, Sir ST., 68 *Water-colour paintings of Flowering Plants from Sumatra.* By unknown painter, dated March 1824; now in the collections of Mrs DRAKE, of Inshriach, Aviemore, Inverness-shire, Scotland, whose great great uncle was Sir Stamford.

A mimeographed report on the collection is written by E. J. H. CORNER, Oct. 1957, giving an alphabetically arranged list.

RAFFLES, Sir ST., *Sketches of Javanese Scenery* made for Sir Stamford in about 1814–15. Now in the collections of Mrs DRAKE, see above.

A list of the subjects appended to CORNER's report.

ROXBURGH, W., had *over 2500 splendidly coloured drawings* made, of which a set is at Calcutta and another one at Kew. The latter is numbered and is valuable for identification of species described by ROXBURGH, specially if the types are not localized. The Kew set is carefully listed by J. R. SEALY, *The Roxburgh Flora Indica Drawings at Kew* (Kew Bull. 1956, 297–399. 1956–1957).

CHAPTER II. THE TECHNIQUE OF PLANT COLLECTING AND PRESERVATION IN THE TROPICS

Cyclopaedia p. lxvi–lxix add:

14. Selected literature &c.

ALLARD, H. H. (1951): Drying specimens slowly or rapidly (Castanea 16, 1951, p. 129–134).

FOSBERG, F. R. (1947): Formaldehyde in plant collecting (Science 106, p. 250).

GATES, B. N. (1950): An electrical drier for herbarium specimens (Rhodora 52, p. 129–134).

MERRILL, E. D. (1948): On the control of destructive insects in the herbarium (J.Arn.Arb. 29, p. 103–110).

MOORE, H. E. (1950): A substitute for formaldehyde and alcohol in plant-collecting (Rhodora 52, p. 123, 124).

ROWLEY, G. D. (1952): Problems of labelling (J.R.Hort. Soc. 77, p. 215–219).

CHAPTER IV. CHRONOLOGY OF THE COLLECTIONS

a. GEOGRAPHICALLY ARRANGED SURVEY

Cyclopaedia p. lxxvi seq. add:

MALAYSIA—General

H.C. (1798), W. ROXBURGH Jr (1803).

I. SUMATRA

General

EKEBERG (1747–78), WÄNMAN (1767–70), MENZIES (1789), GRIFFITHS (*c.* 1800), EWER (1802–08), W. ROXBURGH Jr (1803–04), LUMSDAIN(E) (1812), XANTUS (1868–71), BRAU DE ST-POL LIAS & DE LA CROIX (1880–81), B. E. G. M. ALLEN (1953), FOR. RES. INST. BOGOR.

1. Atjeh (incl. Gajoe & Alas Lands)

BRAU DE ST-POL LIAS (1880–81), ALSTON (1954).

2. Tapanoeli

OTTO-SURBECK (1953 onwards), ALSTON (1954).

3. Sumatra West Coast

ANONYMOUS (1861), HANCOCK (1892 instead of 1862), ? BOUILLENNE (1931), VAN BORSSUM WAALKES (1953), PLEYTE (1953), ALSTON (1954), W. MEIJER (1954 onwards), ADELBERT (1955–56), VAN KREGTEN (1955–56), P. VERMEULEN (1956), MARADJO (1956–57), ISMAËL (1957), JACOBS (1957).

4. Sumatra East Coast (incl. Siak, Bengkalis, P. Berhala, *etc.*)

L. Martin (*c.* 1892), M. Jensen (1901), Nesvadba (*c.* 1930), Sun Hong Fan (1940–41), Otto-Surbeck (1953 onwards), Alston (1954).

5. Indragiri

Wegmann (1923), Amiruddin & Safri Sjater & Husni Karim (1956), W. Meijer (1956).

8. Palembang

Kjellberg (1930), Twiss (before 1932), de Raadt (up to 1950), Kostermans (1955).

9. Lampong Districts

? van Neck (1599, 1601–02).

10. P. Weh, P. Bras, *etc.*

Ostenfeld (1914).

16. Mentawai Islands (P. Siberoet & Sipo(e)ra)

Steemann Nielsen (1929), van Borssum Waalkes (1953).

19. Islands in Sunda Straits: Krakatau group *etc.* (not those near Java)

Torén (1752), van Borssum Waalkes (1951–52).

20. Banka, P. Lepar, P. Liat

Tuxen (1921), Anta (1949), Kostermans (1949).

21. Billiton, P. Mendanau, *etc.*

For. Res. Inst. Bogor (1949), Sudiora (1953).

22. Riouw-Lingga Archipelago

? J. W. S. Baumhauer (1872).

II. MALAY PENINSULA

General

Xantus (1868–71), Liew (19..), Lelang (*c.* 1900), Charter (1908–33), Whitty (1921–33), Sa'at (1924), Somerville (1924 onwards), Walton (1926–55), F. G. Browne (1929–51), Landon (1932 onwards), E. F. Allen (1937-*hodie*), H. M. Burkill (1938–57), Motan bin Alang (1947 onwards), B. E. G. M. Allen (1948 onwards), Kiah bin Hadji Mohamed Salleh (up to 1953 at least), Melville (1953), Alston (1954), Purseglove (1954–57), Simmonds (1955), Wyatt-Smith (up to *hodie*).

2. Kedah

Wolfe (195.), Wyatt-Smith (1955–56).

3. Prov. Wellesley

Van Ooststroom (1950).

4. Perak

Brau de St-Pol Lias & de la Croix (1880–81), H. C. Smith (1881), de la Croix (1883), Baldwin (before 1908), Seimund (1926), F. G. Browne (1929–51), Sinclair (1949).

5. Dindings

H. M. Burkill (1955).

6. Kelantan

F. G. Browne (1929–51).

7. Trengganu

Hislop (1952), Sinclair (1953–55).

8. Pahang

F. G. Browne (1929–51), Purseglove (1941), van Steenis (1954), H. M. Burkill (1956), Sinclair (1956).

9. Selangor

Sun Hong Fan (1940), E. F. Allen (195.), Sinclair (1953), Baptist (1954), van Steenis (1954), Bhaskaran Nair (1955), H. M. Burkill (1956).

10. Negri Sembilan

Sinclair (1953), van Steenis (1954), H. M. Burkill (1956).

11. Malacca

Haenseler (. . . .), R. I. C. Scott (1853), Bebas (*c.* 1900–05), Ali & Hassan (before 1907), Sinclair (1955–56).

12. Johore

Feddersen (1918–26), Sun Hong Fan (1940), Sinclair (1950 onwards), Schofield (before 1953), van Steenis (1954).

13. Langkawi Islands

Gilliland (1956 onwards).

14. P. Penang (or Prince of Wales' Island)

Christ. Smith (1796), Howison (*c.* 1800), H.C. (1802), E. Loureiro (1870), Beck (*c.* 1886), Birch (*c.* 1905), ? Bezdek (1911), D. H. Campbell (1913), I. H. Burkill (1917), Pease (1927), van Ooststroom (1950), Sinclair (1950–51).

15. Singapore *etc.*

Menzies (*c.* 1789), Hance (18 . .), Feilberg (*c.* 1868), Xantus (1868–71), Normann (1870–71), ? Bezdek (1911), Pease (1927), Sun Hong Fan (1940), Sato (*c.* 1945), Kostermans (after 1945), Sinclair (1948 onwards), van Ooststroom (1950), W. Meijer (1951), Melville (1953), Gilliland (1955 onwards).

III. JAVA

(for Krakatau, see I, 19)

General

Prayan or Prayon (1756–65), van Santen (1758–59), Lebeck (1798–1800), B. W. Westermann (before 1817), ? Mellerborg (1826–28), Werner (1846), Fr. Schneider (before 1892), Hancock (1892 instead of 1862), Newton (*c.* 1896–97), A. J. Ewart (1896–97), Gilbert (1917), Bouillenne (1931), Polak (1948–50), Kostermans (up to *hodie*), For. Res. Inst. Bogor.

1. West Java

? van Neck (1598–99, 1601), ? Tärnström (1746), Ekeberg (1747–78), Torén (1748–49), Wänman (1767–70), ? Bladh (1767–77), ? Hoffman (1769–79), ? Alnoor (1773–88), ? Gröndahl (1790–95), Weyrich (1853), ? Diels & Pritzel (1902), Pasma (1914), Holstvoogd (1930–49), Bouillenne (1931), Crince le Roy (1932), Wahr–Pereira (1932), Fagerlind (1938, 1953), Neervoort (1939–49), P. C. Koopman (1941), Atmawisastra (1942 onwards), Hasan I (1947–49), Nurta (1947–49), den Hoed (1948), Sun Hong Fan (1949), Kern (1949–52), Adelbert (1949–54), van Ooststroom (1950), van Steenis (1950), van Borssum Waalkes (1950–57), W. Meijer (1951 onwards), Hoogland (1952), Alston (1953–54), Alpha (1954), van Kregten (1954), Suganda (1954), Kostermans (1955), Jacobs (1955–57), Dilmy (1956), Forman (1956), P. Vermeulen (1956), Holttum (1957–58).

2. Central Java

Tirto (1906), Boissevain (1927), Haas (1935), van der Gaag (1949), Kern (1951), Kostermans (1951), W. Meijer (1954), P. Vermeulen (1956).

3. East Java

Kern (1951), Forman (1956), Jacobs (1957).

4. Islands near SW. Bantam

(Prinsen, Meeuwen & Trouwers Island)

Van Borssum Waalkes (1951).

6. Noesa Kambangan

Bouillenne (1931).

8. Noesa Baroeng

Rappard (1950), Jacobs (1957).

9. Kangean Archipelago

Dames (1949).

14. Islands in the Bay of Djakarta (Batavia) (incl. Duizend Islands)

Den Hoed (1948), Kern (1950), van Ooststroom (1950), van Steenis (1950), W. Meijer (1953), Alston (1954).

15. Islands in the Bay of Bantam, P. Merak, and P. Babi

Hoogerwerf (1952).

IV. LESSER SUNDA ISLANDS

General

Heberer (1927).

1. Bali and Noesa Penida

Alston (1954), Forman (1956), Lundquist (1956), P. Vermeulen (1956).

2. Lombok

Sun Hong Fan (1947–48).

3. Soembawa and adjacent islets

Blomberg (1941).

4. Soemba

Bouman (1941).

5. Flores, P. Komodo, P. Papagaran Besar, P. Badjo

Hoogerwerf (1953).

10. West Timor
(Indonesian, incl. Portug. enclave)

Gull (1867), van Steenis (1953), van Borssum Waalkes (1956).

11. East Timor (Portuguese)

Van Steenis (1953–54).

16. Babar Islands

Van Borssum Waalkes (1956).

17. Tanimbar Islands (or Timor laoet)

Van Borssum Waalkes (1956).

V. BORNEO

General

Maille & Saunders (. . .), Xantus (1870), Durnford (1888 onwards).

General, Indonesian part

Zieck (19..), For. Res. Inst. Bogor.

1. Northwest Borneo
(Sarawak and Brunei)

Kuneang (189 .), Seligman(n) (1899), Sinclair (1949), Smythies (1949 onwards), B. E. G. M. Allen (1951, 1956–57), J. A. R. Anderson (1951–*hodie*), F. G. Browne (1951 onwards), Dickson (1952–53), Ahmad bin Topin (1954–55), W. M. A. Brooke (1954–55), Brünig (1954 onwards), Seal (1954 onwards), Aini bin Haji Mahamad (1955), Pickles (1955–56), Purseglove (1955–56), Shah (1955–56), Bell (1956), Ashton (1957 onwards).

2. West Borneo

Wight (18 . .), Guggitz (before 1914), Enoh (1948), Polak (1948–49), Klay & Schophuys (1949), Paymans (1953).

3. South and Southeast Borneo

Kostermans (1948, 1953), Alston (1953), Schut (1954).

4. East and Northeast Borneo
(from Balikpapan to the north)

Atjil (1932), Kostermans (1950 onwards), W. Meijer (1952–53), Nedi (1955), Forman (1956).

5. British North Borneo

Routledge (*c.* 1897), Bartsch (1908), Caguicla (1930–31), Balajadia (1933–41), J. Valera (1933–41), Kadir bin Abdul (1937 onwards), Martyn (1937 onwards), Enchai or Enchoi (*c.* 1939), Clemente (1939–45), Otek Bin (before 1940), Majuyap bin Majuni (1940–47), Enggoh bin Limbuan (1946–54), Cuadra (1947–51), Simbut (1948 onwards), Davies & Inger (1950), B. E. G. M. Allen (1951, 1957), Sario (1951 onwards), Arthur (1952), Saw (1952), Wong Yun Siew (1952), P. Castro (up to 1953), Darnton (1954–55), G. H. S. Wood (1954–57), Nicholson (1955 onwards), Sinclair (1957).

7. Labuan

Van Steenis (1953).

13. P. Nunukan, Tarakan, Mandoel, *etc.*

Paymans (1951), W. Meijer (1953), Kostermans (1953–54).

VI. PHILIPPINE ISLANDS

General

Borja (19 . .), Cuevas (19 . .), Bartolomé (*c.* 1910), Herbert (192 .), Co (195 .), Alequaen (1952).

1. Balabac Island

Vidal (187 .–8 .).

2. Palawan, Dumaran, *etc.*

Conklin (1947), G. E. Edaño (1947, 1951), Earl Irving (1948), F. Tamesis (1949), M. D. Sulit (1950), Fox (1950–51).

4. Mindoro

Whitford (1906), H. H. Bartlett (1935), M. Celestino & A. P. Castro (1947), G. E. Edaño (1947–48), I. P. Paniza (1948), M. D. Sulit (1951, 1953), Conklin (1952–53), B. B. Britton (1953), J. V. Santos (1955), P. N. H. (up to *hodie*).

5. Batanes Islands

J. V. Santos (1955).

6. Babuyan Islands

? Weyrich (1854), J. V. Santos (1955).

7. Luzon

Wänman (*c.* 1769), Weyrich (1854), Zschokke (1907 onwards), Ranario (1919), Kryshtofovich (1921), Valdez (1921), A. O. Valentin (1925), M. D. Sulit (1926–27), Pease (1927), Sete (1928), H. H. Bartlett (1935), Breuner (1945), Canicosa (1945 onwards), G. E. Edaño (1945 onwards), Steiner (after 1945), Alsacid (1946), D. R. Mendoza (1946 onwards), M. D. Sulit (1947 onwards), Fox (1947–48), Balintay (1948), Beach (1949), Cagosa (195 .), Fariñas (195 .), Layosa (195 .), Manayon (195 .), Mati (1952), Militante (1952), Trono (1952), Viola (1952), Arañez (1953), Banzon (1953), Baskiñas (1953), B. B. Britton (1953), Dansereau (1953), B. B. Gonzales (1953), de Guia (1953), Hoogland (1953), Loreja (1953), van Steenis (1953), Vergara (1953), Mundo (1953–55), G. L. Enriquez (1954), Hagasa (1954), Sanchez (1954), Veloira (1954), F. C. Garcia (*c.* 1956), Pancho (*c.* 1956), Lagrimas (1956–57), Icarañgal (*c.* 1956–57), H. Gutierrez (*c.* 1957), Quisumbing (up to *hodie*), J. V. Santos (up to *hodie*), numerous incidental collectors in P.N.H. series (up to *hodie*).

8. Polillo

F. M. Salvoza (1946), A. P. Castro (1948), Fox (1948), McVittie (1949), Muni (1949).

9. Marinduque

Vidal (187 .–8 .).

12. Masbate and Ticao

Fariñas (195 .).

13. Samar

Vidal (187 .–8 .), Sasquety (1915), Quisumbing (1946), A. P. Castro (1948), E. Conese (1948, 1952), M. D. Sulit (1948, 1951), G. E. Edaño (1951–52), F. S. Gachalian (1951–52), Yench (1952).

14. Leyte and Biliran

G. E. Edaño (1950), Gautt (1953).

15. Bohol

J. V. Santos (1955), in P.N.H. series.

16. Cebu

Vidal (187 .–8 .), in P.N.H. series.

17. Negros and Siquijor Island

C. Abella (1948–49), G. E. Edaño (1948–49), Ohna (1952), B. B. Britton (1953), D. S. Rabor (1953).

18. Panay, Guimaras, and Cuyo

Vidal (187 .–8 .), I. P. Paniza (1949), M. D. Sulit (1950), J. D. Soriano (1952–53), J. V. Santos (1955).

20. Cagayan Sulu group

J. V. Santos (1956).

21. Sulu Islands

M. S. Clemens (1915), E. S. Evidente (1951), J. V. Santos (1956).

22. Basilan and Malamaui Islands

J. V. Santos (1956).

23. Mindanao, Dinagat, Siargao Island, *etc.*

Stearns (. . . .), Hachisuka (1929), Hosokawa (1936), G. E. Edaño (1946, 1948, 1949), R. Convocar (1949), Mrs K. B. Day (1949), D. R. Mendoza (1949), Quisumbing (1949), Skinner (1949), M. D. Sulit (1949), McVittie (1949–50), Fariñas (195 .), Añonuevo & Pelzer (1950), Corvera (1951), A. Pascua (1951), Cid (1952), B. B. Britton (1953), Pancho (*c.* 1956), J. V. Santos (1956), P.N.H. series (up to *hodie*).

VII. CELEBES

1. North Peninsula

Alston (1954), Forman (1956).

2. Central Celebes

Kostermans (1950), Alston (1954).

3. Southwest Peninsula

Van der Gaag (1949), Alston (1954).

4. Southeast Peninsula

Radde (1890).

16. P. Lembeh, Talise, *etc.* near the Minahassa

Tenison-Woods (1886), Steemann Nielsen (1929), Alston (1954).

VIII. MOLUCCAS

General

H.C. (1797–1802), Capt. ANDERSON (1802), W. ROXBURGH Jr (1803), ? J. O. VOIGT (*c.* 183 .).

2. P. Morotai and P. Raoe

N.G.F. (*c.* 1945), ADEN (1949), KOSTERMANS (1949), TANGKILISAN (1949).

3. Halmaheira, Loloda Islands, and P. Moeor

IDJAN & MOCHTAR BIN MUSA (1951), PLEYTE (1951), G. A. L. DE HAAN (1952), ALSTON (1954).

4. P. Ternate, Tidore, and Makian

CURTIS (*c.* 1882), IDJAN & MOCHTAR BIN MUSA (1951), PLEYTE (1951), ALSTON (1954).

5. P. Batjan, Kasiroeta, *etc.* and Kajoa Islands

CURTIS (*c.* 1882), ALSTON (1954).

7. Soela Islands

ALSTON (1954).

8. Boeroe

ALSTON (1954).

11. Ambon

CHRIST. SMITH (1798), ALSTON (1954), VAN BORSSUM WAALKES (1956).

13. Lucipara Islands

NAUMANN (1875).

14. Banda Group

VAN BORSSUM WAALKES (1956).

18. Kai Islands

VAN BORSSUM WAALKES (1956).

IX. NEW GUINEA

(incl. Bismarck Archipelago, buth not the Louisiades & Solomons)

General

HUGHAN (. . . . .), N.G.F. (1944–45), GRASSL (1957).

General, Dutch New Guinea

HARA & INOKUMA (1943), CHR. KOSTER (1951 onwards), BRONGERSMA (1952), CHR. VERSTEEGH (1952 onwards), BOSWEZEN NIEUW GUINEA (1952 onwards), BOUWER (1953 onwards), RAPPARD (1954–57), BROUWER (1955 onwards).

General, British New Guinea

? DIELS & PRITZEL (1902), ANONYMOUS (1933), INGRAM (1939–45), RICHARDSON (194 .–5 .), E. ALLAN (after 1945), MCDONALD (after 1945).

1. Vogelkop (Dutch West New Guinea)

TUYAMA (1943), BERGMAN (1948), F. R. I. (1949), VAN HELLENDOORN (1949), ZIECK (*c.* 1952), CHR. KOSTER (1954 onwards), VAN ROYEN (1954), SCHRAM (1954 onwards), MANGOLD (1954 onwards), STEFELS (1955 onwards), IWANGGIN (1957).

2. Dutch North New Guinea

BAYER (1945), AJAWAILA (1947), HOOGLAND (1954), LAM (1954), MCKEE (1954), VAN ROYEN (1954), SCHRAM (1954 onwards), CHR. KOSTER (1956), KALKMAN (1956 onwards), VAN DER ZIJDE (1956–57), IWANGGIN (1957 onwards), NAUTJE (1957).

3. Dutch South New Guinea

GUTTERIDGE (1943), BOENDERMAKER (195 .), SCHRAM (1954 onwards), DEN HAAN (*c.* 1955), RAPPARD (1955), VAN DER SIJDE (1956), KALKMAN (1957 onwards), NAUTJE (1957).

4. Papua

FECHNER (1886), MURPHY (*c.* 1905), A. WADE (192 .), DUBUY (1933), CAVANAUGH (194 .), A. J. HART (after 1940), CROWE (1943), DE LEEUW or DE ZEEUW (1943), MCADAM (*c.* 1943–44), WAKEFIELD (1943–45), N.G.F. (1944 onwards), ROOT (1945), HEATHER (after 1945), JACKSON (after 1945), SCHACHT (after 1945), WOMERSLEY (1951), H. A. BROWN (1952–53), BRASS (1953), HOOGLAND (1953 onwards), LAM (1954), MCKEE (1954), VAN ROYEN (1954), SAUNDERS (1954), B. W. TAYLOR (1954), CHR. VERSTEEGH (1954), SIMMONDS (1955).

5. Mandated Territory of New Guinea
(former Kaiser-Wilhelmsland)

DUNCKER (1909), BATESON (*c.* 1930), MCADAM (1938–39), CAVANAUGH (194 .), STONOR (194 .), WAKEFIELD (1943–45), MCKEE (1944–45, 1954), N.G.F. (1944 onwards), MAIR (1945), WOMERSLEY

(1946 onwards), Gilliard (1950), Fryar (195 .), Gray (195 .), Morwood (195 .), Vogel (1950), Gyldenstolpe (1951), F. W. S. Mayer (1951), Gilmore (1952), Semple & Rayner (1953), Hoogland (1953 onwards), Lam (1954), van Royen (1954), Chr. Versteegh (1954), Floyd (1954–55), Simmonds (1954–55), Saunders (1955), Havel (1955 onwards), Pullen (1956).

6. D'Entrecasteaux Islands (incl. Fergusson, Goodenough and Normanby Island)

Brass (1953, 1956).

Bismarck Archipelago-General

Biro (1901), Simmonds (1954).

8. New Britain (former Neu Pommern)

Duncker (1909), McAdam & D'Espeissis (1938), N.G.F. (1944 onwards), R. S. Haas (1945), Mair (1945), Heather (after 1945), McIntosh (after 1945), Womersley (1953–55), Floyd (1954), McKee (1954), Simmonds (1954).

12. St Matthias group, Tench Island

Duncker (1908).

13. Admiralty, Purdy and Hermit Islands, and Matty (Wuvulu)

F. E. Hellwig (1902–04), Duncker (1908), N.G.F. (1944–45).

14. Schouten and Padaido Islands

N.G.F. (1944–45), Winder (1945), Botma (1949), Boswezen Nieuw Guinea.

15. P. Japen and Koeroedoe

Tuyama (1943), Chr. Versteegh (195 .).

16. Noemfoor

N.G.F. (1944–45), Chr. Koster (195 .), Boswezen Nieuw Guinea.

17. Mios Noem

Chr. Versteegh (195 .).

19. Islands near the coast in Geelvink Bay

Chr. Versteegh (195 .), Chr. Koster (1956), Kalkman (1957).

21. P. Waigeo(e) *etc.*

Bergman (1948), Chr. Versteegh (195 .), van Royen (1955), Boswezen Nieuw Guinea.

22. P. Gebe, Fau and Gag

Corson (*c.* 1841).

24. Batanta group

Van Royen (1954).

25. Salawati

Bergman (1948), Chr. Koster (1956).

26. Misoöl group

Jaheri (1901), Pleyte (1948).

27. Aru (= Aroe) Islands

Van Borssum Waalkes (1956).

b. VOYAGES AND EXPEDITIONS CHRONOLOGICALLY

Cyclopaedia p.c–civ add:

Years:	*Name of ship(s) and (or) of the expedition:*	*Name of commander(s) or scientific leader:*	*Name of chief botanical collector(s):*
1598–99	'De 2e Scheepvaart' (*Dutch E. I. C.*)	J. C. van Neck	J. C. van Neck
1600–03	'Tweede Reys van Neck' (*Dutch E. I. C.*)	J. C. van Neck	J. C. van Neck
1742–44	'Drottningen av Sverige' (*Swed. E.I.C.*)	P. von Utfall	C. G. Ekeberg (? coll.)
1746–48	'Callmar' & 'Cronprins Adolph Friederic' (*Swed. E.I.C.*)	M. Estbergen & P. Dens	Chr. Tärnström
1746–49	'Götha Leyon' (*Swed. E.I.C.*)	B. Askbom	C. G. Ekeberg (? coll.)
1748–49	'Hoppet' (*Swed. E.I.C.*)	F. Pettersson	O. Torén, ? C. H. Braad
1750–52	Read: 'Götha Leyon' (*Swed. E.I.C.*)	D. Schierman	O. Torén, ? C. H. Braad

Years:	*Name of ship(s) and (or) of the expedition:*	*Name of commander(s) or scientific leader:*	*Name of chief botanical collector(s):*
1750–52	Read: 'Prins Carl' (*Swed. E.I.C.*)	C. G. Lehman	P. Osbeck
1751–54	? 'Hoppet' (*Swed. E.I.C.*)	C. Treutiger	C. G. Ekeberg
1755–56	? 'Sophia Albertina' (*Swed. E.I.C.*)	C. G. Lehman	C. G. Ekeberg
1759–60	'Friederic Adolph' (*Swed. E.I.C.*)	C. G. Ekeberg	C. G. Ekeberg
1762–63	'Finland' (*Swed. E.I.C.*)	C. G. Ekeberg	C. G. Ekeberg
1765–67	'Stockholms Slott' (*Swed. E.I.C.*)	C. G. Ekeberg	A. Sparrman
1766–68	'Lovisa Ulrica' (*Swed. E.I.C.*)	H. Holmers	P. J. Bladh, ? C. H. Wänman
1768–70	'Adolph Friederic' (*Swed. E.I.C.*)	H. Strehlenert	P. J. Bladh, ? C. H. Wänman
1769–71	'Finland' (*Swed. E.I.C.*)	C. G. Ekeberg	C. G. Ekeberg
1773–74	'Finland' (*Swed. E.I.C.*)	J. Selle	A. Alnoor
1774–75	'Sophia Magdalena' (*Swed. E.I.C.*)	C. G. Ekeberg	P. J. Bladh *etc.*
1777–78	'Sofia Magdalena' (*Swed. E.I.C.*)	C. G. Ekeberg	C. G. Ekeberg
1777–78	'Stockholms Slott' (*Swed. E.I.C.*)	P. Pettersson	H. P. Wennerberg, P. J. Bladh, *etc.*
1778–80	'Lovisa Ulrica' (*Swed. E.I.C.*)	J. J. Ekman	H. P. Wennerberg
1780–81	'Finland' (*Swed. E.I.C.*)	Nicl. Almroth	A. Alnoor
1781–82	'Gustaf III' (*Swed. E.I.C.*)	J. A. Burtz	H. P. Wennerberg
1783–84	'Gustaf III' (*Swed. E.I.C.*)	M. von Krusenstierna	A. Alnoor
1786–89	'Prince of Wales' & 'Princess Royal' (*Engl.*)	Colnett	A. Menzies
1787–88	'Gustaf Adolph' (*Swed. E.I.C.*)	J. Spindler	A. Alnoor
1791–95	'Discovery' & 'Chatham' (*Engl.*)	Vancouver	A. Menzies
1838	'Kitty' (*Engl.*)	?	J. Corson
1898	'Cambridge Anthropological Exp.' to Torres Straits (*Engl.*)	A. C. Haddon	Ch. G. Seligman(n)
1902–04	'Südsee-Exp.' in the 'Gazelle' (*Germ.*)	—	F. E. Hellwig
1908–09	'Hamburg Südsee-Exp.' in the 'Peiho' (*Germ.*)	Capt. Vahsel, Dr Fülleborn	G. Duncker
1946–47	'Chicago-Philippine Exp.' (*Amer.-Philip.*)	Dr H. Hoogstraal	G. E. Edaño *etc.*
1950	'Bornean Zoological Exp. of Chicago Nat. Hist. Mus.' (*Amer.*)	D. D. Davies	D. D. Davies & R. F. Inger
1950–51	'Hallstrom Exp.' to E. New Guinea (*Austr.*)	?	A. A. Vogel
1951	'Exp. to Halmaheira' (*Indon.-Dutch*)	P. Groenhart	D. R. Pleyte
1951	'Exp. to Sunda Straits' (*Indon.-Dutch*)	A. Hoogerwerf	J. van Borssum Waalkes
1951	'Gyldenstolpe Exp.' to E. New Guinea (*Swed.*)	Count N. C. G. F. Gyldenstolpe	Greta Gyldenstolpe
1953	'4th Archbold Exp.' in Papua (*Amer.*)	L. J. Brass	L. J. Brass
1953	'Exp. to Sumatra West Coast' (*Indon.-Dutch*)	P. Groenhart	J. van Borssum Waalkes
1955–56	'Oxford Univ. Exp.' to Borneo (*Engl.*)	G. Arnold	G. H. Pickles
1956	'Exp. to Southern Moluccas' (*Indon.-Dutch*)	P. Groenhart	J. van Borssum Waalkes
1956	'5th Archbold Exp.' in Papua (*Amer.*)	L. J. Brass	L. J. Brass

c. EARLY EXPLORERS IN MALAYSIA UP TO 1840

Cyclopaedia p. cv–cvi add:

1589	J. C. van Neck (*Dutch*).
1747	C. G. Ekeberg (*Swedish*).
1747	G. F. Hjortberg (*Swedish*).
1747	Chr. Tärnström (*Swedish*).
1748	O. Torén (*Swedish*).
Before 1753	C. H. Braad (*Swedish*).
1758	H. van Santen (*Dutch*).
1764	F. A. Prayan or Prayon (*German*).
1767	C. H. Wänman (*Swedish*).
1774	P. J. Bladh (*Swedish*).
c. 1777	A. Alnoor (*Swedish*).
1789	A. Menzies (*Scotch*).
1790	C. F. Grönda(h)l (*Swedish*).
1793	G. MacArtney (*Scotch*).
1799	H. J. Lebeck (*Dutch*).
c. 1800	J. Griffiths (*Engl.*).

c. 1800	Howison (*? Engl.*).	1810	W. Farquhar (*? Scotch*).
c. 1800	J. Scott (*Engl.*).	1812	Dr Lumsdain(e) (*Engl.*).
1802	Capt. Anderson (*Engl.*).	Before 1817	B. W. Westermann (*Danish*).
1808	Dr John (*Engl.*).	1827	Cl. E. Mellerborg (*Swedish*).

CHAPTER VI. SOURCES OF INFORMATION

a. SURVEY OF SOURCES GIVING DATA ON COLLECTORS, COLLECTIONS AND TRAVELS

Cyclopaedia p. cxvii–cxxv add:

General

1. *Published sources*

Roxburgh, W., *Hortus bengalensis*, or a Catalogue of the Plants growing in the Honourable East India Company's Botanic Garden at Calcutta. 1814.
Includes the names of numerous donors.

Henriksen, Kai L., *Oversigt over Dansk Entomologis Historie* (Entom.Meddel. 15, 1921–37, p. 1–578, many photogr.).

Olán, E., *Ostindiska compagniets saga* (2nd ed. 1923).
On the history of the Swedish East India Company. Includes an enumeration of the voyages with the name of the ship, the captain, dates of departure and return, and the supercargoes (p. 112–117).

Kerr, A., *Early botanists in Thailand* (J. Thail. Res. Soc. Nat. Hist. Suppl. 12, 1939, p. 1–27).

Burkill, I. H., *Chapters on the History of Botany in India.* I–II (J. Bomb. Nat. Hist. Soc. 51, 1953, p. 846–878, 1 map; *ditto* 54, 1956, p. 42–86; to be continued).

Lanjouw, J. & F. A. Stafleu, *Index Herbariorum*, part II *Collectors* (Regn. Veget. 2, 1954, 1st instalm. A–D; *ibid.* 9, 1957, (2) E–H).

Priszter, Sz., *Ausländische Forschungstätigkeit der ungarischen Botaniker* (Act. Bot. Ac. Sc. Hung. 1, 1955, p. 267–300).
Includes maps, bibliography, and biographical data.

Sachet, M. H. & F. R. Fosberg, *Islands Bibliographies* (Publ. 335 Nat. Acad. Sc., 1955).
Three annotated bibliographies, dealing respectively with Micronesian botany, coral atolls, and the vegetation of tropical Pacific islands (no floras and check-lists included).

2. *Unpublished sources*

Numerous data on Swedish collectors in the employ of the Swedish East India Company were found in unpublished letters in the Royal Swedish Academy in Stockholm, and in the University Library at Uppsala, respectively mainly in the Bergius and Thunberg correspondence.

Regional

Indonesia (general)

Roepke, W. K. J., *History of entomology in the Dutch East Indies.* Entomology in the Netherlands & their overseas territories (IXth Int. Congr. Entom. Amsterdam 1951, p. 1–20).

Junge, G. C. A., *Ornithologisch onderzoek in de Indische Archipel* (Ardea 41, Jubil. *no*, 1954, p. 301–336). Historical survey of the ornithological collections made in the former Dutch East Indies; *in Dutch.*

5. Borneo and neighbouring islands

Smythies, B. E., *An annotated Checklist of the Birds of Borneo* (Sarawak Mus. J. 7, 1957, p. i–xv, 523–818, with map).
Historical sketch of ornithological explorations on p. 531–551.

b. REPORTS, PAPERS, AND OTHER INFORMATION PERTAINING TO HERBARIA WHERE MALAYSIAN COLLECTIONS ARE PRESERVED

Cyclopaedia p. cxxvi–cxli add[1]:

2. Special

Adelaide, Australia

Herb. University Adelaide.

Includes Herb. Schomburgk; Java plants without indication, probably from Blume *etc. ex* Herb. Leyden. At first the Herbarium was in the Gardens' Department, now in the Botany School. The Waite Agricultural Institute has also an herbarium, but it is planned in the future to make one general herbarium with Herb. Black.

Berlin, Germany

Herb. Berlin-Dahlem.

In 1950 Prof. Dr Pilger informed us that all (or nearly all) type specimens are saved which belong

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(1) New entries are provided with an asterisk.

to the families arranged in ENGLER's system till *Rosaceae.*

Cambridge, Mass., U.S.A.

Herb. Harvard University.

HOWARD, R. A., *The Harvard University Herbarium* (Fl. Mal. Bull. 11, 1955, p. 425–427; Taxon 4, 1955, p. 25–36, pl. 1, fig. 1–8).

In the new building at Cambridge, the major portion of the Arnold Arboretum Herbarium, the Gray Herbarium in its entirety, and the Oakes Ames Orchid Herbarium, are housed. The Farlow Herbarium is technically a part of the new building set-up, but remained in its former building, connected to the new one. The horticultural part of the Arn. Arb. Herbarium stays at Jamaica Plain, but the wood samples and the wood and pollen slides are housed in the new building. The herbarium of the New England Botanical Club occupies part of the fourth floor.

SCHWEINFURTH, CH., The Oakes Ames Orchid Herbarium (Philip. Orch. Rev. 6^1, 1955, p. 7–9).

Concise historical review.

*Canberra, Australia

***Herb. Canberra.**

At Canberra, Land Survey Section of C.S.I.R.O.; a new building was erected to house the New Guinea Herbarium.

*Hollandia, New Guinea

***Herb. Forestry Department.**

A forest exploration herbarium was started in Sept. 1952; in Nov. 1957 it comprised 6752 *nos.* Dupl. are sent to Leyden. In 1958 transferred to Manokwari.

Kiev, U.S.S.R.

Herb. Ukrainian Academy of Sciences.

GHRISHKO, M. M. & O. I. SOKOLOVS'KIĬ, *Botanichniĭ Sad Akademiĭ Nauk Ukrainskoĭ RSR i iogho Koletziĭ* (The Botanic Garden of the Ukrainian Academy of Sciences and its collections) (Kiev 1950, 116 pp., 1 map and text-fig.) (*n.v.*).

Kuala Lumpur, Malaya

***Herb. Department of Agriculture.**

A Herbarium for local use, mostly of plants found in association with agriculture. Duplicates of less common plants are forwarded to Singapore Herbarium.

Kuching, Sarawak, NW. Borneo

Herb. Sarawak Museum.

The herbarium of the Forest Department, Kuching, is now amalgamated with that of the Sarawak Museum.

*Lae, Terr. of New Guinea

***Herb. Forestry Department.**

The Herbarium was established during World War II. Material collected in the first years decayed, but dupl. are in Herb. Brisbane. In 1946 the Forest Botanist J. S. WOMERSLEY was appointed in charge (*cf.* Fl. Mal. Bull. *no* 3, 1948, p. 61–62, and *no* 7, 1950, p. 188).

WOMERSLEY, J. S., *The Papua and New Guinea Herbarium* (Fl. Mal. Bull. *no* 8, 1951, p. 262–264).

Dupl. are distributed to Brisbane, Canberra, Bogor, Kew, Leyden, Singapore, Arn. Arbor., and Imp. Forestry Institute Oxford. Dupl. of *Coniferae* also to M. Y. ORR at Edinburgh, and to E. STIRLING BOOTH at Adelaide.

*Lisbon, Portugal

***Herb. Inst. Bot. Lisbon.**

ROMARIZ, C., *Collecções botanicas do Instituto botânico de Lisboa Herbários do ultramar Português* (Bot. Soc. Port. Cienc. Nat. II, 4, 1952, p. 57–73).

Includes an enumeration of the collections from Portuguese Timor.

*Liverpool, England

***Herb. Liverpool University.**

HEYWOOD, V. H., *The University Herbarium, Liverpool* (Taxon 5, 1956, p. 10–11).

London, England

Herb. British Museum (Nat. Hist.).

DANDY, J. E., *The Sloane Herbarium:* an annotated List of the Horti sicci composing it, with biographical Accounts of the Principal Contributors, based on Records compiled by the late James Britton. London, in the press.

*Los Baños, P.I.

***Herb. College of Agriculture.**

This was a local herbarium of the College; duplicates are in Ann Arbor, Michigan. Probably most of the material was collected by students on excursions to Mt Maquiling. The original set at Los Baños was destroyed in 1945.

Madrid, Spain

Herb. Botanic Gardens. (Officially Instituto Botánico 'Antonio José Cavanilles'.)

The herbarium of VIDAL and his collectors will be incorporated. Possibly also the other collections of the former Museo Ultramarino.

Herb. Escuela de Montes (Ciudad Universitana).

Is said to consist of Spanish woody plants. Evidently there is no herbarium at the Escorial, at least not now. What happened to the Philippine collections made by BARANDA and J. G. VALDES is not known to the author.

Herb. Museo Ultramarino (= Oversea).

Does not exist as such any more. Possibly all collections in *Herb. Bot. Gard. Madrid.*

Manila, Philippines

Philippine National Herbarium.

QUISUMBING, E., *Botanical Expeditions in the Philippines* (Proc. 8th Pac. Sc. Congr. 1953, vol. 4 Bot., 1957, p. 501–542, map). Gives extensive information on collections made up to 1953.

*Manokwari, New Guinea

***Herb. Forestry Department.**

The Herbarium which was started in 1952 at Hollandia (see there) was transferred to Manokwari in 1958.

Melbourne, Australia

National Herbarium.

In 1950 the Herbarium was still divided in a Herb. generale, Herb. Austral., Herb. New Zealand, Herb. Papuanum, and Herb. Polynesia (incl. N. Caledonia). All material and the labels in the Papuan Herbarium are lying loose between the covers which are inserted in vertical portfolios. VON MUELLER described only a small part of the Papuan material. The archives dating from VON MUELLER's time were destroyed under the directorate of RAE.

Monaco

The entire entry in the Cyclopaedia must be omitted; Herb. Monacensis = Munich, see there.

*Pajakumbu, Sum. West Coast, Indonesia

***Herb. Fac. Agr. Pajakumbu.**

This new herbarium of the Faculty of Agriculture at Pajakumbu, was started by Dr W. MEIJER, since 1955 Lecturer, later Professor there.

*Quezon City, Philippines

***Herb. University of the Philippines.**

The herbarium of the Botany Department of the University. Dupl. in the Philip. Nat. Herb., Leyden, *etc.*

Stockholm, Sweden

Herb. Royal Academy of Sciences.

The BERGIUS herbarium includes plants from THUNBERG (Java, Ceylon, *etc.*), WÄNMAN (Java, Manila, Sumatra, *etc.*), OSBECK, RADERMACHER (Java), SPARRMAN, EKEBERG (Sumatra, *etc.*), BLADH (Ind. Or., China, *etc.*), KOENIG (few), HORNSTEDT (Java).

Herb. State Museum.

Naturhistoriska Riksmuseets Historia. Dess uppkomst och utveckling (Utg. Kungl. Vetensk. Ak. Stockholm 1916). *Botaniska Afdelningen* by C. A. M. LINDMAN, p. 93–129.

Reports on the acquisitions in Öfversigt af Kongl. Vetensk.-Ak. Forhandl., and later in Årsb. Kungl. Svensk. Vetensk.–Ak.

The herbarium includes many dupl. from Indonesia, presented by BLUME and MIQUEL; dupl. E.I.C. presented by J. HOOKER; plants from OSBECK, KOENIG, THUNBERG, *etc.* with Herb. ALSTRÖMER.

Uppsala, Sweden

Botanical Museum.

The THUNBERG herbarium includes plants from MELLERBORG, LEBECK (Java, *etc.*), BLADH, GRÖNDA(H)L, WÄNMAN, KOENIG, *etc.*

JUEL, H. O., *Notes on the herbarium of Abraham Bäck* (Svensk. Linné-Sällskap. Årsskrift 7, 1924, p. 68–82, with ill.).

c. SELECT LIST OF ORIGINALLY PRIVATE HERBARIA AND THEIR PRESENT LOCATION

Cyclopaedia p. cxli–cxlii add:

ALSTRÖMER, Cl., Herb. State Mus. Stockholm. Included plants from OSBECK, KOENIG, THUNBERG.
BÄCK, Abraham, Herb. Uppsala.
BERGIUS, P. J., Herb. Roy. Acad. Stockholm.
BESCHERELLE, Herb. Brit. Mus., London.
BROOKS, C. J., Herb. Brit. Mus., London.
DESFONTAINES, R. L., Herb. Florence.
FORSKÅL, P., Herb. Copenhagen; Herb. RETZIUS (= Lund).
HAUSSKNECHT, H. K., Herb. Weimar, Germany.
HORNEMANN, J. W., Herb. Copenhagen.
KIGGELAER, Franz, with Herb. SLOANE in Herb. Brit. Mus., London.

LEVINGE, Herb. Nat. Mus. Dublin, Eire.

LINDEMANN, must read: Herb. Leningrad; part of dupl. *c.* 6500 specimens bequeathed to Bot. Lab. Novorossijskii, now Odessa Univ.; dupl. in Moscow.

LINNAEUS, C., Herb. Linn. Soc. London.

MARTYN, Th., Herb. Cambridge (England).

MORICAND, M. E., Herb. Geneva.

RETZIUS, A. J., Herb. Lund.

ROSENSTOCK, E., entry in Cyclopaedia add: mainly in Herb. Stockholm, many dupl. in Herb. Brit. Mus., fragments at Berkeley (Cal.).

SAVATIER, Herb. Kew.

SPRENGEL, K. P. J., entry in Cyclopaedia add: ferns sold to VON ROEMER and probably destroyed at Leipsic (ALSTON *in litt.*).

STEUDEL, C. G., partly in Herb. Oxford, England.

SWARTZ, O. P., Herb. State Mus. Stockholm. Included Malacca plants.

THUNBERG, C. P., Herb. Uppsala, with several pertaining handwritten catalogues.

VAHL, M., Herb. Copenhagen.

WAHLBERG, P. F., Herb. State Mus. Stockholm.

WITTROCK, V. B., Herb. State Mus. Stockholm

ACKNOWLEDGEMENTS

During the past years ample help for preparing this Supplement was given by the librarian of the Rijksherbarium, Mr L. VOGELENZANG, and by the Leyden University Library. By courtesy of the Amsterdam University Library it was possible to study letters from their MSS Department at Leyden.

The 'Algemeen Rijksarchief' at The Hague procured several data on servants of the Dutch East India Company.

Mr A. H. G. ALSTON kindly gave information whenever possible, and the staff-members of the Flora Malesiana, especially Mr P. W. LEENHOUTS and Mr J. KERN, always drew my attention to new names or localities found on herbarium labels. Dr C. A. BACKER put his corrected and annotated copy of the Cyclopaedia at my disposal.

Extensive valuable data were received from Dr A. J. G. H. KOSTERMANS (on collections of the Indonesian Forestry Service), Ir F. W. RAPPARD and Mr C. KALKMAN (on collections of the Forestry Service of West New Guinea), Mr J. B. MCADAM and Mr J. S. WOMERSLEY (on collectors. in East New Guinea), and from Dr E. QUISUMBING (on contributors to the P.N.H.).

Valuable information was found in the Florence Herbarium (Herb. BECCARI) in 1951, and specially during a trip to Hamburg, Copenhagen, Lund, Stockholm, and Uppsala, in May 1957. In Copenhagen Dr H. MØLHOLM HANSEN once more took great pains to answer my queries; Mr C. O. JØRGENSEN of the Danish East Asiatic Company gave information on Danish planters in Malaya. In Sweden many interesting details on the collecting activities of servants of the Swedish East India Company could be unearthed, thanks to the kind co-operation of Dr T. NORLINDH, Prof. Dr R. FLORIN, Mr E. SÖDERBERG, Dr A. HOLMBERG (Librarian of the Academy), Dr E. ASPLUND, and others.

M. J. VAN STEENIS-KRUSEMAN.

Leyden, December 1957.

SPECIAL PART

LEGEND TO ABBREVIATIONS AND SYMBOLS

Cyclopaedia p. 3–4 add:

1. Abbreviations of Herbaria and collecting series

Sandakan:
S.H. (= Sandakan Herbarium) series.
San (= Sandakan) series.
B.N.B. (= British North Borneo) series.
Hollandia: (now MANOKWARI):
B.W. (= Boswezen) series.
Lae:
N.G.F. (= New Guinea Forces, later changed into New Guinea Forests) series.

4. Geographical names and abbreviations

As in Indonesia some islands and places are nowadays mentioned by Indonesian names which differ greatly from the formerly used ones, it seems appropriate to cite here the more important name changes, although in this Supplement the familiar names will still be found.

Bogor = Buitenzorg
Djakarta = Batavia
Djawa = Java
Irian = New Guinea
Kalimanten = Borneo
Maluku = Moluccas
Sulawesi = Celebes

5. Abbreviations of cited literature

See ‘Citation of Serials and some Books’ in Fl. Mal. I, 5^2, 1956, p. cxlv–clxv.

ALPHABETICAL LIST OF COLLECTORS[†]

Abbott, William Louis

Zoological collecting localities.[2] *Anambas Islands* (*1899–1900*), *Natuna Islands* (*1900*); coasts of *N. Sumatra:* Atjeh and Tapanuli, and the islands *Simalur*, *Banjak*, and *P. Mansalar* (*1901–02*).—*1902. Simalur, Batu Islands, Nias.—1904. Billiton, Ban*(*g*)*ka*, and *Enggano, Karimata Islands.—1907. Bawean.—1908. Karimata Islands.* —He also visited some small islets in the Java Sea.

Literature. (2) *Cf.* G. C. A. Junge in Ardea 41, Jubil. *no*, 1954, p. 320–321.

***Abella,** C.

contributed some numbers from Mt Tolong, *Negros* (*1948–49*) to the P.N.H. numbers of the Philippine National Herbarium (see there).

***Abiguela,** R. R., *cf. sub* Philippine National Herbarium.

***Adelbert,** Albert George Ludwig

(1914, Middelburg, Z., Holland; x) spent part of his youth in Java and Sumatra, but returned to Holland to attend a secondary school in The Hague. Subsequently he studied biology at Leyden University; from 1943–48 Botanical Assistant at the Rijksherbarium, Leyden. From 1948 onwards Assistant at the Herbarium Bogoriense, Buitenzorg (Bogor); in 1952–53 Acting Chief. Since Dec. 1954 he was transferred to the new botanical garden Setia Mulia near Padang, Sumatra West Coast, as leader of the staff. End of June 1956 he went on furlough to Holland, and at present he is working on a thesis on *Lycopodiaceae.*

Collecting localities. *1949. W. Java:* Bogor.—*1950.* At Tjisarua, Tjibodas (garden), Kuripan, Tjibodas (Reserve), Telaga Warna, and G. Geger Bintang (near Tjibodas).—*1953.* Tjisarua (Oct. 9); Puntjak and Telaga Warna (Dec. 14).—*1954. Expedition to Bantam* under P. Groenhart (with Pleyte, van Kregten, *etc.*): from Bogor *via* Djakarta and Serang to Pandeglang (Feb. 1); *via* Labu(h)an to Sanghijang (2); vicinity and hinterland of Sanghijang (3–5); between Labuan and Tjibaliung, mouth of the Tjibungur (6); S. Bantam, coastal area between Malimping and Bajah (7–8); to Pandeglang; NW. slope of G. Pulasari, reaching the crater (10–12); back to Bogor (13).—*1955–* June *1956. Sumatra West Coast:* in the vicinity of Setia Mulia, the Botanic Garden near Padang.

Collections. > 400 numbers in *Herb. Bog.* Plants from *Sumatra West Coast*, coll. from *1955 onwards*, in *Herb. Setia Mulia.*

***Aden**

(1926, Bogor, Java, Indonesia; July 22, 1953, Tjibeureum above Tjibodas, W. Java), together with Main, assisted Kostermans on an expedition to *Morotai*, Moluccas, from April–June *1949.*

Agama, José

retired from the Forest Department of North Borneo on 8th June 1957 after 42 years of service.

Biographical data. Mal. For. 20, 1957, p. 180.

***Aguda** Jr, F., *cf. sub* Philippine National Herbarium.

***Ahmad bin Topin**

a Kuching Malay, attendant from the Sarawak Museum, who partly accompanied Miss W. M. A. Brooke (see there) on her collecting trips in Sarawak. When she was temporarily disabled, he collected on his own, but in her series. He was trained by her in collecting and herbarium work.

In Nov. *1954* he went to Niah Caves with Mr Harrison of the Sarawak Museum, and made a small collection of plants (Miss Brooke *in litt.*).

In *1955* he accompanied the Oxford Expedition for 3 months in the Plieran Valley, and assisted the forestry member (G. H. Pickles, see there) of the party. He did a small amount of individual collecting, and in those cases his name together with Pickles's occurs on the herbarium sheet.

Lately he is spending most of his time in entomological work.

***Aini bin Haji Mahamad**

a Forester of the Department of Forestry, Sarawak.

In *1955* he assisted the forestry member of the Oxford Expedition for three months in the Plieran Valley. He did a small amount of individual collecting too and in that case his name together with that of G. H. Pickles (see there) occurs on the herbarium sheet.

***Ajawaila,** O. D.

Collections. *Herb. Bog.:* > 7 water plants from Lake Sentani, *North New Guinea* (sent for identification on May 30rd, *1947*).

Albertis, Count Luigi Maria d'

2nd line, for Corsica read: Sardinia.

Collections. Add: Dupl. *Scitamineae* in *Herb. Copenh.* (pres. by Melbourne).

Alcasid, Godefredo L.

of the zoological staff of the Philippine National Museum, Manila, accompanied the Chicago-Philippine Expedition headed by Dr Harry Hoogstraal (see there), and collected plants in Abra Prov., *Luzon*, in Apr.–May *1946*, and not in 1947–48.

Collections. Numbered in the P.N.H. series; in *Herb. Manila* and *Herb. Chicago*, > 300 *nos.*

(†) New entries are provided with an asterisk.

Alderwerelt van Rosenburgh, C. R. W. K. van

In the Cyclopaedia 'van' was dropped by mistake.

COLLECTIONS. Add: According to ALSTON the *Selaginellas* in Berlin are dupl. *not* collected by himself.

MRS ALLEN

***Aleqaen,** Venancio, *c.s.*

collected in Apr.–May *1952* in the series of the University of the Philippines; in *Herb. Univ. Philip.*

***Alfred,** Brother, *cf. sub* Philippine National Herbarium.

***Ali & Hasan**

both corporal, collected *Strychnos tieuté* LESCH. (*cf.* KING & GAMBLE in J. As. Soc. Beng. 74, pt 2, 1907, p. 622) in *Malacca.*

***Allan,** Ernest

(1915, Durham, England; x), in the employ of the Forest Service, contributed after World War II to the N.G.F. series (*cf. sub* New Guinea Forces).

***Allen,** Betty Eleanor Gosset Molesworth

(1913, Opotiki, New Zealand; x) was trained in botany at Auckland Univ. College in New Zealand, and later worked at the Auckland War Memorial Museum. She came to Malaya after World War II planning some months vacation, but married Mr F. H. G. ALLEN, local manager of Henry Waugh & Co Ltd, and remained there.

She is a keen collector, especially of ferns.

COLLECTING LOCALITIES. From *1948 onwards.* All over *Malaya* (excluding Kelantan and Trengganu).—*1951. N. Borneo, Sarawak:* on limestone. *Br. N. Borneo* (fragm. coll.).—*1953.* Small collection in *Sumatra.*—From Aug. *1956*–Jan. *1957* in *Sarawak:* Mt Matang, Mt Santubong, and lowlands.—*1957. Br.N.Borneo:* Mt Kinabalu (Feb.).

COLLECTIONS. From the Malaysian region and N. Siam up to 1957 about 3300 ferns, 1600 bryophytes and lichens; only few phanerogams. *Herb. Sing.: Malayan* and Siamese ferns; comprehensive coll. of ferns in *Herb. Stat. Mus. Stockholm* and in *U.S. Nat. Herb.*; new records and interesting finds in *Herb. Kew* and *Brit. Mus.*; also *Malayan* ferns in *Herb. Auckl. Mus.*; small set of ferns in *Herb. Kepong.* She has a private working set of *Malaysian* pteridophytes and mosses.

Besides in Malaysia she collected in Europe, Australia, and New Zealand, but mostly cryptogams.

Allen, Edgar Francis

(1914, Formby, Lanc., England; x), agriculturist, educated at Cambridge University; A.I.C.T.A. (Trinidad); in the Agricultural Department, Malaya, 1937–41, 1945-*hodie*; 1941–45 Malayan Volunteer Air Force (R.A.F.).

COLLECTIONS. Add: *Herb. Sing.*, also orchids and plants from limestone hills.

He collected *Goodyera hispida* and *Bulbophyllum concinnum*, two new records for Selangor, *Malaya,* in the Templer National Park.

***Alnoor,** Abraham

(1733, Stockholm, Sweden; 1805, Stockholm, Sweden), son of a wine-merchant of Dutch descent; silk-manufacturer at Stockholm from 1756.

For several years in the employ of the Swedish East India Company, from 1773–88 as supercargo accompanying five voyages to the East (see below).

In 1779 he corresponded with C. P. THUNBERG on SPARRMAN's collections of the Cape, Batavia, and Ceylon, *etc.*[1]

ITINERARY.[2] 2nd Assistant in the 'Cronprins Gustaf', Dec. *1767*–June *1769.*—1st Assistant in the 'Finland', *1769–71* (see C. G. EKEBERG).—In the 'Finland', Jan. *1773*–June *1774* (Capt. J. Selle).—In the 'Stockholms Slott', Jan. *1777*–June *1778* (see also P. J. BLADH, and H. P. WENNERBERG; Capt. P. Pettersson), meeting C. P. THUNBERG in Sunda Straits[3] on July 11, *1777.*—In the 'Finland', March *1780*–July *1781* (Capt. Nicl. Almroth).—In the 'Gustaf III', Feb. *1783*–June *1784* (Capt. M. von Krusenstierna).—In the 'Gustaf Adolph', Jan. *1787*–July *1788* (Capt. J. Spindler).

COLLECTIONS. He presented East Indian plants to *Herb.* BERGIUS (= *Herb. R. Swed. Ac. Sc. Stockholm*).[4]

LITERATURE. (1) MS letter in University Library, Uppsala.

(2) *Cf.* list of the voyages with the names of the captains and the supercargoes in E. OLÁN, Ostindiska compagniets saga (1920).

(3) *Vide* letter from Thunberg to Bergius dated Oct. 7, 1777, from Ceylon, in R. Swed. Ac. Sc. Stockholm.

(4) *Cf.* A. Holmberg in Personhist. Tidskr. 43, 1944–45, p. 104.

***Alpha,** R.

employee of the Kebun Raya Indonesia (Botanic Gardens) at Bogor, Java, assisted T. O. van Kregten with the collecting of plants during a tour in Bantam in Feb. *1954* (itinerary *etc.* see *sub* Adelbert). His name may appear on some of the labels.

***Alston,** Arthur Hugh Garfit

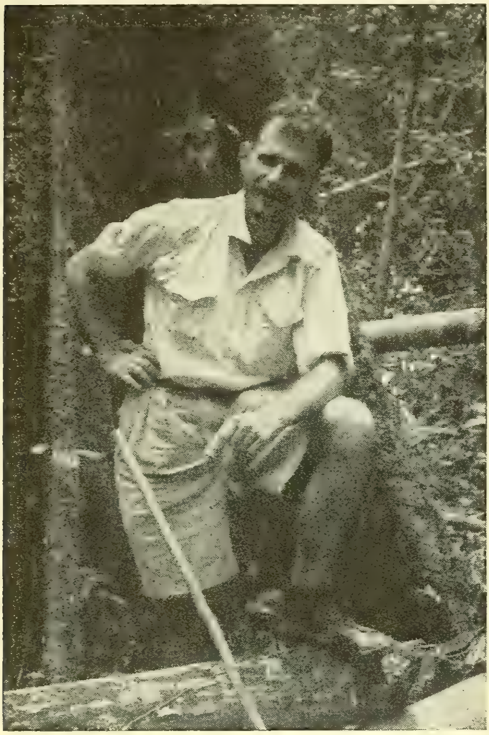
(1902, West Ashby, Lincolnshire, England; 1958, Barcelona, Spain), botanist, educated at Oxford University. After some months at Kew appointed Systematic Botanist, Dept of Agriculture, Ceylon 1925–29. Since 1930 in Dept of Botany, British Museum (Natural History). Besides in Malaysia, he travelled extensively in Europe, including Albania, Greece, and Spain, in Algeria (N. Africa), and in South and Central America.

His publications deal mainly with ferns and history; author of the supplement volume to Trimen's Flora of Ceylon. Lately revising fern families for Flora Malesiana, and co-editor of its 2nd series Pteridophyta.

Itinerary. *1953.* Siam; *W. Java:* Donmuang (Oct. 24), Bogor (= Buitenzorg) (30), Djasinga and Dungus Iwul (Nov. 3), Tjibodas (7), Bogor (8); Situ Lembang, N of Bandung (17); G. Tangkuban Prahu (18), and in Nov.–Dec. at Tjibodas (with Tjibeureum, Rawa Gajonggong, Huis ten Bosch), Tjisarua (Dec. 3), Tjimindi.—*1954. W. Java:* Pasir, Ganessa (Jan. 3); Karanghaur, near Tjisolok (6), Tjisukawayana (6); Bogor (10); *S. Borneo:* Sampit (Jan. 16–19), Tjempaka Mulia (20), Sampit (21–23), Handjalipan (24), Kuala Kwajan (25), Permantang (25–29), Handjalipan (29); *W. Java:* Bogor (Feb. 1–13); *Sumatra West Coast Res.:* Padang (Feb. 14–15), Lubuk Selasih and Kota Hilalang (16), Batang Palupuh and Bukit Tinggi (17), Telagu Kota Baru S of Bukit Tinggi (18); Lembah Anai W of Padang Pandjang, G. Merapi (19); Lake Manindjau and Paripandjang, Matur and Padanggelanggang (20); Bukit Tinggi (21), Air Putih E of Pajakumbuh (22); Batang Palupuh, Pasarkumpulan, Bondjol, and Kambahan near Lubuksikaping (23); Bukit Tinggi (24), Padang (25), Indrapura (26), Kota Limasering (27), G. Labu, and Batu Hampar, Kayu Aro Estate (28); Sungei Kering, G. Kerintji (March 2); old Japanese road, G. Kerintji (3); G. Kerintji (4); Sungei Tanduk, Kayu Aro (5–7); Kota Limo Manis, Sungei Tanduk, River Kumbang, Sungei Pagas (7); Penuh, Sungei Kunjit, and Muara Sako (8); Indrapura, Laut Njour, Painan, Teluk Batung SE of Painan, Teluk Kabung (9); Bukit Tinggi (= Fort de Kock), Air Putih, Pintu Angin (10); Bukit Tinggi, Padang Luar, Lembah Anai W of Padang Pandjang (11); ravine at Bukit Tinggi (12); Rimbu Panti (13); *W. Sumatra*, Tapanuli Res.: Bukit Dua-blas, S of Muarasipang (13); Pintu Padang, S of Padang Sidempuan, and Terutung (14); *Sumatra East Coast Res.:* Rampa, between Tebingtinggi and Lubukpakam (15), Medan (16), Sibolangit (17–18), Kabandjahe and Kotabuluh (19); *N. Sumatra*, Atjeh: Kotatjane and Lau Simerah (20); Lau Penganggalan, Memding, and Lau Kaulam (21); G. Satan, Lau Gurah, and Lau Kelawu (22); Lau Sigala (23); Blangkedjeren (24); Kotatjane and Kotabangon (26); *Sumatra East Coast Res.:* Merek and R. Bolon, Dolok Silali (26); *W. Sumatra*, Tapanuli Res.: Sidikalang (27); Parbuluan, Tele N of Baniara, Hariarapintu (28); Lae Pondon (29–30); Lae Renun, E of Sidikaling (30); Lae Pakoan, Parbuluan, Hariarapintu, and Baniara (31); Lae Pondon (Apr. 1); Sidikaling, Silalahi, Sumbul (2); Hariarapintu and Hutagalung (3); *Sumatra East Coast Res.:* Lubuk Pakam (5); Pe(r)matang Siantar, Bandar Dolok, Marial Puta, Aik Nauli (7); G. Simbolon, Batu Lubang, Prapat, Lake Toba (8); *W. Sumatra*, N. Tapanuli: Aek Nahilu, Lumban Djulu, G. Pangu Lubao, Pong Hulu-bau (8); *Sumatra East Coast Res.:* Sungei Balei, Bunut Estate near Kisaran, Sentang, and Tandjung Balai (9); Asahan River (10); *W. Java:* Bogor (Apr. 16–28), making an excursion to *Pulau Kelor* and *Amsterdam Island* in Bay of Djakarta (27); Bogor (Apr. 29–May 20); Koningsplein, Djakarta (= Batavia, May 5); *SW. Celebes:* Makassar (26), Pare Pare (27); *Centr. Celebes:* Donggala (28); *N. Celebes:* Toli-Toli (29); *NE. Celebes*, Minahassa: Tomohon (31), G. Mahawu (June 1), Tomohon (2–6); Lake Lahendong, Kelelonde, Soputan Range (7); G. Masarang,

ALSTON

Kakaskasen, Tonsealama (8); G. Lokon (9), Tonsealama and Tanggari (10), Tomohon (12–13); Soputan Range, at Manimporok (14), Kelelonde (15, 16), Kawamaäsam (15), Tonderukan (17), Kelelonde (17–18); Tomohon (19), G. Masarang (20), Kakaskasan to G. Mahawu (21), Tomohon and Tanggari (22), Makawidei (23), Cape Batu Angus (23–25), Batu Angus (25), *Pulau Lembeh* (26), Makawidei (27), G. Tangkoko (28), Air Prang (29), Tomohon (30); Tara Tara, Ranotongkor, Pasir Pandjang, 8 km E of Tanawanko (July 2); Kinelow near Menado (3), Tonsealama (5), Sonder (6); Kinilow, G. Empong (7); Tomohon (8–15), Tataäran (15), G. Mahawu; Tempangtempang, Langowan, Kawamaäsan (Soputan Range), Pantu valley, G. Aiseput (17); Tomohon (18–19), G. Tetawiran (20), Tomohon (21), Tondano (22), Tomohon (23), G. Klabat and Totelu (24), Tomohon (25–26); Tounan, near Rumoöng Atas, R. Ranotuana, Pinamorgan, and Popontollen (27); Munte (27–28), G. Manembo-nembo (28), Bitung (31); *N. Moluccas, Ternate:* Peak of Ternate above Gamalama (Aug. 3); Ngade near Laguna, L. Laguna, Gambesi (S. side of the island), Castela, Foramadiahi, Taduma (W. side), and Tolire Ketjil (4); Ternate (5); *Tidore:* Soasiu and Gurabanga (6), G. Kiematuba (7), Gurabanga (8); *Halmahe(i)ra:* Oba (8), Akekolano and Ake (River) Oba (9); *Ternate* (10); *Halmahe(i)ra:* Djailolo, Huku-Huku near Atjengo, and Taboso (10); Idamdehi and Peak of Djailolo (13); Idamdehi to Atjengo, Gamduoro, Gamgono, and Lolori (14); Atjengo (15); *Batjan:* Indomut, Senggah River, and Amasing (20); Tuwokona, and Gandasuli River (22); G. Sibel(l)a (23–25), Labuha (27); *Sula Islands: Sanana; Buru:* Namlea and Sawa (Sept. 2); *Ambon:* Djembatan (3); *Lesser Sunda Islands, Bali:* Buleleng (10); *W. Java:* Bogor (Sept. 16–Oct. 2). On the voyage home he touched *Malaya.*



J. A. R. ANDERSON

COLLECTIONS. In *Herb. Brit. Mus.*, except *c.* 3000 *nos* collected in Ceylon, which are in *Herb. Peradeniya* (some dupl. at Kew, Brit. Mus., New York, *etc.*). The plants collected during the abovementioned trip are numbered as follows: Siam 12351–12356; *Java* (& cult. Hort. Bog.) 12357–13028, 13463–13575, 17069–17216; *Borneo* 13576–15377; *Celebes* 15577–16596; *Moluccas* 16597–17057; *Bali* 17058–17068; *Malaya* 17217–17225. They comprise ferns, phanerogams and lower cryptogams; dupl. will presumably go to *Herb. Bog.* (almost complete set), *Leyden*, and *Arn. Arb.*

He collected also some zoological, entomological, and mineralogical material.

Alvins, M. V.

COLLECTING LOCALITIES. Add: *Pulau Nangka* and *Dûdol* (= *? Dodol*) (Feb. 4, *1886*).

Amdjah

1st line for 1916 read: 1915.

***Ames,** Oakes

is credited with collecting in the Philippines and Borneo in Index Herb. (pt II, 1954). CH. SCHWEINFURTH of the Botanical Museum, Cambridge, Mass., assures me (*in litt.*) that Prof. AMES to his certain knowledge did *not* collect in any part of Malaysia.

***Amiruddin Musa**

(1930, Kepahiang, Bengkulu, S. Sumatra, Indonesia; x), during 1956 Student-Assistant of Dr W. MEIJER, Faculty of Agriculture, Pajakumbuh.

COLLECTING LOCALITIES. *1956. Centr. Sumatra:* during trip in Hutan Pulau Lawas, Teratah Air hitam, E of Taluk, W. Indragiri (Jan. 18–23).

COLLECTIONS. Made with SAFRI SJATER and HUSNI KARIM under the joint name of 'Kongsi Tiga', in *Herb. Fac. Agr. Pajakumbuh*, 69 *nos*; dupl. in *Herb. Sing.*, *Leyden*, *Brit. Mus.*, and *Geneva.*

Anderson, Captain

evidently collected in the *Moluccas* in *1802* (see ROXBURGH, Hort. Beng. 1814, p. 15).

***Anderson,** James Aidan Robb

(1922, Bamburgh, Northumberland, England; x), served in the British Army during World War II (1940–46), and was subsequently educated in forestry at Edinburgh University (B. Sc. 1950);

studied in Finland, 1950–51. In 1951 he took up an appointment as Assistant Conservator of Forests in the British Colonial Service, and was stationed at Sibu (Sarawak) from 1951–54; in 1955, on return from leave, Research Officer at Kuching; in 1956 seconded to Brunei as State Forest Officer.

He is making ecological studies in fresh-water swamps; a preliminary check-list of the species was in preparation in 1956.

COLLECTING LOCALITIES. *NW. Borneo, 1951 onwards.* Mostly in fresh-water swamp forests of Sarawak and Brunei, principally in the Rejang Delta (*1954*), but besides at Baram (*1955*), Triso Peninsula (*1955*), Kayangeran Forest Reserve (*1954*, *1956*), and Badas (Brunei) (*1954*).

COLLECTIONS. About 1000 specimens (up to June 1956), numbered in the field series of the Forest Department Sarawak; in *Herb. Sarawak, Sing.*, and *Kepong.*

Andersson, Nils Johan

COLLECTIONS. Add: Sheets collected in *Singapore* (dated Jan. 28, *1853*) are present in *Herb. State Mus. Stockholm.*

LITERATURE. (2) p. 16b line 9 after Svensk Vetensk. Akad. Öfvers. add: 9, 1852, p. 117–119;

After line 10 (in Swedish) insert:; Nya Bot. Not. 1853, p. 16–17, 101–108; *ibid.* 1854, p. 20–28, 43–48.

BIOGRAPHICAL DATA. Add: in 'Naturhistoriska Riksmuseets Historia' 1916, p. 113–114, with portr.

Andrea, A. F.

(1822, Lolland, island in the W. Baltic; May 1893, ?), in the mercantile marine from 1843–78, retiring in the latter year. From 1854 as a captain; in 1865 his ship was destroyed by fire in the South Atlantic, but thanks to his efficiency and presence of mind the crew was saved. Through the influence of JAPETUS STEENSTRUP, Professor of Zoology, he became interested in natural history, and did henceforth very extensive collecting work, especially on pelagic animals. As a reward for his valuable aid to science he got a Danish government pension.

He is also the author of poems and religious books.

Third line of the entry in the Cyclopaedia (Fl. Mal. 1, p. 16b) must read *1871* instead of 1875.

BIOGRAPHICAL DATA. Mr R. SPÄRCK of the Zool. Mus. in Copenhagen *in litt.* (Aug. 23, 1957).

Annandale, Thomas Nelson

COLLECTIONS. Add: In *Herb. Kew* recorded about 10 specim. Skeat Expedition coll. ANNANDALE & ROBINSON. As H. C. ROBINSON is not known to me as a member of the Skeat Expedition, this statement (found at Kew) sounds doubtful; it seems more probable that the specimens were collected in 1901–02.

***Añonuevo,** P.

of the staff of the Philippine National Museum, collected on Mt Pulog (*Luzon*, March *1948*) with A. P. CASTRO, and > 300 plants in *Mindanao* (March–Nov. *1950*) with K. J. PELZER; numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium).

***Anonymous**

The Assistant Resident of Air Bangis and Rau, *Sumatra West Coast*, sent some herbarium specimens of trees to *Herb. Leyden;* collected March 20, *1861.*

***Anonymous**

The Director of Agriculture, *New Guinea*, sent 15 orchids to *Kew Herb.* in *1933.*

Anta

accompanied KOSTERMANS (see there) to *Banka* in *1949*, and collected at least on G. Maros. Material in *Herb. Bog.*

***Arañez,** Adoracion T.

collected at Batangas (*Luzon*) in Dec. *1953*; in *Herb. Univ. Philip.*

***Arce,** B., *cf. sub* Philippine National Herbarium.

***Arcilla,** F., *cf. sub* Philippine National Herbarium.

***Ardieta,** R., *cf. sub* Philippine National Herbarium.

Arens, Pedro Martin José

(† 1954, Hilversum, Holland).

BIOGRAPHICAL DATA. Vakbl. Biol. 34, 1954, p. 23–24.

Armit, William Edington de Margrat

COLLECTIONS. Add: Fern dupl. were sent to the specialist CHR. LUERSSEN in Germany; dupl. of *Scitamineae* in *Herb. Copenh.*

Arrhenius, Olof Wilhelm

COLLECTIONS. Add: Material from *Java* and 125 *Java* plants pres. to *Herb. State Mus. Stockholm* in 1922.

***Arthur,** H. R.

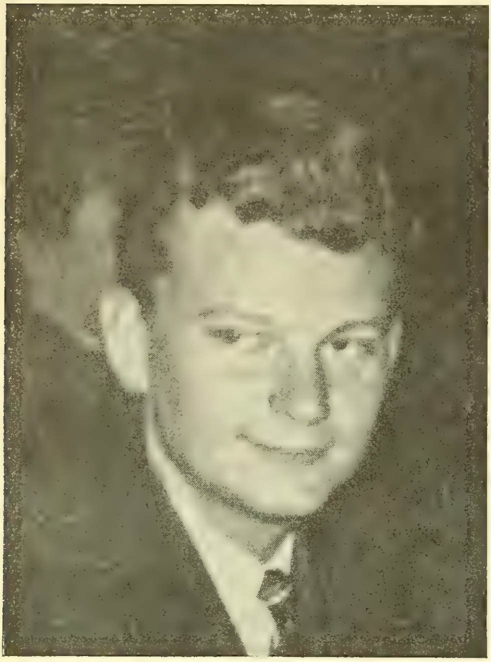
COLLECTIONS. At least the *nos* 149–150, collected Aug. *1952* on Mt Kinabalu, *Br. N. Borneo*, in *Herb. Hongkong.*

***Ashton,** Peter Shaw

(1934, Boscombe, Hants, England; x), botanist, educated at Cambridge University (B.A.); appointed as State Forest Botanist in Brunei, Borneo, in 1957, to study the trees of economic importance, mainly Dipterocarps. He will work for 3 years in the field, followed by 2 years at Cambridge under Mr CORNER, with the intention of studying for a Ph.D., and writing a Forester's Manual of Brunei Dipterocarps.

COLLECTING LOCALITIES. From March *1957 onwards* in Brunei, *NW. Borneo*, up till now (Oct. same year) having collected near the Temburong, Brunei, Tutong, and Belait rivers.

Collections. Brunei (*Borneo*) collections in: *Herb. Leyden*, *Sing.*, *Kew*, *Arn. Arb.*, *Bog.*, *Kepong*, *Sandakan*, *Princes Risborough*, *Kuching*, *Brisbane*, *Brit. Mus.*, *New York*, *Manila*, *Paris*, and *Florence*, will be distributed in the above-mentioned order. Woody plants numbered with S. (Sarawak) numbers 5700–5950 and 7800–7900; Brun (Brunei) numbers 1–800 (so far in Oct. 1957); herbs and lower plants numbered A1–200 (so far), his own collecting numbers; besides 350 *nos* collected jointly with G.H.S. Wood (see there) in Brunei, distributed from Sandakan with San numbers.



ASHTON

In *Herb. Brit. Mus.* besides: small collection of ferns from Brazil (coll. 1954).

***Astudillo,** R., *cf. sub* Philippine National Herbarium.

***Atjil,** A., *cf. sub* Forest Research Institute, Buitenzorg (Bogor), Java.

***Atmawisastra**
'mantri' of the Mountain Garden at Tjibodas, assisted A. M. Neervoort (see there) in collecting plants (after the war, only occasionally).

***B.N.B.** *nos*, *cf. sub* Forest Department British North Borneo.

***B.W.** *nos*, *cf. sub* Boswezen Nieuw Guinea.

***Babaran,** S.
Collections. Plants from the *Philippines* in *Herb. Brit. Mus.* (*cf.* Index Herb. pt II, 1954).

Backer, Cornelis Andries
Collecting localities. *W. Java:* Tjiandjoer and environs & G. Gedeh-Pangrango (Sept. 13–21) in *1911* and *not* in 1912.

Bailey, Frederick Manson
Biographical data. Add: Proc. R. Soc. Queensl. 61, 1950, p. 105–114.

Bain, Vivian Light
(1899, Taiping, Perak, Malay Peninsula; x) was educated in forestry at Rangoon University (Diploma in 1926). Till March 1951 in the Malayan Forest Service, lastly as Senior Assistant Conservator of Forests in Perak.
Biographical data. Mal. For. 14, 1951, p. 2–3 + portr.

***Balajadia,** Deogracias
was appointed Ranger of the Forest Department British North Borneo in 1933. Stationed at Kudat and Sandakan. He resigned in 1941 and returned to the Philippines.
Collecting localities. *1933–41. Br. N. Borneo:* at Kudat and Sandakan.
Collections. *Cf. sub* For. Dept Br. N. Borneo.

***Baldwin**
is cited as a collector of *Didymocarpus malayana* Hook. *f.* in Perak, *Malay Peninsula* (*cf.* King & Gamble in J. As. Soc. Beng. 74, pt 2, 1908, p. 752).

Balen, J. A. van
(1854–1941) arrived in New Guinea in Jan. 1883, his first station being P. Roön in the Geelvink Bay. In 1889 he established a missionary station at Windehsi. He resigned in 1913.
Biographical data. Ned. Zendingsblad 24, 1941, p. 91 + portr. (the initials are erroneously mentioned as A.J.).

***Balintay,** M.
collected in Oct. *1948* some thirty plants on Mt Pinatubo, *Luzon.* Possibly he accompanied R. B. Fox (see there). Numbered in the P.N.H. series (*cf.* Philippine National Herbarium).

***Ballesteros,** J. S., *cf. sub* Philippine National Herbarium.

***Baltazar,** C. R., *cf. sub* Philippine National Herbarium.

***Baluyot,** A., *cf. sub* Philippine National Herbarium.

Banks, Sir Joseph
Biographical data. Add: Science. Bot. Disc. in New Zealand. Post-prim. School Bull. 5, *no* 2, 1951, p. 19–32; Proc. Linn. Soc. Lond. 163, 1950–51, p. 21–26 (1952); H. C. Cameron: 'Sir Joseph Banks, the Autocrat of Philosophers' (London).

***Banzon,** Gregoria T.
collected at Novaliches, Rizal (*Luzon*), in Nov. 1953; in *Herb. Univ. Philip.*, > 71 *nos.*

***Baptist,** Dr E. D. C.
first collected *Croton hirtus* at Bukit Rajah Estate, Klang, Selangor (July 7, *1954*); specimen in *Herb. Rubber Research Inst. Malaya* (Gard. Bull. Sing. 15, 1956, p. 1).

Barkmeyer-de Vries, A. M., *cf.* also *sub* A. M. DE VRIES.

Barnard, Basil Henry Francis
(1874, Gatton, Somerset, England; 1953, Clevedon, Somerset, England), was educated at Keble College, Oxford. According to his own information he entered the Forest Service in 1898.
BIOGRAPHICAL DATA. Mal. For. 17, 1954, p. 3–4.

Barnard, R. C.
retired as silviculturist from the Forest Research Station, Kepong, in 1956.
Author of many silvicultural papers.
BIOGRAPHICAL DATA. Mal. For. Rec. 19, 1956, p. 122–123, with portr.

Barrett, J. H., *cf. sub* New Guinea Forces.

Bartlett, Harley Harris
retired in 1955.
ITINERARY. *1935. Philippines*, add: *Mindoro* (Apr.), *Luzon* (July).
COLLECTIONS. Add: According to Index Herb. (pt II, 1954) *Java* plants of his are in *Herb. Sing.*, and *Sarawak* plants in *Herb. Leyden.* BARTLETT himself, however, assured me that he never coltected in either place. The Sarawak plants must have been collected by E. BARTLETT.

***Bartolomé,** J., *cf. sub* Philippine National Herbarium.

***Bartolomé,** Vicente Concepción
COLLECTIONS. Plants from the *Philippines* (coll. about *1910*) in *Herb. Ann Arbor* (*cf.* Index Herb. pt II, 1954). According to the Director, Prof. H. H. BARTLETT, he may have been a student collector, and it seems possible that the specimens were brought back by Dr F. C. GATES who taught at the College of Agriculture, University of the Philippines.

Bartsch, Paul
evidently made his *Borneo* collection in Sandakan also in *1908* (*cf.* SMYTHIES in Sarawak Mus. J. 7, 1957, p. 540).

***Basaca,** M., *cf. sub* Philip. Nat. Herbarium.

***Baskiñas,** Leticia
collected in Dec. *1953* at Baguio, *Luzon*; in *Herb. Univ. Philip.*

Bateson, Gregory
COLLECTIONS. *Herb. Kew:* plants from *NE. New Guinea* (Sepik River) and *New Britain* (Baining Mts, Gazelle Peninsula); > 143 *nos.*

Bauer, Ferdinand Lucas
ITINERARY. Line 3 (of p. 42a) read as follows: Apr. 1–7, *1803.* For detailed data . . .

Baumhauer, Jan Willem Samuel
COLLECTIONS. Possibly he collected in the *Lingga Archipelago* in *1872.*

***Bayer,** F. M.
collected some ferns *etc.* near Hollandia, *North New Guinea*, in *1945.*

***Beach,** Kay H.
resident of Edwardsville, Kansas, a Quaker (Friend) who collected plants on his Friends Service Committee missions in the Far and Near East. In *1948–49* he was in northern China and collected about Shanghai, Hongkong, and Manila (*Luzon*) on the way home. In 1951–52 he was in India in the same work, returning *via* Afghanistan, Iran, Iraq, Jordan, and Israel.
COLLECTIONS. In *Herb. Univ. Cal.* and *U.S. Nat. Mus.* (*cf.* Index Herb. pt II, 1954).

***Bebas**
a Forest Guard of Mr DERRY (see there) in Malacca about *1900–1905*; he collected plants in the *Malay Peninsula* (Mr J. PURSEGLOVE *in litt.*).

Beccari, Odoardo
COLLECTIONS. Delete: *Herb. Monaco.* After '(Plantae Beccarianae)' insert: From his herbarium at Florence it is clear that he evidently later altered his intention, probably after having extended his expeditions to other Indonesian islands. In fact P.B. *nos* were exclusively given to Borneo plants, P.S. *nos* to those from Sumatra, and P.P. *nos* to Papuan plants, the initials standing respectively for 'Piante bornensi', 'Piante sumatrane', and 'Piante papuane'. In recent years a paper was published on his herbarium, including a list of Malaysian sea-grasses he collected.[13] A copy of a compiled number list of his phanerogamic herbarium is present at Florence, Leyden, Bogor, and in the Arnold Arboretum (Jamaica Pl.).
The dupl. in *Melbourne* mostly from *Sumatra*, few from *Java* and *New Guinea.*
LITERATURE. (12) Add: E. IRMSCHER: 'Neue Begoniaceeen von O. Beccari in Malesien gesammelt' (Webbia 9, 1954, p. 469–510, 8 fig.).
(13) C. G. G. J. VAN STEENIS: 'Thesaurus beccarianus' (Webbia 8, 1952, p. 427–436).

***Beck,** Dr Eugen
brother of the botanist Dr GÜNTHER BECK, made a voyage to Aden, the East Indies, Further India, and Hongkong in *c. 1886.*[1]
COLLECTIONS. *Herb. Vienna:* about 300 plants from above-mentioned voyage. The collection includes some plants from *P. Penang.*[2]
LITERATURE. (1) *Cf.* Jahresbericht über das Museum in Ann. Naturh. Mus. Wien 2, 1887.
(2) *Cf.* Index Herb. pt II, 1954.

***Bell,** Peter Robert

(1920, Bexleyheath, England; x), botanist, educated at Cambridge University, 1938–40, 1945–46; Lecturer in Botany in the University of London. He paid a visit to Sarawak in 1956.

COLLECTING LOCALITIES. *1956. NW. Borneo*, Sarawak: on Mt Poi and other high peaks (June–July), northern half of the Pueh Range, especially above *c.* 3000 ft.

COLLECTIONS. *Herb. Brit. Mus.: nos* 1882–2088 inclusive, especially *Pteridophyta* and *Bryophyta*; dupl. will be sent to *Herb. Sarawak* and eventually elsewhere.

***Belleza,** A., *cf. sub* Philippine National Herbarium.

Benthem Jutting, Woutera Sophie Suzanna van married to P. J. VAN DER FEEN (*not* VEEN).

***Bergman,** Sten

(1895, Ransäter, Prov. of Värmland, Sweden; x), studied at the University of Stockholm, taking his Ph. D. in 1952. He made scientific expeditions to Kamchatka (1920–22), Kurile Islands (1929–30), Korea (1935–36), and *West New Guinea* (*1948–49*, *1952–53*).[3] His main interest is ornithology.

He conducted the Swedish-Netherlands expedition to West New Guinea and some neighbouring islands, assisted by SJÖQVIST (itinerary see below).

ITINERARY.[1] *1948.* Arrival at *Sorong*, W of *New Guinea* (July 22); July 29 with LIEFTINCK, SJÖQVIST, and LUNDQVIST for a 5-day tour by motor-boat, visiting the coasts of *Waigeoe* and *Salawatti*; in the first half of Aug. exploring E and SE of Sorong; by flying-boat (Aug. 17) to Klamono, *c.* 50 km SE of Sorong, staying till the 25th; Sept. 15 to Majalibit Bay, *S. Waigeoe*, making base camp in *Beeuw* (small islet); mid-Oct. returning to Sorong *via* Saonek; subsequently exploring SE of Sorong (Mooi region).

COLLECTIONS. From *1948*, most plants collected by PLEYTE (see there) *c.s.* A small collection was made by himself[2] mostly on Mt Tombrok, situated on the western side of Lake Anggi Gita near Arfak Mts in the Vogelkop; in *Herb. State Mus. Stockholm*; phanerogams identified by Dr VAN STEENIS in Jan. 1952. No botanical collections made in 1952–53.

LITERATURE. (1) *Cf.* Chron. Bot. 105, 1949, p. 31.

(2) E. B. BARTRAM: 'Mosses of Northwest (Dutch) New Guinea collected by Dr Sten Bergman' (Svensk Bot. Tidskr. 45, 1951, p. 603–607).

(3) ST. BERGMAN: 'Wilde und Paradiesvögel. Eine Forschungsreise nach Neuguinea' (Wiesbaden 1952).

***Berry,** Andrew

(fl. 1784–1819) of the Madras Medical Service, 1784–1814, was associated with the Moravian missionaries, and laid out a garden in Madras City. He was a friend of ROXBURGH and largely contributed to the Calcutta Garden, mostly plants from India, but also credited with plants from the *Malay Islands* (*1799*), *Moluccas* (*1807*), and Africa (see ROXBURGH, Hort. Beng. 1814). Those from outside India were presumably cultivated in his own garden, and *not* brought to India by himself.

BIOGRAPHICAL DATA. Biogr. Index BRITTEN & BOULGER, 2nd ed. by RENDLE, 1931; BACKER, Verkl. Woordenb. 1936; J. Bomb. Nat. Hist. Soc. 51, 1953, p. 858.

Beumée, Johan Gotlieb Benjamin
retired in 1953.

***Beijen,** Ch., *cf. sub* Boswezen Nieuw Guinea.

Beyer, Henry Otley, *cf. sub* Philippine National Herbarium.

***Beyer,** Wm.

collected some thirty plants in *Luzon*, which were numbered in the P.N.H. series (see Philippine National Herbarium).

***Bezdek,** József

(1880, Hungary; x), teacher in geography in a secondary school in Budapest. In *1911* he made a botanical collection in Ceylon, and made a study of tropical botanical gardens, visiting also those in *Penang* and *Singapore* (*cf.* Act. Bot. Ac. Sc. Hung. 1, 1955, p. 275–276, 297).[1] Possibly some plants from the Malaysian region in *Herb. Budapest.*

LITERATURE. (1) J. BEZDEK: 'Néhány tropikus botanikus kertről és a Bronx-parki nővénytani intézetről' (On some tropical botanic gardens and the botanical institute in Bronx Park) (Botanikai Közlemények 11, 1912, p. 64–82; in Hungarian).

***Bhaskaran Nair,** V. K.

while making a survey of vegetation at the Rubber Research Institute Experiment Station, *Malaya*, collected *Croton hirtus* from Sungei Buloh, Selangor (March 10, *1955*); material in *Herb. Sing.* (Gard. Bull. Sing. 15, 1956, p. 1).

***Binnendijk**

COLLECTING LOCALITIES. According to labels of material in the Bogor Herbarium BINNENDIJK collected in *Sumatra*, but no data on a visit to that island came to my knowledge. In the letters of S. BINNENDIJK I found a note that his son, W. H. BINNENDIJK, collected seeds of *Teysmannia albifrons* at Rau (Padang Uplands, *Sum. W. Coast*) (letter dated June 14, *1879*), which were forwarded to Leyden. It seems possible that he also collected other material.

Binnendijk, Simon

COLLECTING LOCALITIES. Add: *W. Java:* G. Tjampea (= G. Tjibodas) (*c.* Apr. *1852*); several times on G. Gedeh-Pangrango.

Binstead, Charles Herbert

COLLECTIONS. Add: types probably with *Herb.* DIXON in *Herb. Brit. Mus.*

***Birch**, J. K.

COLLECTIONS. Pteridophytes (463) from *P. Penang* in *Herb. Brit. Mus.* (acq. 1927). He collected in the island about *1905*.

Bíró, Lajos

(born at Tasnád, Hungary; died in Budapest) studied initially theology, but his intense interest in natural history induced him to take up zoology. His qualification in the University of Budapest took him many years as he had to earn the means for studying, as a private tutor.

After his return from New Guinea[7], he was appointed 'Custos honoris causa' at the Hungarian National Museum, where he elaborated his collections; he was awarded a Honorary Dr's degree of the University of Szeged.

He explored several other countries, *viz*: N. Africa (1902–03), Greece (1906), Turkey (Ankara, 1925), and Bulgaria (1928).

Schizaea biroi A. RICHT. and *Biropteris* KÜMM. were also named after him.

ITINERARY. *1901*. Add: In *French Isl.*, but as collecting there proved to be rather poor, he left for Sydney, doing some collecting in Australia; subsequently returning to New Guinea, making preparations for his home voyage, leaving Dec. 21.

LITERATURE. (6) Add: *Lichens* elaborated by Ö. SZATALA in Ann. Hist.-Nat. Mus. Nat. Hung. 7, 1956, p. 15–50.

(7) L. BÍRÓ: 'Het ér Új-Guineában' (Budapest 1923; letters written from New Guinea); 'Újguineai utazásom emlékei' (Budapest 1932; reminescences from his New Guinea voyage); and some other papers in Hungarian in Természetrati Közlöny 31, 1899, p. 74–75, and *ibid.* 51, 1919, p. 397–398.

BIOGRAPHICAL DATA. S. ASZTALOS: 'Bíró Lajos, a nagy magyar utazó' (Budap. Művelt Nép. 1953, 139 pp.); Act. Bot. Ac. Sc. Hung. 1, 1955, p. 273, 275, 276; Ann. Hist.-Nat. Mus. Nat. Hung. 7, 1956, pt 1 (memorial part), German biogr. p. 7–13, with portr.

***Bladh**, Pet(t)er Johan

(1746, Vasa, Finland; 1816, Bennvik at Närpes, Vasa Prov., Finland) passed his youth at Vasa in Finland, and studied for some time at Åbo. From 1766–84 in the employ of the Swedish East India Company, the years 1777–83 permanently stationed in China, but in total staying there much longer. From 1766–75 he accompanied several voyages to the East (see below), respectively as a clerk, 2nd, and 1st assistant of the supercargo; in 1776 appointed supercargo and from the next year stationed at Canton, where he later became agent of the trading-station. In 1784 he returned definitely to Europe, and settled as soon as possible in Finland, taking with him all of his curios to Bennvik estate, where everything was Chinese. In 1808, during a war, his house was badly plundered by the Russians. In business, and 'kansliråd' at the nearby Kaskö (= Kaskinen).

He always had a keen interest in natural history and in 1770 attended BERGIUS's lectures, and courses in mineralogy, and chemistry at Stockholm as a visitor. A correspondent of C. P. THUNBERG,[1] who named the genus *Bladhia* after him (= *Ardisia*), but also of A. J. RETZIUS, and A. BÄCK. In 1779 he was appointed member of the Royal Swedish Academy at Stockholm.

ITINERARY.[2] In the East-Indiaman 'Lovisa Ulrica' from Göteborg (Dec. 16, *1766*) *via* Cadiz and *Java* to Canton (arrival Aug. 25, *1767*), back in Sweden June *1768*[3].—In the 'Adolph Friederic' from Göteborg (Dec. *1768*) to *East India*, returning June 1, *1770*.—In the 'Stockholms Slott' from Vasa.—In the 'Stockholms Slott' from Jan. 9, *1772*–June 1, *1773*, bringing A. SPARRMAN to the Cape.—In the 'Sophia Magdalena' (Capt. C. G. EKEBERG), Jan. *1774*–June *1775*; in *1774*, having visited Batavia and Angkè on the N. coast of *W. Java*[4].—In the 'Stockholms Slott', Jan. *1777*, to Canton (see also A. ALNOOR and H. P. WENNERBERG), passing Sunda Straits in July of the same year, meeting THUNBERG at Anger (= Anjer), *W. Java*[5], subsequently *Nord Ejland* (= prob. *Noordeiland* or *P. Moendoe*), and passing Banka Straits; back in June *1778*.

Evidently most of the China voyages were made *via Java*.

COLLECTIONS. In *Herb.* BERGIUS (= *R. Swed. Ac. Sc. Stockholm*)[6], at least from *Ind. Or.* and China; also in *Herb.* LINNAEUS (= *Linn. Soc. Lond.*), *Herb.* RETZIUS (= *Lund*)[7], *Herb.* THUNBERG (= *Uppsala*), and *Herb.* BÄCK (= *Uppsala*), but possibly from China and Macao (coll. there at least in 1782) only; in *Herb. Brit. Mus.* (with *Herb.* BANKS).

In 1777 BLADH wrote to THUNBERG[8] that he was looking for a suitable correspondent at Batavia, partly for making scientific collections, partly for other information. THUNBERG (who recently had visited Batavia) brought him into connection with a Dutch physician, J. HOFFMAN. Whether the latter really made collections for the Swedes is not yet known to me.

BLADH also made zoological and ethnographical collections.

LITERATURE. (1) Several MS letters from BLADH to THUNBERG in Library University of Uppsala; much of BLADH's correspondence preserved in Vasa (Finland); other MSS of BLADH at Göteborg.

(2) *Cf.* B. LUNELUND: 'Peter Johan Bladh och Svenska Ostindiska compagniet åren 1766–84' (Svensk. Litteratursällsk. Hist. Litteraturhist. Stud. 16, Helsingfors 1940, p. 298–341).

(3) Description of BLADH's voyage with HOLMER's papers in Sjöhistorisk. Mus., Stockholm; BLADH's 'Utgiftsbok' of this voyage, together with other papers of his in Österbottens Historiska Museum (Vasa, Finland) (the book contains all purchases and expenditures made at Cadiz, Java, and Canton) (*n.v.*).

(4) See letter from BLADH to THUNBERG, dated Canton, Dec. 15, 1774, in MS collection University Library Uppsala.

(5) See other letter from BLADH to THUNBERG at Uppsala; also letter from THUNBERG to BERGIUS, dated Ceylon, Oct. 7, 1777, in R. Swed. Ac. Sc. Stockholm.

(6) *Cf.* A. Holmberg in Personhist. Tidskr. 43, 1944–45, p. 104 (written 'Blad').

(7) In Dec. 1780 A. J. Retzius thanked Bladh for a despatch of plants, and said to be jealous of Thunberg, who was ahead of him by naming the genus *Bladhia*! (MS letter in Vasa).

(8) See letter dated July 1777 in University Library Uppsala.

Biographical data. Bretschneider, Hist. Bot. Disc. China 1898, p. 111–112; Backer, Verkl. Woordenb., 1936; B. Lunelund: 'Peter Johan Bladh och Svenska Ostindiska compagniet åren 1766–84' (Svensk. Litteratursällsk. Hist. Litteraturhist. Stud. 16, Helsingfors 1940, p. 298–341); O. Gerz, Kungl. Fysiogr. Sällsk. i Lund 1772–1940, 1940, p. 94, 220.

***Blanco**, Domingo T., *cf. sub* Philippine National Herbarium.

Blanco, Francisco Manuel

Collections. In 1947 Dr Merrill found a specimen of Blanco's from the Philippines of *Ficus minahassae* T. & B., which he had apparently sent to Blume, in the State Herbarium (Rijksherbarium) at Leyden (private letter from Merrill, dated June 21, 1950, to Dr van Steenis). According to Dr E. Quisumbing no Blanco plants were found in *Madrid* during a short stay in 1953 (see 'A Report on my trip' 1954, p. 45).

***Bleys**, J. A., *cf. sub* Boswezen Nieuw Guinea.

Bloembergen, Siebe

In 1950 appointed Professor of Plant Taxonomy and Plant Geography in the Faculty of Agriculture of the University of Indonesia at Bogor; he returned to Europe in August 1955 and in 1956 was appointed teacher in natural history at a secondary school at Leyden.

***Blomberg**, Rolf

(1912, Stocksund, Sweden; x). From 1934 onwards he made several exploration trips in South America and Indonesia, collecting mostly ethnographical and zoological material, preserved for the greater part in the Statens Etnografiska Museum and the Naturhistoriska Riksmuseet in Stockholm, and in the Naturhistoriska Museet, Göteborg.

Author of several popular books on his travels, ethnology and zoology. In 1951 residing at Quito, Ecuador, and an active member of the Ecuadorian Institute of Anthropology and Geography.

Itinerary.[1] *1938–39. Borneo, Java.—1941–45. Lesser Sunda Islands:* ascent of Mt Tambora, *Sumbawa* (2nd week of Sept. *1941*).

Collections. Small collection from Mt Tambora in *Herb. State Mus. Stockholm*, in 1951 identified by Dr van Steenis; no duplicates available.

Literature. (1) R. Blomberg: 'Högkvarter hos huvudjägare' (Stockholm 1938, 1951); 'Tropisk urskog' (Stockholm 1940, 1952).

Blow, Thomas Bates

Collections. Add: in *Herb. Brit. Mus.* (with *Herb.* Groves): *Charophyta.*

Blume, Carl Ludwig

Collections. Also dupl. in *Herb. Liège.*[4]

Literature. (3) Add: Also in 'Mengelingen' column in Bataviasche Courant 1822, *nos* 7, 8, 10, 13, 27, 28, 29, 32, 48.

(4) *Cf.* Fr. Crépin, Guide de botaniste en Belgique, 1878, p. 301.

***B.N.B.** *nos*, *cf. sub* Forest Department (British) North Borneo.

Bock, Carl

The cuckoo *Cuculis bocki* was named after him.

***Boendermaker**, Arie

(1910, Den Helder, N.H., Holland; x), Resident of the Civil Service at Merauke, S. New Guinea, collected *Batis* near Merauke (in *Herb. Leyden*). He is stationed in New Guinea from June 1951 onwards.

Bois, Cora du

Author of: 'The people of Alor. A social-psychological study of an East Indian island' (1944).

***Boissevain**, Miss W.

(later Mrs Schuller tot Peursum), occasionally collected some ferns at Kopeng, slope G. Merbabu, *Centr. Java*, in *1927*.

Collections. *Herb. Leyden.*

Booberg, Karl Gunnar

Collections. Add: Also some dupl. in *Herb. Lund.*

***Borja**, F.

Collections. *Philippine* plants in *Herb. Arn. Arbor.* (*cf.* Index Herb. pt II, 1954).

***Borssum Waalkes**, Jan van

(1922, Groningen, Holland; x), botanist, educated at Groningen University; in 1950 appointed Assistant at the Herbarium Bogoriense, Indonesia; returned to Holland in 1957.

He is preparing a thesis on *Malvaceae*.

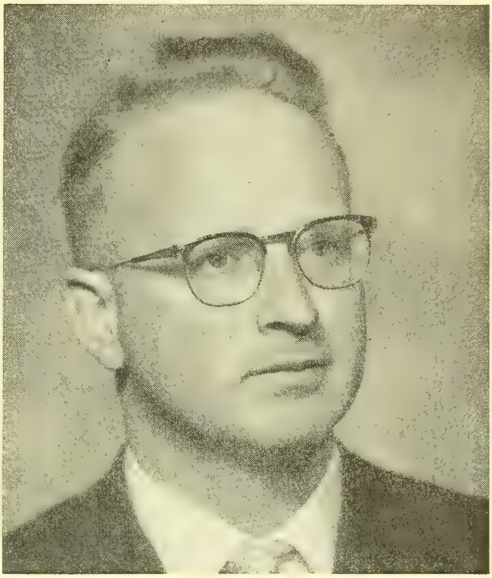
Collecting localities. **1950.** *W. Java:* Bogor (Nov.).—**1951.** Tjibodas, G. Gedeh (Jan. 21); Bogor, Botanic Garden (Feb. 18); Tjisarua, G. Pangrango (March 25); Djakarta (Apr. 28); Djakarta and vicinity (June); Udjong Kulon (25–28, with A. Hoogerwerf); *Prinseneiland* (June 29–July 3, with A. Hoogerwerf); Tjisarua, G. Pangrango (Aug. 3); Bogor (Nov. 18); *Expedition to Sunda Straits* under A. Hoogerwerf: Tjipining, Banten (Aug. 31); *Prinseneiland* (Sept. 1–Oct. 5)[1]; *Krakatau Islands* (6–13)[2]; Rawa Tembaga (Nov. 18)[3]; Pulau Damar ketjil[4].—**1952.** *W. Java:* G. Pangrango (Feb. 10); S. of Tjibeber (20); Bandung (22–24); Lembang (24); Tjipetir (March 16); G. Gedeh (17–19); Lembang (Apr. 13); G. Gedeh

(Aug. 29, Sept. 11–13); Depok (Oct. 2); Udjong Kulon (Nov. 15, with A. HOOGERWERF); *Krakatau Islands* (Nov. 16, with A. HOOGERWERF)².—**1953.** *Expedition to Sumatra West Coast* under P. GROENHART, together with D. R. PLEYTE: sailing from Priok (May 29); arrival at Padang (June 2); Telug Kabung and vicinity (June 3–8); trip to Painan (June 9); from Telug Kabung to Bukittingi (= Fort de Kock) (10); to Lubuk Sikaping (11); Panti and vicinity (12); Lubuk Sikaping and vicinity, G. Gadang (13–18); from Lubuk Sikaping to Bukittingi (19); G. Marapi, crater (21–22); from Bukittinggi to Solok *via* Batusangkar (= Fort v. d. Capellen) (24); vicinity of Solok, spurs of G. Bongsu (25); to Simpang, Danau di Atas, Danau di Bawah (26); to Sumpur, Lake Singkarak (28); Sawalunto (29); Sulit Ajer and vicinity (June 30–July 2); in the same period D. R. PLEYTE (see there) collected on G. Talang; from Kajuarau (G. Talang) to Padang (July 4); trip to *Mentawei Islands* (6–10): collecting in the vicinity of Sikakap and Sioban harbour (7), Siberut (8), and Sikabaluan (9); above Indarung; leaving Padang (14); arrival at Priok (17).—**1956.** *Southern Moluccas* (Maluku Tenggara), with N. G. BISSET and D. R. PLEYTE: leaving Tandjong Priok (Feb. 20); *Timor:* Kupang and environs (24–25), leaving (26); *Babar Group: P. Wetan* (arrival 28), visiting Tepah (29), by boat to Letwurung on the E. coast (staying 29–March 4), on foot to Ahanari and back (2); *P. Dai* (4–5); *Tanimbar Isls, Jamdena:* Saumla(k)ki (6–11), exploring the environs; *P. Selaru:* Adaut (12–15) and environs, Namtabung (16–19) and environs; *Jamdena:* Saumlakki (20–22); *P. Larat:* Ritabel and environs (24–26); *Jamdena:* Loroumbung on the E. coast (28), on foot to bivouac Norkeseh on the Ranarmoje River in the central part of the island (29–30), bivouac Norkeseh and vicinity (31–Apr. 5); by proa descending the Ranarmoje River to Makatian on the W. coast (6); Makatian and environs (7); *Jamdena:* Saumlakki and vicinity (8–10), on foot to Ilnge *via* Sifnana and Laurang (11), and proceeding in NW. direction (12); returning by way of Ilnge to Saumlakki (13); Saumlakki and environs (14–17); by K.P.M. steamer (18–25) to Ambon, touching at Ritabel, Elat, and Tual (*Kai Isls*), Dobo (*Aru*), and *Banda*; *Ambon* (25–May 3); BISSET and PLEYTE returning to Java by K.P.M. steamer, VAN BORSSUM WAALKES by plane.

COLLECTIONS. *Herb. Bog.:* up to 1953, 2891 *nos* (*nos* 200–1086 from Sunda Straits, *nos* 1436–2891 from *Sumatra West Coast*) (1064 phanerogams, 392 cryptogams). His Malaysian collections are numbered from 1 onwards, although some thousands of plants were collected in Europe before 1950; 384 *nos S. Moluccas* (only 1 from *Timor*). His collection includes mosses and a few *fungi.* Partly destroyed by insects.

LITERATURE. (1) J. VAN BORSSUM WAALKES: 'Pulau Panaitan (Prinseneiland): Botanisch gedeelte' (31ste Dienstrapport Bagian Perlindungan Alam dan Pemburuan of Djawatan Penjelidikan Alam 1951, p. 159–181).

(2) J. VAN BORSSUM WAALKES: 'Krakatau-eilanden: Botanisch gedeelte' (33ste Dienstrapport *ibid.* 1952, p. 185–198); 'Een bezoek aan de Krakatau-eilanden' (Trop. Natuur 32, 1952, p. 35–44); 'The Krakatau-Islands after the eruption of October 1952' (Peng. Alam 34, 1954, p. 97–104, 4 fig.).



VAN BORSSUM WAALKES

(3) J. VAN BORSSUM WAALKES: 'Botanische waarnemingen in en om de rawa Tembaga' (Med. Blad Nat. Hist. Ver. Indon. 3, 1951, p. 87–90).

(4) J. VAN BORSSUM WAALKES: 'Over de flora van Pulau Damar ketjil' (Med. Blad Nat. Hist. Ver. Indon. 3, 1951, p. 91–92).

***Bosstraten,** Th. van, *cf. sub* Boswezen Nieuw Guinea.

Boswell, A. B. S.

(1901, U.K.; x), Forest Officer, educated at Edinburgh University (B.Sc.), employed in the Forest Department of Malaya from Sept. 1921 to May 1951. He collected in the C.F. series (*cf.* Conservator of Forests series in Fl. Mal. vol. 1).

BIOGRAPHICAL DATA. Mal. For. 14, 1951, p. 1 + portr.

***Boswezen Nieuw Guinea**

The Forestry Service at Hollandia, North New Guinea, established since 1950, started a local herbarium in 1952. All the collections are numbered in a B.W. series; in general two twigs of every number were kept at *Hollandia*, while the remaining material is sent to *Herb. Leyden.* When only one fertile twig is available, it is sent to Leyden. In 1958 the herbarium was transferred to Manokwari.

The more important collectors in this series have a separate *detailed entry.* The following *employees* *of the Forestry Service* have done some *occasional collecting*: Ch. Beijen (Rendani near Manokwari), J. A. Bleys (Arfai near Manokwari), Th. van Bosstraten (Merauke and vicinity), C. Bouman (Merauke, Asmat area), J. Dijkstra (Merauke), P. H. Hallewas (*Sorong*), D. Inam (Kokas), M. Jarissetouw (*Noemfoer*, Hollandia), R. L. Johannes (Wissel Lakes), H. R. Karstel (Sarmi, Cyclops Mts), J. Klencke (*Sorong*), M. Ch. Kokkelink (Oransbari), J. A. Lasschuit (Oransbari), W. van der Leden (Sarmi), C. L. Leefers (Merauke, Koerik), L. U. Long (Merauke), G. N. Loupulua (Fak-Fak), C. Lugtmeyer (*Biak*), W. van Lutterveld (Wissel Lakes), G. M. Malinka (*Japen*), T. Manuputty (*Waigeo*), E. Roenteboy (Nafri), R. Roenteboy (Tami River), M. Rosendahl (Genjem), Th. Samuels (Anggra Meos), H. Schrijn (Hollandia), J. B. Smit (Rendani and Tafelberg, near Manokwari), G. H. van der Star (Jaoer, Oransbari, *Meos Waar*, Anggra Meos), V. E. Westerhuis (Tami River, Hollandia), E. E. van der Zee (Boedidi, Kokas), J. F. U. Zieck (Sauw Mts, bivouac Noordpool near Anggi Lakes).

Botma, Geertje

Collecting localities. Add: *1949. Biak.*

Collections. Add: Some dupl. in *Herb. Leyden.*

***Bouillenne**, Raymond

D.Sc., Director of the Botanical Institute at Liège, Belgium, and University Professor in the same place. In 1931 he and his wife made a study tour to Java, staying several months at Buitenzorg (= Bogor), he working in the Foreigners' Laboratory on the internal and external factors influencing the formation of roots.[1]

Itinerary.[1] *1931. W. Java:* Buitenzorg (from June onwards), visiting Wijnkoopsbaai (June), Tandjong Priok (July), G. Papandajan (Sept.), *Noesa Kambangan* and the Kinderzee (*Centr. Java*) (Sept.), and Pasuruan in *E. Java* (Oct.); in *Sumatra:* Kepajang (Nov.), Forest Reserve at Panti near Fort de Kock (*West Coast*) (Nov.), and *Sabang* (Dec.).

Collections. Plants from *Java* (and ? *Sumatra*) in *Herb. Liège.*

Literature. (1) R. Bouillenne: 'Ma mission en Malaisie' (repr. in Arch. Inst. Bot. Liège 10, 1933, p. 1–15, pl. 1–3); with F. Went: 'Recherches expérimentales sur la néoformation des racines dans les plantules et les boutures des plantes supérieures' (*ibid.* 10, 1933, p. 1–175, pl. 1–22).

***Bouman**, C., *cf. sub* Boswezen Nieuw Guinea.

***Bouman**, W. E.

Collections. *Herb. Bog.:* > 6 *nos* of grasses from *Sumba* (Lesser Sunda Islands), coll. Sept. *1941.*

***Bouwer**, K.

(1928, Poerworedjo, Java; x), from 1947–51 police-officer, from March 1951–Aug. 1953 with the dammar collecting, since Nov. 1953 on monthly pay in the employ of the Forestry Service at Hollandia, New Guinea.

Collecting localities. *1954. West New Guinea:* Manokwari (Feb.), Prafi Plain; with P. van Royen (see there) in the Cyclops Mts and Kebar Plain.—1957. Tiliwalimilik near Sorong (March 19).

Collections. *Herb. Leyden*, and *Manokwari:* numbered in the B.W. series (*cf. sub* Boswezen Nieuw Guinea); in 1957 ± 100 *nos.*

Bovien, Prosper Louis

Biographical data. Entomol. Meddel. 15, 1936, p. 313–314.

***Braad**, Christopher (or Christoffer) Hinric (also Henrik or Hindr.).

(1728, Stockholm, Sweden; 1781, Norrköping, Sweden) studied at Uppsala in 1743; from 1748–62 in the employ of the Swedish East India Company, first as assistant and clerk, later as supercargo; in 1764 he got the title of 'assessor'.

He was an able man, and was sent on a diplomatic errand to Suratte, disguised as a naturalist, to investigate the possibilities for establishing a Swedish factory there. Later he was offered a director's post, but declined.

His MS notes made during his travels are valuable.[2]

Collections. According to W. T. Stearn[1], Linnaeus had by the time of the completion of the 'Species Plantarum' (1753) acquired botanical material from Braad. At that time he had accompanied two voyages to the East, *viz* in *1748–49*, and *1750–52* (itineraries *etc. cf. sub* Torén), but made four in all; the last one as supercargo in the 'Riksens Ständer', sailing April *1760* to Suratte and Canton, probably leaving the ship on the home voyage at Suratte.

Literature. (1) *Cf.* Introduction to 'Species Plantarium. A Facsimile of the first edition 1753' (London 1957) p. 108; and Preface of Linnaeus, Species Plantarum (1753); evidently seeds!

(2) Carl-Axel Torén made use of them when writing his paper on O. Torén (see there); in Westinska Saml. Uppsala Bibl.

Biographical data. E. Olán, Ostindiska Compagniets Saga, 1923, p. 136; Krok, Bibl. Bot. Suec. 1925, p. 100.

Brass, Leonard John

In 1948 a member of the 'Archbold Cape York Expedition' to North Australia.

Itinerary. Add: *4th* Archbold *expedition*, **1953**, in *far eastern parts of Papua* (March-Nov.)[9]: Cape Vogel Peninsula, from a base at Menapi (March 21–May 4) and from Dabora on the S. coast (Apr. 7–10); a strip of territory extending from the N. coast at Baiawa, Moi Biri Bay (May 6–11); Mt Dayman, N. slopes, Maneau Range (2790 m) (May 17–July 26); Biniguni camp, Gwariu River (July 27–Aug. 13); Peria Creek, Kwagira River (Aug. 14–Sept. 6); *D'Entrecasteaux Group, Goodenough Island:* Bolu Bolu (Sept. 22–Oct. 4); E. slopes of *Goodenough Island* up to about

1750 m on the central mountains (Oct. 7–30); Wakonai (Oct. 31–Nov. 1); *Fergusson Island:* Mapamoiwa (Nov. 2).—*5th* Archbold *Expedition*, **1956**, in *far eastern parts of Papua* (Apr.–Dec.). *D'Entrecasteaux Group, Normanby Island:* Waikaiuna (Apr. 11–28), Lebudowa River (19, 21, 26), mountains behind Waikaiuna Bay (23), Mt Pabinama (May 1–12, up to summit 950 m alt.); Butai Creek, Lebudowa River (12, 15); Waikaiuna (14–18); *Fergusson Island:* Iamelele (24–June 1), Saibutu (May 24), mountains S of Agamoia (June 1), mountains between Agamoia and Ailuluai (7–18), Aigamoia (19–23), Lake Lavu (21); Niubuwo and between Niubuwo and Fagululu (25); Deidei, Gomwa Bay (July 3–5); *Louisiades:* Misima Isl. (July 18–Aug. 11), Sudest Isl. (Aug. 16–Sept. 23), Rossel Isl. (Sept. 28–Oct. 28); *Woodlark Island* (Nov. 3–21); *Normanby Island:* Sewataitai (25); mainland of *Papua*, Milne Bay Distr.: Dawa Dawa (Dec. 3–5), Modewa Bay (12–20), Gara River (15), Harala-ama River (18).

Collections. Add: From the exp. *1953* in *Herb. Arn. Arbor.:* 3445 *nos* (incl. 620 bryophytes); dupl. set will be deposited in *For. Herb. Lae* and in *Herb. Leyden*; *Herb. Leyden* bought 3174 *nos* of the *1956* exp. (incl. 729 *crypt.*).

Literature. (7) Add: L. O. Williams: 'Orchidaceae Novae Guinea I' (Bot. Mus. Leafl. Harv. Univ. 12, *no* 5, 1946, p. 149–172, pl. 21–23); 'Notes on the family of Corsiaceae' (*ibid.* p. 179–182, pl. 24).

(8) Add to Ferns by E. B. Copeland . . .: and in *ibid.* 78, 1949, p. 5–40, pl. 1–6; *cf.* also *Grammitidaceae* in Philip. J. Sc. 81, 1952, p. 81–118, 10 pl.

L. O. Williams: 'Notes on the family Corsiaceae' (Bot. Mus. Leafl. Harv. Univ. 12, *no* 5, 1946, p. 179–182, pl. 24).

Cyperaceae by S. T. Blake in J. Arn. Arb. 35, 1954, p. 204–238.

(9) L. J. Brass: Results of the Archbold Expeditions *no* 75. 'Summary of the Fourth Archbold Expedition to New Guinea (1953)' (Bull. Am. Mus. Nat. Hist. 111, 1956, p. 77–152, fig. 1, pl. 10–21).

***Brau de St-Pol Lias,** M. F. Xavier J. J. H.

(1840, Seix, Ariège, France; 1914, Paris, France), explorer and economist, friend of A. Marche (see there), director and founder of the 'Société des Colons-Explorateurs'; an ardent patriot who tried to promote French commercial interests in the Far East. In 1876 he started a plantation in Sumatra with the agriculturist Tabel, but the latter moved to a Deli plantation after two years. During the first voyage, in 1876–77, Buitenzorg in Java was also visited. In 1880–81 a second exploration tour was made (see itinerary) during which they obtained some tin concessions in Malaya; he was accompanied that time by the mining engineer J. E. de la Croix. His tour in Atcheen yielded no results as the Dutch East Indian government thought the situation at that time too precarious. He continued his explorations in these regions up to 1885.

Itinerary.[1,2] *1880–81.* Sailing from Toulon (Jan. 20, *1880*) to *Singapore* in 42 days, from where proceeding to *Java:* Batavia and Buitenzorg, to hand over letters of recommendation to the authorities; visit to Ploem at Batoetoelis, trips to the slope of G. Salak, Soeka-Mantri Estate, and into Priangan Residency (Megamendoeng, Tjiandjoer, Bandoeng); leaving for Atcheen, *N. Sumatra* (March 25):[3] by boat to Malabou (= ? Meulaboh) (Apr. 6–21); Soussou (= Susoh), Labouan-Hadji (= Labohanhadji) (24), Tampat-Touan (= Tapaktuan; trip to the mountains of Panté-Laouass), Singkel (Apr. 30–May 1), *P. Doua* (2), back to Tapaktuan (3), Labohanhadji (6), Meulaboh, Gloumpang, Olélé; departure (20) for L(o)hong; Klouang, bird-nest caves; leaving Klouang (July 2); after a stay of five months not yet been able to penetrate into the interior; from Olélé (Aug. 22) to *P. Pinang* (= *Penang*) (staying 24–26), and sailing for the *Malay Peninsula:*[4] Perak, Larrout (= Larut); Taiping (28–Sept. 2); Kuala Kangsar (4–7), visiting Hugh Low; to the tin mines inland, and the Orang-Sakèy, Anak G. B(o)ub(o)u, G. Snaïan or Berapi, above Wray's estate, Gapis (—13); environs of Taiping and Kuala Kangsar (14–30), partly with Wray and Low; by way of *Penang* to *Sumatra East Coast:* Deli (from Oct. 8), visit to the Batak Lands (de la Croix remaining in the Malay Peninsula); back in *N. Sumatra:* Atcheen, exploration of L(o)hong,[5] leaving Kotaradja on Sept. 14 by proa to Benteng Ketapang; mostly exploring along the river, ascent of Batang-Ou (Jan. 5–6, *1881*); after an interval of 6 months return from Deli to the *Malay Peninsula:*[4] Perak by way of *Penang*; Larut, Taiping, Pluss River (Feb. 6)[6], Sg. Tchot (7–8); Low discovers a *Rafflesia* (9); back (10–12) by way of Kuala Kangsar, Telok Kartang to Matang; by way of *Penang* to *Batavia* (*Java*), from where probably homeward bound; March 3 the tin concessions were obtained.

Collections. *Herb. Paris:* 59 *Sumatra* plants (acq. *1880–81*), collected by him & de la Croix (see there), and besides fruits, leaves, *etc.* and vegetable products. From his book[4] (see footnote *l.c.* p. 160–162) it is evident that he collected in Perak (*Malay Peninsula*) too.

Literature. (1) Reports on the two tours in Arch. Miss. Scient. vol. 9 ? (author failed to locate them).

(2) Brau de St-Pol Lias: 'De France à Sumatra par Java, Singapour et Pinang' (Paris 1884).

(3) Brau de St-Pol Lias: 'La côte du poivre. Voyage à Sumatra' (Paris 1891).

(4) Brau de St-Pol Lias: 'Pérak et les Orangs-Sakèys. Voyage dans l'intérieur de la presqu'île Malaise' (Paris 1883).

(5) Brau de St-Pol Lias: 'Chez les Atchés-Lohong' (Paris 1884).

(6) Brau de St-Pol Lias: 'Sur la rivière Pluss' (Nouv. Revue 16, Mai-Juin 1882, p. 553–589).

Biographical data. Larousse du XXe siècle.

***Breuner** Jr, L. G.

a transient American who contributed some 15 numbers from *Luzon* (*1945*) to the P.N.H. series (*cf. sub* Philippine National Herbarium).

Britton, Barbara Beresford
(1929, Charlottesville, Virginia, U.S.A.; x), botanist, educated at Cornell University (B. Sc. 1950), and Vassar College (M. Sc. 1951). Successively employed at The National Academy of Science, Washington, D.C., 1951–52; Fulbright Fellow in the Philippines, 1952–54; at Scripps Clinic & Research Foundation, La Jolla, California, 1955–57. In the latter year married to Mr Joseph Lee Sedwitz, surgeon in the U.S. Navy.

MISS BROOKE

Collecting localities. *Philippines 1953.* On several trips in *Luzon*, *Mindoro*, *Negros*, and *Mindanao.*

Collections. *C.* 500 *nos*; sets in *Herb. Univ. Philip.*, *Leyden*, and in the U.S.A.

Britton, Max Edwin
collected partly with G. E. Winder.

***Brongersma,** Leo Daniel
(1907, Bloemendaal, N.H., Holland; x), zoologist, educated at the University of Amsterdam (Ph.D. 1934); from 1928–34 Assistant of the Zoological Museum in Amsterdam, since 1934 employed at the Leyden Museum of Natural History (in 1958 director); since 1951 Lecturer at Leyden University.

He stayed in New Guinea in 1952 and 1954–55 for zoological collecting purposes, and will be leader of a planned New Guinea expedition to the central mountains.

Premna brongersmai H. J. Lam was named after him.[1]

Collecting localities. *West New Guinea: e.g.* near Ajamura, Semu, Vogelkop, 300 m alt. (June 25, *1952*); in *S. New Guinea* near Merauke.

Collections. Few specimens; in *Herb. Leyden.*

Literature. (1) H. J. Lam: 'A new Premna (Verbenaceae) from New Guinea' (Blumea 7, 1954, p. 553–556, fig. 1–2).

***Brooke,** Winifred Mary Adelaide
(1893, Stroud Green, London, England; x) made a botanical exploration of the Canary Islands (7 in all) in 1936, proceeded to South Africa in August, staying there for over a year, making numerous sketches of flowers, but not preserving any specimens. From 1949–50 she explored several remote districts of Bolivia, making her headquarters at Cochabamba. When leaving, she travelled down the Chilean coast, collecting when there was an opportunity. In 1953 a botanical trip in Sarawak was planned, and she stayed there from 1954–55.

Itinerary. **1954**. *NW. Borneo*, Sarawak: landed at Kuching (Jan.); March 11 returning from a two-week stay at Santubong coast at one of the mouths of the Sarawak River; on the voyage back to Kuching visiting the *Turtle Islands* and collecting a little there in Talang Talang and Satang; by government launch to Betong on the Saribas River; subsequently invited to stay at Lundu, collecting on Mt Gading and making a 4-day excursion to Berumput on the Indonesian frontier (some of her men bringing down plants from the top, 5000 ft); at intervals collecting on Mt Matang (3000 ft) near Kuching; staying in forest camps in the Rejang Delta, first at Kelupu on the island of *Lassa* (1 week), and another week at a sawmill at Sungei Kelapaan on a tributary of the Lassa River, both localities in swamp forest; return by launch to Sibu, and by outboard 70 miles up the Rejang to Kapit and further to the Methodist Mission of Nanga Mujong (staying 1 week); from Kapit on a large outboard for 8 hours up the Pelagus rapids and on to a camp of the Borneo Company at Nanga Bah; proceeding up river to Belaga, and visiting the Bakun rapids up the Balui; Pasang rapids; trip to Teneong mountain, where she fractured two ribs, in the meanwhile her assistant Ahmad bin Topin continuing collecting; returned at Kuching for medical attention (end of Sept.); during the wet season camping at the Forest Reserve of Sungei Raya, staying at Serian and at the rubber estate of Samarahan, all in the vicinity of Kuching, up to early **1955**; arriving at Lawas in the 5th Division (end of May), making headquarters there until Sept.; 2-day trip up the river and to the Murut longhouse at Maputi; in Aug. with a plane of the Borneo Evangelical Mission to Bahkelalan (3000 ft) close to the Kelabit Plateau, exploring Mt Belinki (5000 ft), in all remaining 12 days; back at Kuching, from where visiting the rocky limestone district of Bau, the entrance to the Kuching River (staying at Tanjong Po); last long trip to Simanggang in the 2nd Division on the Lupar River and proceeding by outboard to Lubok Antu on the E. frontier (staying 2 weeks in the district).

COLLECTIONS. Early collections from the Canary Islands (1936), and Bolivia and Chile (1949–50) in *Herb. Brit. Mus.*, *New York*, and *Chicago*.

Sarawak collections: in *Herb. Leyden*, *Brit. Mus.*, *Geneva*, and *Sarawak*. Eventually partial sets will be found in Edinburgh (special families), Chicago, Stockholm, Zürich, and Adelaide. From Nanga Mujong up to end Sept. 1954 she was assisted by AHMAD BIN TOPIN (see there), whose name is not mentioned on the labels.

Unfortunately it is evident that part of the data mentioned on the field labels is not reliable, especially as regards the habit. *Loranthaceae* and herbaceous plants are *e.g.* mentioned as shrubs or trees, probably due to Dyak collectors who operated By ~~on~~ themselves and gave wrong information when asked for particulars. For non-initiated botanists these erroneous data will be very confusing.

Brooks, Cecil Joslin
(† *c.* 1953, Hampstead, England).

COLLECTIONS. Add: In the *Brit. Mus.* about 3000 *nos* collected by himself and 200 by other collectors.

BIOGRAPHICAL DATA. Add: The Entomologist 88, 1955, p. 23.

Brooks, Frederick Tom
(† 1952, ? Cambridge, England).

BIOGRAPHICAL DATA. Proc. Linn. Soc. Lond. 163, 1950–51, p. 254–256 (1952).

***Brouwer,** Adolf
on monthly pay in the employ of the Forestry Service at Hollandia, N. New Guinea.

COLLECTING LOCALITIES. *West New Guinea:* in the sample plots near Holtekang *pr.* Hollandia; in *1955* near Oransbari, S of Manokwari.

COLLECTIONS. Numbered in the B.W. series (*cf.* Boswezen Nieuw Guinea): in *Herb. Leyden* and *Manokwari*; in 1957 ± 250 *nos.*

***Brown,** Herbert Alfred
(1905, Highams Park, London, England; x) studied horticulture at Boskoop, Holland, in 1922; subsequently worked for Castle Nurseries Ltd, South Chingford, E. 4, until 1928. Then felt the call to be a missionary and in order to pay his way through the university he set up his own nursery business, continuing until 1938. He studied theology at Paton College, Nottingham (1930–31), and subsequently in London; in 1938 ordained minister congregational order, and appointed to Papua by the London Missionary Society, and up till now stationed at Moru. His special interest is anthropology in which he took a Post-Graduate course during furlough in 1957.

COLLECTING LOCALITIES. *Since Sept. 1951. Papua:* Mt Yule area, Kunimaipa valley, the upper Tauri and Lakekamu Rivers, Upper Akaifu valley, Loloipa River, on coastal flats, swamps, *etc.*

COLLECTIONS. *Herb. Arn. Arb.:* 416 *nos* (up to 1955 coll.); later collections not yet sorted, numbered and dispatched. Numbering is based on the chronological order of collecting.

Brown, Robert
Line 8 and 9 (in Cyclopaedia, p. 83b) read as follows: 'Porpoise', FLINDERS proceeded in the 'Cumberland'. After his return to England in Oct. 1805, BROWN was . . .

Line 20–22 read: He is commemorated in *Eriocaulon brownianum* MART. and in the genus *Brunonia* SM.

ITINERARY.[7] After Mauritius (see Cyclopaedia) add: BROWN and BAUER awaited FLINDERS's return in Australia, and visited Timor only in April.

LITERATURE. (7) For Australia see N. T. BURBIDGE: 'R. BROWN's collecting localities' (Proc. Linn. Soc. N.S.W. 80, 1956, p. 229–233).

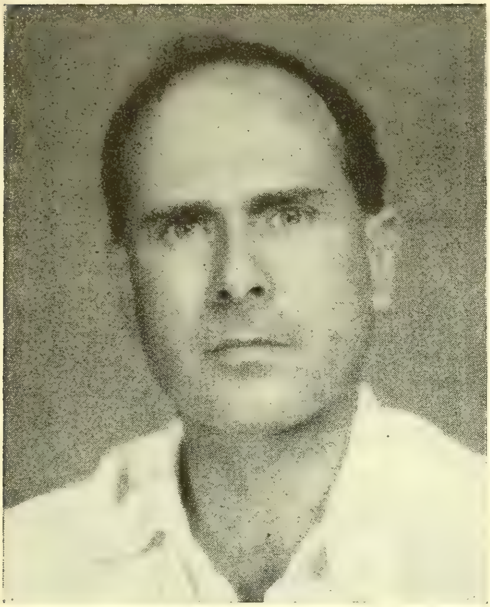
BIOGRAPHICAL DATA. Add: La Belg. Hort. (ed. MORREN) 7, 1858, p. i–xii, portr., bibliogr.; J. Bot. 34, 1896, p. 26–28 (Memorial); Australas. Herb. News 10, 1952, p. 6–7 (on contents of MSS); Proc. R. Soc. Queensl. 66, 1955, p. 6.

F. G. BROWNE

***Browne,** Francis George
(1907, Cape Town, S. Africa; x) was educated in forestry at Edinburgh (B.Sc. 1928); in 1929 appointed Assistant Conservator of Forests, Malaya; since 1951 Conservator of Forests, Sarawak.

Author of 'Forest Trees of Sarawak and Brunei' (1955).

Collecting localities. *1929–51. Malay Peninsula:* mainly in Perak, Pahang, and Kelantan. —From *1951 onwards. NW. Borneo, Sarawak:* in various localities.



H. M. BURKILL

Collections. From the *Malay Peninsula* in *Herb. Kepong*, numbered in the Forest Dept Series (C.F. *nos*); *Sarawak* specimens (few) in *Herb. Kuching*, numbered in the Sarawak Forest Dept series.

**Brünig*, Friedrich Wilhelm Otto Eberhard

(1926, Schöningen near Brunschweig, Germany; x) was educated in forestry in Germany and Oxford (Ph.D. University of Göttingen 1953). After a short period of service in Germany (Hessen), he was appointed as Assistant Conservator of Forests in the British Colonial Service in March 1954; stationed at Kuching, Sarawak, from that date.

Collecting localities. *NW. Borneo.* From June *1954 onwards.* In the 1st and 2nd Division of Sarawak, especially on poor podsolized soils. Other divisions will have their turn later.

Collections. *Borneo* plants in *Herb. Sarawak*, *Sing.*, *Kepong*, *etc.* Numbered in the Sarawak Forest Dept series.

***Buencamino**, F., *cf. sub* Philippine National Herbarium.

Bünnemeijer, H. A. B.

(† 1954, Oegstgeest, Z.H., Holland).

Collections. The mentioned collection from the Diëng Plateau (1917) was incorporated in Backer's herbarium.

Bünning, Erwin

In the second half of 1951 he made a study tour to Java once more, staying at Bogor (= Buitenzorg) with a German 'Tropen-Stipendium'.

Literature. (1) Add: 'Der tropische Regenwald' (Verständl. Wiss. 56, 1956, viii + 118 pp., 116 fig.).

Burbidge, Frederick William

Literature. (1) At the end of the paragraph delete '(*non vidi*)' and read: (The Little Journal, London, May 1884, p. 191–202).

Burchard, W.F.G.

Biographical data. Backer, Verkl. Woordenb., 1936.

***Burchell**

presented *Cordia campanulata* (*Moluccas etc.*) to the Botanic Garden at Calcutta (see Roxburgh, Hort. Beng. 1814, p. 17) in *1809*. Presumably the plant was cultivated in the garden at the island of St Helena, where William John Burchell (1782–1863) was schoolmaster and acting botanist in the employ of the E.I.C. from 1805–10.

Biographical data (W. J. Burchell). Dict. Nat. Biogr. 7, p. 290–291; Biogr. Index Britten & Boulger, 2nd ed. by Rendle, 1931; Backer, Verkl. Woordenb., 1936.

Bureau of Science, Manila, P.I.

Collections. Add: Several dupl. in *Herb. Leningrad.*

***Burkill**, Humphrey Morrison

(1914, Singapore; x), son of I. H. Burkill (see there), studied natural sciences at Gonville & Caius College, Cambridge University (B.A. 1936, M.A. 1939). From 1938–41 employed by Dunlop Malayan Estates; 1942–45 Military Service; 1946–48 with Dunlop Malayan Estates again; from 1948–54 in the Botanical Division, Rubber Research Institute, Kuala Lumpur; 1954 appointed Assistant Director of Botanic Gardens, Singapore; since 1957 Director.

Collecting localities. *Malay Peninsula. 1955. Pangkor Isl.* (July 3–11).—*1956. Pulau Satsuma* (Raffles Light), *Pulau Biola* and *Pulau Senang* (March 30–Apr. 2; Aug. 3–7); Horsburgh Light (June 27–28), *P. Pisang* (July 6–7); Cameron Highlands, Pahang (Aug. 27–Sept. 10), ascending G. Batu Brinchang; Port Dickson (Aug. 26, Sept. 11–15); *P. Angsa* and *P. Selatan* (Nov. 18–22); Sungei Buloh, Selangor (Nov. 23–26).

Collections. *Herb. Sing.:* in 1956 amounting to *c.* 1000 *nos*, including many marine *Algae*.

A few *pre-1954* collections incorporated in the *Rubber Res. Inst.*; others in *Herb. Sing.*

Burkill, Isaac Henry

Collecting localities. *1917.* Add: *Penang* (July 22).

Busseuil, François Louis
COLLECTIONS. Add: Also in *Herb. Montpellier* (*cf.* Index Herb. pt II, 1954).

Buisman, Maarten
COLLECTIONS. Add: Also specimens in *Herb. Kew.*
***B.W.** *nos, cf. sub* Boswezen Nieuw Guinea.

C., H.
In ROXBURGH, Hort. Beng. 1814, numerous plants from the *Moluccas* (*1792–1802*), *Malay Islands* (*1798*), and from *P. Penang* (*1802*) are cited with the initials H.C. in the donor column.

***Cagosa,** H. S.
collected in Quezon City, *Luzon*; plants in *Herb. Univ. Philip.*

***Caguicla**
(† 1931, Keningau, Br. N. Borneo), was appointed Agricultural Assistant in 1930, stationed in Keningau.
COLLECTING LOCALITIES & COLLECTIONS. In Keningau, *Br. N. Borneo, 1930–31,* for the Sandakan Herbarium, *cf. sub* Forest Department British North Borneo.

***Calupig,** J. A., *cf. sub* Philippine National Herbarium.

Campbell, Charles
is credited with the donation of plants from *Sumatra* (*1796–1807*), *Malay Islands* (*1800–01*), *and the Moluccas* (*1798, 1803*) in ROXBURGH, Hort. Beng. 1814. The plants from outside Sumatra were probably cultivated under his supervision in the garden at Bencoolen, and not collected by himself.

Campbell, Douglas Houghton
(† 1953, Stanford, Cal., U.S.A.) was an ardent field botanist and made numerous trips all over the world from 1882 onwards.[5]
ITINERARY.[5] *1906.* Besides staying in *Java* (see Fl. Mal. vol. 1), he touched *Singapore* (March) and visited *Sumatra* (Apr., May).—*1912–14.* He travelled for 2 years[6], reaching the Settlements in Dec. *1912*, visiting *Penang* (Jan. *1913*), the *Malay Peninsula* and *Sumatra East Coast* (see Fl. Mal. vol. 1), *Borneo* (March), *Java*, and the *Philippine Islands* (Apr., May).
COLLECTIONS. Add: *Herb. Carn. Inst. of Wash.* (Stanford, Cal.); *Herb. Brit. Mus.:* 150 *nos* from *Malaysia; Herb. New York.*
LITERATURE. (1) Line 5 of the reference change 'forms' into: ferns.
(5) *Cf.* list in Asa Gray Bull. II, 2, 1953, p. 118–120, partly derived from notations on his watercolour sketches.
(6) *Cf. ibid.* p. 135–136.
BIOGRAPHICAL DATA. Add: Asa Gray Bull. II, 2, 1953, p. 103–148, incl. bibliogr. and portr.

***Cana,** F.
COLLECTIONS. *Philippine* plants in *Dudley Herb. Stanf. Univ.* (*cf.* Index Herb. pt II, 1954).

Canicosa, E.
collected some tens of plants in *Luzon* from *1945 onwards*; numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium).

***Carey,** William
(1761–1834), missionary and orientalist, in India from 1794. Editor of ROXBURGH'S Flora Indica. He is cited as the donor of a plant from *Malacca* (*1808*) to the Calcutta Bot. Gard. (*cf.* ROXBURGH, Hort. Beng. 1814). Probably what he did was sending plant material from a Malacca plant cultivated in his botanic garden at Serampore.
BIOGRAPHICAL DATA. Dict. Nat. Biogr. 9, p. 77; Biogr. Index BRITTEN & BOULGER, 2nd ed. by RENDLE, 1931; BACKER, Verkl. Woordenb., 1936; J. Bomb. Nat. Hist. Soc. 51, 1953, p. 867, and *ibid.* 54, 1956, p. 45.

Carr, Cedric Er(r)oll
LITERATURE. (4) Add: P. ARENS: 'Bemerkungen zu einigen von C. E. Carr in Neuguinea gesammelten Moosen' (Blumea 7, 1953, p. 339–341).
Annonaceae from *New Guinea* by J. SINCLAIR in Gard. Bull. Sing. 15, 1956, p. 4–13, fig. 1–4.

***Carroll,** D., *cf.* sub Forest Department British North Borneo.

Castro, Arturo P.
of the zoological staff of the Philippine National Museum, was assigned to the Chicago-Philippine Expedition headed by Dr HARRY HOOGSTRAAL (see there) in 1946–47; he made botanical collections together with others on several occasions.
COLLECTING LOCALITIES. *1947. Mindoro* (*cf. sub* M. CELESTINO).—*1948. Luzon:* Mt Pulog (with P. AÑONUEVO, March); *Samar* (*et al*, May-June); *Polillo Isl.* (*et al*, Nov.–Dec.).—Occasionally in *Luzon.*
COLLECTIONS. In total *c.* 500 *nos* collected with others, and numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium), *Herb. Manila*; plants from *Mindoro* (*1947*) also in *Herb. Chicago.*

Castro, Pedro
(1900, Sandakan, Br. N. Borneo; x) graduated in Kepong Forest School in 1936; retired at the end of March 1953 after 34 years of service with the Department.
Pandanus castroi was named after him.
COLLECTING LOCALITIES. Add: In various parts of *N. Borneo.*
COLLECTIONS. Add: For his Borneo collections *cf. sub* Forest Department British North Borneo.

***Cavanaugh,** Linden George
(1917, N.S.W., Australia; x), Reserve Settlement Officer, Department of Forests, Bulolo, Territory of New Guinea, contributed to the N.G.F. series (see there) during the 1939–45 war.
COLLECTING LOCALITIES. Both in the *Territory of New Guinea* and in *Papua*, partly together with D. FRYAR (see there).

Celestino, Manual
on the zoological staff of the Philippine National Museum, was assigned to the Chicago-Philippine Expedition headed by Dr HARRY HOOGSTRAAL (see there) in 1946–47.

COLLECTING LOCALITIES. *1947. Mindoro:* at Badok, Naujan, Boliran, Gusay, Malayas, Subuan, Pola (together with A. P. CASTRO, Sept.–Oct.).— Occasionally in *Luzon,* partly with CASTRO.

COLLECTIONS. Add: *Mindoro* plants (*1947*) also in *Herb. Chicago.*

***Celo,** Miss E., *cf. sub* Philippine National Herbarium.

***Centro Escolar Univ. Students,** *cf. sub* Philippine National Herbarium.

***Céré,** Jean-Nicolas (de)
Monsieur Cere is mentioned in ROXBURGH, Hort. Beng. 1814, as a donor of several plants from *Sumatra* (1802), S. America (1810), Malabar, and Bourbon, to the Calcutta Garden. This will be JEAN-NICOLAS (DE) CÉRÉ (1737–1810) who assisted P. POIVRE with the cultivation of spice plants in Isle-de-France (Mauritius). In 1774 or 1775, some years after the latters return to France, CÉRÉ was appointed Director of the then Royal Garden at Montplaisir. He raised numerous peppers, clove, cinnamon, and nutmeg trees which he distributed all over the French neighbouring islands. Later he expanded his activities, introduced useful plants from the Malaysian region, China, America, *etc.*, and sent living plants to many countries. He certainly *never* visited Sumatra.

BIOGRAPHICAL DATA. Ann. Mus. Hist. Nat. Paris 16, 1810, p. 329–337.

***Chaffers,** Sidney
a registrat at Manchester University, amateur diatomist.

COLLECTIONS. According to the Index Herb. (pt II, 1954) *Philippine* plants in *Herb. Brit. Mus.* (acq. 1931), and at *Manchester.* Mr A. H. G. ALSTON informed me (*in litt.*) that CHAFFERS made about 100 slides of diatoms from the Philippines; he did *not* collect in the Philippines himself, but the diatoms were prepared and mounted by him from a sample of mud given to him by ALBERT MANN, a diatomist at the Smithsonian. They were actually collected by an American expedition.

Chalmers, James B.
COLLECTIONS. Add: *Herb. Copenh.:* dupl. *N.G. Scitamineae.*

BIOGRAPHICAL DATA. Add: Ann. Rep. Br. N. G. for 1900/01, p. xliv–xlvi, and App.D. p. 25–35 (massacre report).

Chamisso, Adalbert von
BIOGRAPHICAL DATA. Add: G. SCHMID: 'Chamisso als Naturforscher' (Leipzig 1942).

***Charter,** J. R. N.
(1889, Malaya; x) was a member of the Malayan Forest Service from 1908–33. He collected in the C.F. series (*cf. sub* Conservator of Forests series in Fl. Mal. vol. 1).

Cheesman, Lucy Evelyn
About 1954 she was collecting in the New Hebrides.

LITERATURE. (5) Add: L. E. CHEESMAN: 'Old mountains of New Guinea' (Nature 1951, p. 597); 'Things worth while' (1957) (*n.v.*).

BIOGRAPHICAL DATA. Add: E. CHEESMAN, Things worth while, 1957, with portr. (*n.v.*).

Chevalier, Auguste J. B.
(† 1956, Paris, France).

BIOGRAPHICAL DATA. Add: J. Agr. Trop. Bot. Appl. 1, 1954, 3–7, pl. 1 (photogr.), partial bibliogr. on p. 234–256, 375–384, 507–514; Taxon 5, 1956, p. 120–125, portr.

Chinnery, Ernest William Pearson
Author of a paper on the Central Mountains of E. New Guinea (Mt Hagen region *etc.*) in Geogr. J. 84, 1934, p. 398–412.

Chinte, Felix O., *cf. sub* Philippine National Herbarium.

Christophersen, Erling
COLLECTIONS. Add: Also plants in *Herb. Göteborg.*

LITERATURE. (2) Read: E. CHRISTOPHERSEN: 'Litt om plantelivet på de javanske vulkaner Gedeh og Pangerango' (Naturen 60, 1936, p. 289–295, 5 fig.).

***Cid,** Miss F.
collected in Bukidnon, *Mindanao* (Dec. 28, *1952*); in *Herb. Univ. Philip.*

Cinatti, Ruy
He returned to Portuguese Timor towards the end of 1951 as agricultural officer. In 1957 he studied social anthropology at Oxford University. Author of several papers on Timor.[1]

COLLECTIONS. Add: *Herb. Inst. Bot. Lisbon:* c. 50 *nos* (coll. *1947*) from *Port. Timor.*

LITERATURE. (1) R. CINATTI: Esboco historico do sandals em Timor (Lista *etc.* Ministerio das Colonias Lisboa (Lissabon)).

R. CINATTI & V. M. GOMES: Exploracoes botanicas em Timor (Ministerio *ibid.*): Recontrecimento preliminar da formacoes florestais no Timor portugues (Ministerio *ibid.*).

Clason, Else Willem
COLLECTIONS. Add: After World War II he refound his collection of rice-field plants at Pasuruan; subsequently it was incorporated in *Herb. Groningen.*

Clemens, Joseph & Mary (Knapp) Strong
COLLECTING LOCALITIES. Add: Jolo, *Sulu Archipelago* (Oct. *1915*).

COLLECTIONS. Add: Mosses from *New Guinea* evidently in *Herb. Tokyo,* as the Tokyo Science

Museum forwarded them to A. NOGUCHI for identification (*cf. sub* Literature 6). Her collection of the last ten months in New Guinea on Mt Sarawaket had to be left behind in store-rooms, when she was evacuated to Australia herself, and was destroyed by fire. Dupl. from the *Philippines* (1928) in *Herb. Copenh.*; large *Borneo* collection (*1931–33*) in *Herb. Hamburg*; also *Borneo* plants in *Herb. Leningrad.*

LITERATURE. (5) Add: H. HEINE: 'Pflanzen der Sammlung J. & M. S. CLEMENS von Mount Kinabalu in Britisch Nord-Borneo' (Fedde, Rep. 54, 1951, p. 223–248); 'Diagnoses novae plantarum in Borneo septentrionali a J. et M. S. Clemens lectarum' pars II (Mitt. Bot. Staatssamml. München Heft 6, 1953, p. 208–230); 'Pflanzen der Sammlung J. & M. S. Clemens von Mt Kinabalu in Britisch Nord-Borneo' (Thesis, München 1953, mimeogr.).

H. N. MOLDENKE: 'A new species of Sphenodesma (Verb.)' (Phytologia 4, 1953, p. 368).

(6) Add: L. O. WILLIAMS: 'Orchidaceae Novae Guineae I' (Bot. Mus. Leafl. 12, *no* 5, 1946, p. 149–172, pl. 21–23).

S. J. VAN OOSTSTROOM: 'Additional notes on the Convolvulaceae of New Guinea' (J. Arn. Arb. 29, 1948, p. 414–418, 1 pl.).

A. NOGUCHI: 'Mosses of Mt Sarawaket, New Guinea' (J. Hattori Bot. Lab. *no* 10, 1953, p. 1–23).

***Clemente,** P. C.

(1905, Bulacan, P.I.; 1945, Jesselton, Br. N. Borneo) was appointed ranger of the Forest Department in Br. N. Borneo in 1933; stationed at Jesselton since 1939. He died as an aftermath of internment by the Japanese.

COLLECTING LOCALITIES. *Br. N. Borneo:* at Sandakan and on the West Coast.

COLLECTIONS. *Cf.* under Forest Department British North Borneo.

***Clive,** Lady

presented *Cotyledon rhizophylla* from the *Moluccas* to the Botanic Garden at Calcutta in *1799* (ROXBURGH, Hort. Beng. 1814, p. 34). Possibly the wife of Lord E. CLIVE (1754–1839), Governor of Madras (1798–1803), and presumably not collected herself.

***Co,** Elisabeth

COLLECTIONS. In *Herb. Univ. Philip.:* > 75 *nos.*

***Collenette,** I. S. Darnton, *cf.* DARNTON, I. S.

Colomb, Robert Evelyn

(† Dec. 29, 1949, Kuala Lumpur, Malaya).

BIOGRAPHICAL DATA. Mal. For. 13, 1950, p. 56, 62.

Commerson, Philibert

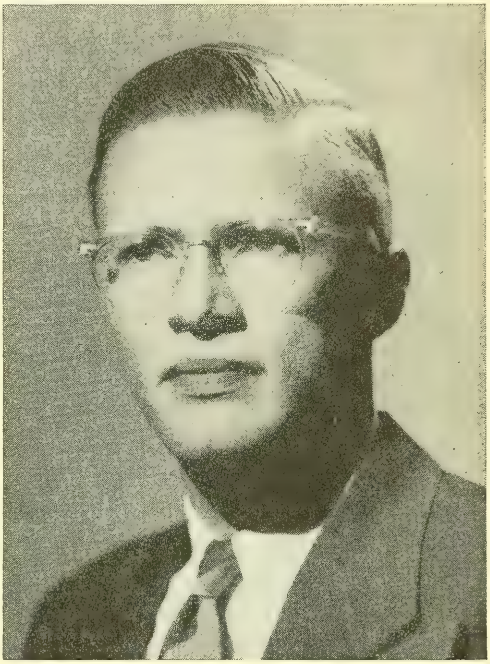
COLLECTIONS. Add: Also dupl. in *Herb.* WEBB (= *Florence*), and many with *Herb.* VAHL in *Copenhagen.*

BIOGRAPHICAL DATA. Add: P. A. CAP: 'Étude biographique sur COMMERSON' (Paris 1861).

***Concepcion,** F. G., *cf. sub* Philippine National Herbarium.

***Conese,** E.

of the staff of the Philippine National Museum, made botanical collections in *Samar* (with SULIT in *1948*; also in June *1952*). In total some eighty numbers, in the P.N.H. series (*cf. sub* Philippine National Herbarium).



CONKLIN

***Conklin,** Harold C.

(1926, Easton, Pa., U.S.A.; x), anthropologist, educated in the University of California, Berkeley (A.B. 1950), and in Yale University, New Haven (Ph.D. 1955). Since 1954 in Columbia University, at first Instructor, and subsequently Lecturer in Anthropology.

Author of papers on anthropology, linguistics, and ethnobotany.[1]

COLLECTING LOCALITIES. *Philippines Islands. Palawan:* Aborlan, Talakaygan, and Kulang-Danum River systems (*1947*); *Mindoro:* Mt Yagaw and vicinity, Mansalay (*1952–53*), partly with SULIT (see there).

COLLECTIONS. Main set in *Herb. Manila* (P.N.H. *nos*), dupl. in *Herb. Univ. Michigan, Harv. Univ., etc.*

LITERATURE. (1) *E.g.:* 'Bamboo literacy on Mindoro' (Pacif. Disc. 2^4, 1949, p. 4–11); 'An ethnoecological approach to shifting agriculture' (Trans. N.Y. Ac. Sc. II, 17, 1954, p. 133–142).

Convocar, Pascual
of the staff of the Philippine National Museum, occasionally collected plants in *Luzon*, and with MENDOZA (see there) in *Mindanao* (March *1949*); > 200 *nos*, numbered in the P.N.H.series (*cf. sub* Philippine National Herbarium).

Cool, Hugo
accompanied with C. A. BACKER an expedition of the Topographical Service to *Krakatoa* in May *1908.*

***Copeland,** H., *cf. sub* Philippine National Herbarium.

***Copral Hassan,** *cf. sub* HASAN and ALI & HASAN.

***Corpus,** F., *cf. sub* Philippine National Herbarium.

***Corson,** James
(† June 16, 1841, buried in the Dutch cemetery in Timor, probably at Kupang) sailed on the whaling-boat 'Kitty', leaving the Thames late in 1838.

Scaevola corsoniana DON was named after him.

COLLECTIONS. His type specimens from *P. Gebeh* (Moluccas) and Batagoda (situation unknown to me) were described by G. DON[1]; originally in *Herb. Linn. Soc.*, sold in 1863 and now lost?

LITERATURE. (1) In LOUDON's Gard. Mag. II, 8, 1842, p. 370–371.

***Cortez,** R. C., *cf. sub* Philippine National Herbarium.

***Corvera,** Hernando
(†), Filipino orchid fancier who occasionally collected a plant in *Luzon*, *Mindanao*, and *Dinagat Isl.* in *1951*; numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium).

Cramer, Pieter Johannes Samuel
(† 1952, Wassenaar, Holland).

BIOGRAPHICAL DATA. Add: Vakbl. Biol. 32, 1952, p. 105–107; Indon. J. Sc. Res. 1, 1952, p. 167–168.

***Crince le Roy**
COLLECTIONS. *Herb. Bog.:* 2 specim. of *Heleocharis* from Batavia, *W. Java* (coll. June 1, *1932*).

***Croix,** J. Erlington de la
a mining engineer who accompanied BRAU DE ST-POL LIAS (see there) to Sumatra and especially to the mines in Perak in *1880–81.*

Planchonella erringtonii DUB. was named after him.

COLLECTIONS. In *Herb. Paris:* > 120 *nos* from Lahat, Perak in *Malaya*, partly from *1883* (?labelled Madame J. ERRINGTON DE LA CROIX, possibly an error), but also with BRAU DE ST-POL LIAS from *1880–81.*

***Crowe,** Captain
collected some plants on the south coast of *New Guinea*, in savannah country (Dec. *1943*); in *Herb. Melbourne.*

Cruttwell (*not* Crutwell!), Norman Edward Garry
Author of a paper on orchid collecting.[1]

Poa cruttwellii HUBB. was named after him.[2]

LITERATURE. (1) Rev. N. CRUTTWELL: 'Orchid hunting in New Guinea' (J. R. Hort. Soc. 77, 1952, p. 254–260).

(2) C. E. HUBBARD: 'A new species of Poa from Papua' (Kew Bull. 1949, p. 474).

***Cuadra,** Austin
(1925, Sandakan, Br. N. Borneo; x) was appointed as Herbarium Assistant at Sandakan in 1947, in 1951 as Forest Guard. He resigned in 1951 and is now working with the Bakau & Kenya Extract Co. Ltd., Sandakan.

COLLECTIONS. *Cf.* under Forest Department British North Borneo. Collected in various parts of *N. Borneo.*

Cuellar, Juan de
In *1792* he accompanied PINEDA (see Fl. Mal. vol. 1) on a trip along the west coast of *Luzon via* Laguna de Bay, Calaman, Maquilin(g) to the provinces Sur and Norte, Cagayan, to the extreme north of the island, returning *via* Ilocos and Pangasinan.

***Cuevas,** Numeriano
COLLECTIONS. *Philippine* plants in *Dudley Herb. Stanf. Univ.* (*cf.* Index Herb. pt II, 1954).

Cuming, Hugh
COLLECTIONS. Add: *Herb. Copenh.*: 303 *nos.*

Cunningham, James
one of the few survivors of the massacre at Pulo Condor by Macassar soldiers on March 2, 1704/05.

Evidently COX's comment that CUNNINGHAM was later found at Macassar is wrong. The English had no factory there at that time, it rightly was at Bandjermasin, where an attack by the natives took place in 1707, after which the settlement was left. The statement that he was a captive for two years in Cochin-China probably does not hold either.

Though 'bred a surgeon', he appears to have been serving the Company as a Factor, and not as a medical officer.

HAMILTON (*cf. sub* Biogr. Data) describes him as follows: 'He . . . would spend whole days in contemplating on the Nature, Shape, and Qualities of a Butterfly or a Shellfish, and left the Management of the Company's Business to others as little capable as himself, so every one but he was Master.'

BIOGRAPHICAL DATA. Add: A. HAMILTON, A new Account of the East Indies 2, 1744, p. 144–145, 205.

Curtis, Charles
When in the Moluccas (between *1880–82* as a VEITCH collector), collected in *Ternate* and *Batjan*; specimens in *Herb. Kew*.

Däniker, Albert Ulrich
(† 1957, Zürich, Switzerland).

Dakkus, Pieter Martinus Wilhelmus
(† 1958, Amsterdam, Holland).

Dames, Teo Willem Gerrit
In about 1955 he went to Sarawak in the employ of the F.A.O. organization.
COLLECTING LOCALITIES. Add: *1949*. P. *Kangean* (Oct.).
COLLECTIONS. Add: The *Kangean* collection probably > 20 *nos*.

Dammerman, Karel Willem
(† 1951, Voorburg, Holland).
BIOGRAPHICAL DATA. Add: Entom. Ber. 14, 1952, p. 1–2; Treubia 21, 1952, p. 469–480, with portr. + bibliogr.; Vakbl. Biol. 32, 1951, p. 1–2; Tijd. Entom. 96, 1953, p. 9–12, incl. portr. + bibliogr.

***Dana,** Mrs E. D., *cf. sub* Philippine National Herbarium.

Danser, Benedictus Hubertus
BIOGRAPHICAL DATA. Add: Fl. Mal. I, 4, 1954, p. (6)–(13), incl. portr. + part. bibliogr.

***Dansereau,** Pierre
(1911, Montreal, Prov. of Quebec, Canada; x), botanist who took his B.A. and B.Sc.Agr. degree in the University of Montreal; in 1930 D.Sc. at Geneva. From 1939–41 Assistant-Director of Technical Services, Montreal Botanical Garden; from 1942–50 Director of the 'Service de Biogéographie' at the University of Montreal, and Associate Professor of Biology at the same; from 1950–55 Assistant-Professor and Associate Professor of Botany, University of Michigan; in summer 1955 appointed Dean of the Faculty of Science, University of Montreal. He was a delegate to the Pan-Pacific Congress held in the Philippines in 1953.
ITINERARY. *1953. Philippines, Luzon:*[1] arrival at Manila (Nov. 14); flying to Baguio, N. Luzon, and trip to Baguio; environs of Baguio (22), Zigzag View, Bued River, Trinidad; return to Manila by car (23); excursion to Los Baños and vicinity (26) and back to Manila; by car to Baguio (29), stops at San Miguel, Tarlac, Kennon valley; to Bontoc (30), collecting along the road; excursion to Mt Polis (Dec. 1); back to Baguio (2); foot of Mt Santo-Tomas and returning to Manila (3); leaving (5) by aeroplane for the U.S.A.
COLLECTIONS. *Herb. Michigan:* some 250 *Philippine* plants; dupl. will be presented to *Herb. Montreal*. Numbers recorded in a special system, running *e.g.* in 10 figures, indicating the number of the plant, the date and the plot or locality for which he made an inventory and ecological notes.
LITERATURE. (1) P. DANSEREAU: 'Philippine Journal' I–III (Asa Gray Bull. 2, 1953 (1954), p. 323–330, 419–438; *ibid.* 3, 1955, p. 97–126).

***Darnton,** Iris Sheila
(1927, Sissinghurst Court, Cranbrook, Kent, England; x) went to British North Borneo in 1954 to make a detailed collection of plants. After a return visit to England she married the geologist COLLENETTE, and is now living at Jesselton in N. Borneo, occasionally accompanying her husband on his field trips.

MISS DARNTON

COLLECTING LOCALITIES. *Br. N. Borneo. 1954.* For 4 months, mostly within 50 miles of Kota Belud, her headquarters.—From *1955 onwards*, from a fairly wide area.
COLLECTIONS. *Herb. Brit. Mus.:* 600 *nos* (coll. *1954*), about 1500 spec.; a 100 more specimens, chiefly orchids, from later trips. Dupl. in *Herb. Leyden*.

***Davies,** Delbert Dwight
(1908, Rockford, Ill., U.S.A.; x), zoologist, educated at North Central College (Naperville, Ill.) and University of Chicago. Since 1930 associated with the Chicago Natural History Museum; Curator, Division of Vertebrate Anatomy since 1941; besides Lecturer in Zoology at the University of Chicago since 1950.
In 1950 he conducted (with ROBERT F. INGER)

the Bornean Zoological Expedition of the Chicago Natural History Museum.

ITINERARY. *1950. NE. Borneo:* Bukit Kretam (SE. end of Dewhurst Bay) (May 7–June 30); Sapagaya Forest Reserve (SE. end of Sandakan Bay) (July 13–Aug. 12).

COLLECTIONS. *Herb. Chicago:*[1] 23 *nos* of flowering plants, ferns, and fruits collected with INGER (see there); no duplicates. Numerous photographs of rain-forest, *etc.* in the files of the Chicago Nat. Hist. Mus.

LITERATURE. (1) *Cf.* Ann. Rep. Chicago Nat. Hist. Mus. 1951, p. 92.

***Davis,** Reg. S., *cf. sub* Philippine National Herbarium.

Co-author of a book 'Philippine Orchids' (New York 1952) with Mrs M. L. STEINER.

Day, Alice W.

= Mrs K. B. DAY, now residing in the U.S.A.

COLLECTING LOCALITIES. Add: After World War II in *Luzon*[1] (*1948 onwards,* partly with Mrs M. L. STEINER), and in *Mindanao (1949).*

LITERATURE. (1) A. W. DAY: 'Collecting in the Mountain Province' (Philip. Orch. Rev. 2, 1949, p. 11–15).

Day, John

COLLECTIONS. Add: According to ALSTON several types with *Herb.* LEVINGE at National Museum, *Dublin.*

***Day,** Mrs K. B., *cf. sub* A. W. DAY.

Demetrio, C. H. = **Demetrio,** Rev. Charles Hermann (1845–1936).

***Department of Agriculture,** Kuala Lumpur, Malaya.

Plant collections are made from time to time by officers of this and other departments in Malaya and sent to the Botany Division of this Department for identification and preservation. Uncommon plants are forwarded to *Herb. Sing.* (*cf.* also *sub* DORE) for identification, and if available 6 specimens are retained there. The majority of specimens in the *herbarium of the department* are those found in association with agriculture, usually common Malayan plants. The collections are numbered as follows: Dicotyledons *no* 1 onwards, Monocotyledons with M *nos*, *Gramineae* with G *nos*, *Cyperaceae* with C *nos*, *Cycadaceae* with Cy *nos*, *Filicales* with F *nos*, *Lycopodiales* with L *nos.*

Desch, H. E.

Wood Technologist at Kepong, author of a Manual of Malayan Timbers, does not remember having collected the *Avicennias* mentioned in the Cyclopaedia (Fl. Mal. 1) himself. His name might appear on the labels because he gave the local staff instructions to collect these and other specimens (*in litt.* 22.8.1955).

Deschamps, Louis Auguste

His MS plates were studied by BACKER and VAN STEENIS.[6]

LITERATURE. (6) C. G. G. J. VAN STEENIS, M. J. VAN STEENIS-KRUSEMAN, and C. A. BACKER: 'Louis Auguste Deschamps. A prominent but ill-fated early explorer of the flora of Java, 1793–1798' (Bull. Br. Mus. Nat. Hist. ser. 1, *no* 2, 1954, p. 51–68, pl. 13).

BIOGRAPHICAL DATA. Bull. Br. Mus. Nat. Hist. ser. 1, *no* 2, 1954, p. 51–54.

***Dickson,** Murray Graeme

(1911, Slough, Bucks., England; x), M.A. (Oxon.), entered the Oversea Civil Service, Sarawak, in 1947.

COLLECTING LOCALITIES. *1952–53. NW. Borneo,* Sarawak: in the neighbourhood of Kuching.

COLLECTIONS. Private collection; some dupl. in *Herb. Sing.* and probably at *Kuching.* The specimens are not numbered.

***Diels,** Friedrich Ludwig Emil

(1874, Hamburg, Germany; 1945, Berlin-Dahlem, Germany), botanist and plant geographer, educated at Berlin University, pupil and successor of A. ENGLER; in 1896 Ph.D. on 'Die Vegetations-Biologie von Neu-Seeland'. In 1900 he was granted a stipend of the Humboldt Stiftung for an investigation of the vegetation of West Australia.[1] Together with his friend E. PRITZEL (who paid for his expenses himself) he travelled by way of S. Africa; in 1902 they visited Tasmania and New Zealand. In later years he visited N. Africa (March–Apr. 1910) and Ecuador (1933). In 1906 appointed Extraordinary Professor at Marburg, in 1914 *ditto* in Berlin; since 1921 Ordinary Professor and Director of the Botanic Garden and the Museum in Berlin.

Author of numerous excellent papers, monographs, and books, including several on the flora of New Guinea.

He is commemorated in several plant names.

ITINERARY. *1902.* When returning to Australia from his visit to New Zealand some harbours in Neu Pommern (= *New Britain*) in the *Bismarck Archipelago* and in Kaiser-Wilhelmsland (*NE. New Guinea*) were visited. On the home voyage he visited the botanic gardens at Buitenzorg and Tjibodas in *W. Java.*

COLLECTIONS. DIELS and PRITZEL made extensive collections in Australia and may have collected some plants in the Malaysian region; as yet no certain data are known to me. *Herb. Berl.?*

LITERATURE. (1) Resulted in: 'Die Pflanzenwelt von Westaustralien' (vol. 7 of 'Vegetation der Erde' von ENGLER & DRUDE).

BIOGRAPHICAL DATA. BACKER, Verkl. Woordenb., 1936; Bot. Jahrb. 74, 1948, p. 173–198, incl. portr. + bibliogr.

***Digbas,** C., *cf. sub* Philippine National Herbarium.

Dihm, Hugo

botanist, pupil of Prof. GOEBEL, who took his Ph.D. degree at Munich in 1894.

COLLECTIONS. Add: *Herb. Munich:* over 100 *Java* plants (pres. 1901), collected in Sept.–Nov. *1899* at Buitenzorg and vicinity. In the years 1917–23 he presented other small collections, but possibly not from Java.

Dillewijn, Cornelius van

(† 1956, Venezuela).

***Dilmy,** Anwari

(1915, Marabahan, SE. Borneo, Indonesia; x) was educated at the Agricultural School at Buitenzorg (now Bogor), Java; 1937–45 active officer in the employ of the D.E.I. Forest Department; 1946–48 Administrative officer of the Borneo Governor's office, Jogjakarta; 1949–52 attending the Forestry College at Bogor; 1952–54 Conservator of Forests, Borneo; in 1954 stationed at the Forest Research Institute, Botanical Division, Bogor; from 1955-*hodie* Keeper of the Herbarium Bogoriense, and besides lecturer at the Academy of Biology at Bogor (Acting Director 1956–57).

Beilschmiedia dilmyana was named after him.

COLLECTIONS. *Herb. For. Res. Inst. Bog.: nos* 1–200 from Janlappa, Djasinga (coll. Apr. 20–27, *1956*); *Herb. Bog.:* a new *Mangifera* from *Centr. Borneo* (= *Kalimantan*).

Dolman, H. C.

retired in 1950.

BIOGRAPHICAL DATA. Mal. For. 14, 1951, p. 1–2, with portr.

Donati, Vitaliano

ITINERARY. 1st line read: 1759.

Donk, Marinus Anton

He was appointed extraordinary professor in the Technical College at Bandung in 1952, and returned to Holland in August 1955.

Doop, Johannes Elizius Alphonsus den

(† 1954, Nijmegen, G., Holland), a schoolteacher and amateur malacologist. After his years of study, for some time teacher at Schiedam.

In 1940 he left for Australia and subsequently for the U.S., staying in numerous places in North and South America, but nowhere for a longer period. When his health broke down, he returned to Holland and settled at Grave some years before his death.

BIOGRAPHICAL DATA. Add: F. C. VAN HEURN: 'Jan den Doop (1889–1954). Een vooraanstaand bioloog' (Bussum 1955, privately printed).

Doorman, Ludovicus Antonius Carel Marie

(† 1955, Amsterdam, Holland).

***Dore,** Dr John

of the Federation of Malaya's Agricultural Department occasionally presents plants to the *Sing. Herb.* They have all been collected by officers of the Department of Agriculture in the course of their normal duties, and then forwarded to the Federal Headquarters at Kuala Lumpur for identification; interesting specimens are forwarded to the Botanic Gardens in Singapore. *Cf.* also *sub* Department of Agriculture.

***DuBuy,** Father F.

collected some plants for BRASS (see there) at Ononge, East Mt Tafa, near Nemodi, Central Division, *Papua*, 2100 m alt. in *1933*.[1]

LITERATURE. (1) *Cf.* J. Arn. Arb. 25, 1944, p. 338 and *ibid.* 34, 1953, p. 347.

Dumont d'Urville, Jules Sébastien César

Fl. Mal. 1, p. 146b Literature (4) read: The botanical results of the 'Coquille' published by J. B. M. BORY DE SAINT VINCENT (Cryptogames, *etc*).

BIOGRAPHICAL DATA. Add: Rev. Int. Bot. Appl. Agr. Trop. 31, 1951, p. 7–50 (1952).

***Duncker,** (Paul) Georg (Egmont)

(1870, Hamburg, Germany; 1953, Ahrensburg near Hamburg, Germany), zoologist, mainly ichthyologist, educated at the universities of Kiel, Freiburg, and Berlin; Ph. D. Kiel 1895. After his study he had no inclination to settle down and he worked successively at Karlsruhe, Plymouth, Naples, Cold Spring Harbour (Long Island N.Y.), and Würzburg. In 1900 he accompanied his first Southsea expedition which he left in Malaya in 1901, where he was Curator of the Selangor State Museum at Kuala Lumpur for a year. After his return in Germany he stayed for another year at Naples, and accompanied the Hamburg Südsee-Expedition (1908–10) during its first year, to collect on behalf of the Hamburg Zoological Museum. From 1907 onwards on the staff of the Museum, since 1928 Curator and Professor; retired in 1934.

ITINERARY. *1908–09.* Leaving Germany in June 1908. *Hamburg Südsee-Expedition* in the 'Peiho'[1]: *St Matthias Isl.*, *Emirau* (*Squally Isl.*), *Tench Isl.*, and *Admiralty Islands* (Aug. 7–Nov. 7, *1908*); circumnavigation of Neu Pommern (*New Britain*) (Nov. 22–Dec. 22); S. coast of *New Britain* (Dec. 28–March 16, *1909*); coast of *NE. New Guinea* and Kaiserin Augusta Fluss (= Sepik River) (May 21–June 11); subsequently sailing from Friedrich Wilhelms-Hafen to the Carolines *etc.* (see A. F. KRAEMER). DUNCKER did not accompany the 2nd year of the expedition to Micronesia, 1909–1910, but was back in Germany Sept. 20, 1909.

COLLECTIONS. *Herb. Hamburg:* some sheets.

LITERATURE. (1) F. E. HELLWIG: 'Tagebuch der Expedition' (in THILENIUS, Ergebnisse der Südsee-Expedition 1908–10, 1 Allg., Hamburg 1927; itinerary see map 2).

H. VOGEL: 'Eine Forschungsreise im Bismarck-archipel' (Hamburg 1911).

BIOGRAPHICAL DATA. Mitt. Hamb. Zool. Mus. 52, 7 pp., incl. bibliogr. + portr.

Durnford, J.

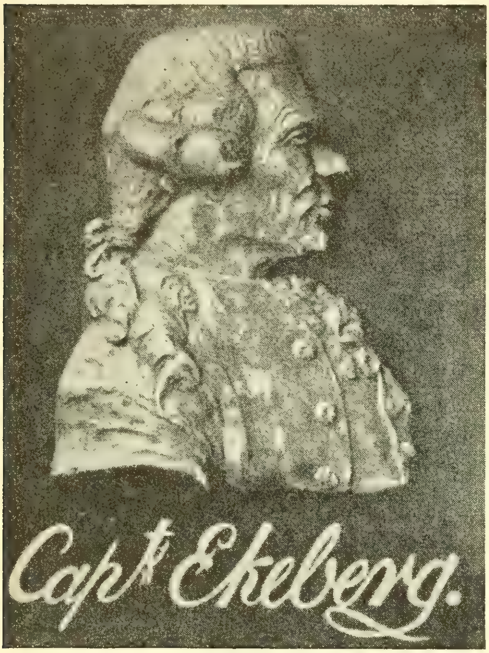
He collected living orchids in *Borneo* as early as

1888 (*vide* letter at Kew). He had the intention to visit *Palawan.*

***Dijkstra,** J., *cf. sub* Boswezen Nieuw Guinea.

Ebalo, L., *cf. sub* Philippine National Herbarium.

Edaño, Gregorio E.
was assigned to the Chicago-Philippine Expedition headed by Dr HARRY HOOGSTRAAL (see there) in 1946–47 as botanical collector.


Capt Ekeberg.

EKEBERG

COLLECTING LOCALITIES. Add or replace: *1946. Luzon:* Manila, Rizal; *Mindanao:* Mt Apo and Mt McKinley (Aug.–Nov.); Bugasan, Parang, Cotabato & Lanao Boundary (Dec.)—*1947. Palawan* (March–May).—*1948. Mindoro:* Mt Halcon and Mt Ilong (Jan.–March); *Negros Or.* (May-June, Aug.–Sept.).—*1949. Mindanao:*Davao (March–Apr., Aug.–Sept.); *Negros Or.* (May).—*1950. Leyte* (March–Apr.).—*1951. Palawan:* Victoria Peaks (March), *Samar* (Dec.).—*1952. Samar* (Jan.), *Leyte* (March–Apr.).—In *Luzon* at least *up to 1953.*

COLLECTIONS. Add: Numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium), thousands of numbers, including *c.* 1700 from the Chicago-Philippine Expedition, of which a set in *Herb. Chicago* too.

Edelfelt, E. G.
Possibly the son of ERIK GUSTAF EDELFELT, a ship's captain who traded to Australia, Callao, *etc.*, in an Indiaman he bought in 1867.[5]

COLLECTIONS. Add: > 222 *nos*; *Herb. Copenh.:* dupl. *Scitamineae.*

LITERATURE. (1) 2nd line, after bracket read: Ymer 6; 3rd line, last word read: Brittiska.

(5) *Cf.* 'Kapten E. G. Edelfelt och hans enskilda affärer. En utredning etc.' (Stockholm 1895).

***Eder,** M. P.
collected plants in the *Philippines*; in *Herb. Arn. Arb.* (*cf.* Index Herb. II (2)).

Ekeberg, Carl Gustaf
started studying pharmacy, later medicine, and accompanied two voyages to Spain as a ship's surgeon. His nautical interest made him enlist in the Swedish East India Company as a mate in 1741; from 1759 onwards captain. With his many-sided education he did work in many fields, making maps, magnetical and meteorological observations, studying botany and zoology, making large collections, diaries, notes, and drawings.[1]

His first relation and correspondence with LINNÉ and the Royal Swedish Academy dates from 1750; since 1761 a member of the said Academy. A correspondent of BERGIUS too.[2]

His publications include a paper on Banka Straits, mainly nautical, but giving also a description of coasts, forests, and beaches.[3]

At Altomta his house (Ekebergsrummet) is still kept.

ITINERARY.[4] *Voyages to the East.* In the 'Drottningen av Sverige', sailing from Göteborg Jan. 10, *1742*; running aground and consequently staying for 6 months in Annam; back in Sweden on July 1, *1744.*—In the 'Götha Leyon' (Capt. Askbom), sailing Dec. 27, *1746* for Canton, staying there the whole year 1748, back in Sweden June 20, *1749*; during the voyage *Java* was visited.—In the ? 'Hoppet' to Canton, Dec. *1751*–June *1754.*—To Canton, in the ? 'Sophia Albertina', Jan. *1755*–Aug. *1756.*—In the 'Friederic Adolph', Feb. *1759*–Aug. *1760*, touching *Java* at least on the home voyage.—In the 'Finland', Feb. *1762*–Aug. *1763*; running aground in Banka Straits, but getting off again.—In the 'Stockholms Slott' (see also A. SPARRMAN, itinerary for *Java etc.*), sailing Dec. 28, *1765*, back in Sweden Aug. *1767.*—In the 'Finland', Dec. *1769*–June 7, *1771*[5], reaching Anjer (*W. Java*) Aug. 8, *1770.*—In the 'Sophia Magdalena' (see also P. J. BLADH), Jan. *1774*–June *1775*, visiting Batavia and Angkè on the N. coast of *W. Java.*—His last voyage in the 'Sofia Magdalena', Jan. *1777*–June *1778.*

Probably most or all of the China voyages were made *via Java.*

COLLECTIONS. The BERGIUS *Herb.* (R. Ac. Sc. *Stockholm*) includes plants collected by him in *Sumatra*, Cochinchina, Ind. Or., and *Java.* He also presented collections to LINNAEUS (*Herb. Linn. Soc. Lond.*), possibly the older ones.

LITERATURE. (1) Diary *etc.* in R. Swed. Ac. Sc., Stockholm.

(2) MS letters to BERGIUS in R. Swed. Ac. Sc., Stockholm, written 1766–74.

(3) C. G. EKEBERG: 'Anmärkningar och Be-

skrifning öfver Banca-Sundet uti Ost-Indien' (K. Vetensk. Handl. 37, 1776, p. 122–130).

(4) *Cf.* C. FORSSTRAND: 'Carl Gustaf Ekeberg, hans färder till Ostindien och Kina, naturvetenskaplige intressen och förbindelser med Linné' (Svensk. Linné-Sällskapets Årsskrift 11, 1928, p. 147–161, incl. bibliogr.); and in E. OLÅN: 'Ostindiska compagniets saga' (1920).

(5) C. G. EKEBERG: 'Capitaine Carl Gustaf Ekebergs Ostindiska Resa, åren 1770 och 1771' (1773) (*n.v.*); J. WALLENBERG: 'Min son på galejan' (1781; several editions, 1855, 1881, *etc.*).

BIOGRAPHICAL DATA. BRETSCHNEIDER, Hist. Bot. Disc. China 1898, p. 60–61; Svensk. Linné-Sällskap. Årsskr. 11, 1928, p. 147 seq.; *ibid.* 29, 1946, p. 83–84, fig. 2–3 (portr.).

Elmer, A. D. E.

BIOGRAPHICAL DATA. Add: Philip. J. Sc. 78, 1949, p. 1–4.

***Enchai** or **Enchoi**

collected in the B.N.B. (see Forest Department Br. N. Borneo) and in the S.H. series, in *British North Borneo*, about *1939*.

Endert, F. H.

(† 1953, Bussum, Holland).

He retired in 1952, arriving in Holland in July.

BIOGRAPHICAL DATA. Tectona 42, 1952, p. 133–136; Trop. Natuur 33, 1953, p. 76–77.

***Enggoh bin Limbuan**

(?, Malagatan Kinabatangan, Br. N. Borneo; x) was employed as labourer by the Forest Department Br. N. Borneo after the war; resigned in 1954.

COLLECTIONS. See under Forest Department British North Borneo. He collected at Sandakan, *Br. N. Borneo*.

***Enoh,** Mohammed

clerk of the Buitenzorg Herbarium, accompanied Miss POLAK (see there) to *Borneo* in *1948*.

COLLECTING LOCALITIES. *1948. W. Borneo* (Sept.): Pontianak, Sg. Bangkong (= Sumur Bor), Schietbaan near Pontianak; Sungai Pinju ketjil; Air Itam; Mempawah-Andjongan; Sungai Kunjit; Mandor; Moton Brian; Moton Beliang, and Bamban.

COLLECTIONS. The plants he collected bear his own numbers, 264–434, in *Herb. Bog.*; some dupl. in *Herb. Arn. Arb.* Miss POLAK also collected on the above-mentioned tour, but it is possible that all the material bear ENOH numbers.

***Enriquez,** Gloria L.

collected at Pilar, Bataan Peninsula, *Luzon* (Oct. *1954*); in *Herb. Univ. Philip.*

***Espeissis,** J. L. d'

Forest Officer.

COLLECTING LOCALITIES & COLLECTIONS. 200 *nos* with J. B. MCADAM (see there) in the coastal areas of *New Britain* (Bismarck Archipelago), *1938*; possibly only partly in *Herb. Brisbane.*

Errington de la Croix, *cf. sub* CROIX, J. ERRINGTON DE LA.

***Espinas,** A.

Philippine plants in *Herb. Arn. Arb.* (*cf.* Index Herb. II (2)).

***Estrada,** D., *cf. sub* Philippine National Herbarium.

Evangelista, B.

is also credited with collecting in the *Philippines*, evidently prewar; specimens in *Herb. Manila* (destroyed), *Arn. Arb.*, *Bogor*, *New York* (*cf.* Index Herb. II (2)).

***Evans,** I. H. N.

(† May 1957, Labuan, off NW. Borneo).

LEENHOUTS, when revising *Burseraceae*, found material collected by him in *Borneo*, at Kota Belud, in July *1940*.

***Evidente,** E. S.

contributed a few numbers to the P.N.H. series (*cf.* Philippine National Herbarium), including 2 from the *Sulu Islands* (*1951*).

***Ewart,** Alfred James

(1872, Liverpool, England; 1937, Melbourne, Vict., Australia), plant physiologist, educated at Liverpool Institute and University; from 1894–95 working at Leipsic under PFEFFER (Ph.D. 1896); from Nov. 1896–March 1897 he spent some months in Java, working in the Foreigners' Laboratory at Buitenzorg, making physiological investigations on chlorophyll and climbing organs. From 1897–1905 associated with Mason's College and some schools at Birmingham, at intervals working in the Department of Botany at Oxford (D.Sc. 1910). In 1906 he was appointed Government Botanist of Victoria (holding this position up to 1921) and Professor of Botany and Plant physiology in the University of Melbourne. Though for some time he tried to continue physiological work, in Australia he wil be remembered mostly as a taxonomist.[1]

COLLECTING LOCALITIES. *Java*, when staying at Buitenzorg from Nov. *1896*–end March *1897*.

COLLECTIONS. Small collection from *Java* and Ceylon in *Herb. Liverpool.*[2]

LITERATURE. (1) Co-author of the 'Flora of the Northern Territory' (1917), author of the 'Flora of Victoria' (Univ. Press, Melbourne 1930), and numerous taxonomic papers.

(2) *Cf.* Taxon 5, 1956, 10.

BIOGRAPHICAL DATA. Proc. R. Soc. Lond. ser. B 124, 1937, p. 379–380; Proc. Linn. Soc. Lond. 150th sess., 1938, p. 314–317; Who's who 1936; Dict. Austr. Biogr. 1, 1949.

***Ewer,** W(alter)

contributed plants from *Sumatra* (*1802–03*, *1808*), and from the *Moluccas* (*1809*) to the Botanic Garden at Calcutta (*cf.* ROXBURGH, Hort. Beng. 1814).

B. HEYNE[1] mentioned a Mr EWER as Administrator for the Farms (branches of revenue arising from the retail sale of spirituous liquors, of palm wine, opium, licences for cockfighting, and gambling houses) at Fort Marlborough, Bencoolen.

L. S. A. M. VON RÖMER mentioned WALTER EWER, Governor of Bencoolen in 1805![2]

LITERATURE. (1) *Cf.* 'Tracts, historical and statistical, on India *etc.*' 1814, p. 375.

(2) In Hist. Schetsen, Batavia 1921, p. 279.

Eyma, P. J.

BIOGRAPHICAL DATA. Bull. Bot. Gard. Btzg III, 18, 1950, p. 403–406 + portr.

***Fabella**, *cf. sub* Philippine National Herbarium.

Faber, F. C. von

(† 1954, Germany), was educated at Wageningen Agricultural College, and subsequently studied natural sciences at Heidelberg and Leipsic, specializing in botany, and taking his Dr's degree at Heidelberg. From 1903–09 employed in Germany, making a botanical exploration in West Africa (especially Kamerun) in 1907. In 1909 he went to Java. In 1930 Honorary Professor at Munich, from 1931–34 Professor of Botany and Director of the Plant Physiological Institute of Vienna University, and from Dec. 1934 onwards Professor and Director of the 'Botanische Staatsanstalten' at Munich; suspended in 1945 and retired in 1949.

BIOGRAPHICAL DATA. Ber. Deut. Bot. Ges. 68a, 1955, p. 49–54, with portr. and bibliogr.

***Fabian**, V., *cf. sub* Philippine National Herbarium.

***Fagerlind**, Folke

(1907, Stockholm, Sweden; x), botanist, educated at the University of Stockholm; lecturer, Assistant Professor, and since 1949 Professor of Botany, University of Stockholm.

In 1938 he stayed for about 4 months in the Buitenzorg Botanic Gardens. In 1953 he visited Australia and Java when returning from a trip to Ecuador.

Author of numerous papers on embryology and cytology of *Balanophoraceae*, *Pandanaceae*, *Rubiaceae*, *etc.*[1]

COLLECTING LOCALITIES. *1938. W. Java:* Buitenzorg Botanic Gardens (Hort. Bog.), at Tjibodas and on the slopes of G. Pangrango-Gedeh, at Pasar Ikan near Batavia.—*1953. W. Java:* on summits of G. Gedeh and Pangrango (July 28 and 29) during an excursion with W. MEIJER (see there) from July 25–Aug. 10; and in Hort. Bog.

COLLECTIONS. Material for embryological and cytological research in *Herb. Un. Stockholm*; 50 *nos Pilea* and *Elatostema* from *Java* in *Herb. State Mus. Stockholm* (pres. 1940).

LITERATURE. (1) *E.g.:* 'Vier neue im Botanischen Garten von Buitenzorg kultivierte Pandanus-Arten' (Svensk Bot. Tidskr. 34, 1940, p. 101–116, fig. 1–6); 'Bau und Entwicklung der vegetativen Organe von Balanophora' (Kungl. Svensk. Vetensk. Ak. Handl. III, 25, *no* 3, 1948, 72 pp., 12 textfig.).

Fairchild, D. G,

(† 1954).

***Fariñas**, Dr Estefanio C.

D.V.M., University of the Philippines; Research Officer, Bureau of Animal Industry, Manila; Associate, National Research Council of the Philippines.

COLLECTING LOCALITIES. *Philippine Islands:* San Marcelino, Zambales Prov. (*Luzon*); Milagros (*Masbate*); Baguio Stock Farm, Mountain Prov., and Grassland Farm, Bulacan Prov. (*Luzon*); other stock farms in *Mindanao.*

COLLECTIONS. *Cf. sub* Philippine National Herbarium.

Farquhar, W.

Line 7 read: *Myristica.*

When FARQUHAR was at Penang waiting for a boat to Calcutta, RAFFLES arrived on the last day of 1818 with orders from Calcutta and one for FARQUHAR telling him to serve under RAFFLES (BURKILL *in litt.* 25.8.1955).

COLLECTIONS. His collection of plates in the Libr. R. As. Soc. of Great Britain and Ireland, consists of 2 books, comprising respectively 55 and 42 plates (pres. 1827). I. H. BURKILL made an inventory of the Latin names of the depicted plants.[2]

In *1810* FARQUHAR sent a plant from *Malacca* to ROXBURGH.[3]

LITERATURE. (2) In Gard. Bull. Sing. 12, 1949, p. 404–407; *ibid.* 14, 1955, p. 530–533.

(3) See ROXBURGH, Hort. Beng. 1814, p. 1.

***Fechner**, R.

collected a fruit on the Middle Fly River, *Papua*, in *1886*; preserved in *Herb. Melbourne.*

Feddersen, P.

arrived in Malaya 1918; on Mount Austin Estate until 1924, when he left the Company's service and started an orchid Garden in Johore. He left the East for good in 1926, and is now living at Sandbjerg per Hørsholm, Denmark.

***Feilberg**, Carl Adolf

(1844, Vester Vedsted ved Ribe, Denmark; 1937, ?), studied medicine at Odense in 1863; in 1864 he volunteered in the war, was made a prisoner, but escaped; subsequently he studied botany. In 1867 he made a trip to the Farøer; from 1868–69 the Danish Botanical Society gave him the opportunity to travel to East India, China, and Further India. In 1874 M.D. and subsequently as a surgeon on a German ship to New Zealand; since 1876 practising in Copenhagen, and on the Øresund Hospital; retired in 1916.

COLLECTIONS. *Herb. Copenhagen:* 282 *nos* from Bombay, Hongkong, Bangkok, Saigon, and *Singapore* (1), *leg. 1868–69.*

BIOGRAPHICAL DATA. Dansk Biogr. Leks. 6, 1935, p. 614–615.

Fevrell, Frederik Theodor (Thore) Emanual (1881, Stockholm, Sweden; 1944, ? Pretoria, S. Africa), since 1902 in the Swedish Navy; from 1919–29 Swedish General Consul at Batavia, Java; *ditto* at Cape Town, 1929–36, and at Pretoria from 1936 onwards.

Biographical data. I. Högbom, Svenskar i Utlandet, Stockholm 1929, p. 89; Kungl. Utrikes Depart. Kalender 1955, p. (376), (385).

***Fischer,** H. A., *cf. sub* Philippine National Herbarium.

Fitzgerald, W. V.

Collections. Fern dupl. from Melbourne in *Kew Herb.*

***Fleming,** John (1747–1829), of the Indian Medical Service, Bengal, 1768–1813. He was in charge of the Calcutta Botanic Garden during one of the periods of leave of W. Roxburgh, of whom he was a very good friend. He is cited as the donor of plants from the Moluccas (1798), and from Manila (1811, *Musa textilis*), to the Calcutta Botanic Garden (*cf.* Roxburgh, Hort. Beng. 1814). As nothing is known of travels outside India, it seems probable that he was intermediary only. Ch. Campbell *e.g.* sent the caoutchouc vine to Roxburgh by means of Mr Fleming (see Marsden, A Hist. of Sumatra, 1811, p. 92).

Biographical data. Biogr. Index Britten & Boulger, 2nd ed. by Rendle, 1931; Backer, Verkl. Woordenb., 1936.

***Floyd,** Alexander Geoffrey (1926, Hampton, Vict., Australia; x) was appointed Assistant Botanist at Lae, NE. New Guinea, in 1953. He contributed to the N.G.F. series (see there), *e.g.* collecting in *New Britain*, Bismarck Archipelago, in July/Aug. *1954*, when seconded to Dr Ward Goodenough's Anthropological Party in W. Nakanai, *c.* 50 miles E of Talasea, especially for identifying and recording the native uses of plants. He resigned in 1955.

Fogh, Frederic C. († 1945, during Japanese occupation of Malaya) arrived in Malaya in 1912 in the employ of the Danish East Asiatic Company; until 1928 planter on Mount Austin Rubber Estates, subsequently transferred to Teluk Merbau Coconut and Rubber Plantations as General Manager.

Forbes, H. O.

Collections. Add: The duplicates in *Herb. Lisbon* consist of 157 *nos* (incl. 8 crypt.), collected in *1882–83*, evidently from *Port. Timor*; several dupl. in *Herb. Ac. Sc. Leningrad.*

Forest Department (British) North Borneo

As collectors on behalf of this department add: D. Balajadia, Caguicla, P. C. Clemente, A. Cuadra, Enchai or Enchoi, Enggoh bin Limbuan, Kadir bin Abdul, Majuyap bin Majuni, H. S. Martyn, Morris, D. I. Nicholson, I. H. Sario, G. Simbut, J. Valera, Otek bin ?, G. H. S. Wood. See separate entries.

Collections. The prewar series is sometimes cited with B.N.B. (British North Borneo) *nos*, but also with S.H. (Sandakan Herbarium) *nos*, though they stand for the same series.

In November 1954 the Forest Botanist, G. H. S. Wood, wrote a letter that he was shortly exhausting his Sandakan postwar A series numbered A 1–5000. The new series is numbered (San) 15.000 onwards, to be sure no duplication with prewar numbers will occur, the highest record Mr Wood could find being 10.802.

Dupl. also in *Herb. Kuala Lump.* (Kepong) and *Sing.*

Forest Research Institute, Buitenzorg (Bogor), Java.

Additions to the alphabetical list of collectors in Fl. Mal. I, 1* (names with 'oe' will occasionally have been written with 'u', but have been inserted here with 'oe'): Z. Abidin (*Tarakan 1951*); Achmad (*SE. Borneo 1950; E. Java 1951; Sumatra East Coast 1952; E. Borneo 1954*); Achmad Almawi (*S. Borneo 1952*); Adang Didi (*W. & E. Java 1943/44*); R. Adiwidjaja (*W. Java 1944*); Adong (*Banka 1949*); F. Ajat (*SE. Borneo 1949*); Ajoeb (*W. Java 1949*); Albani alias Moeljosoekarto (*E. Java 1944*); E. J. van Alphen de Veer (*Billiton 1949; E. Java 1950; W. Sumatra 1955*); Amir (*Centr. Java 1943/44*); Anta (*Banka 1955*); Apandi (*W. Java 1943/44*); Ardikoesoema(h) (*W. Java 1943/44, 1952–54*); Ardiwidjaja (*W. Java 1944*); E. Ardiwinata (*W. Java 1956*); Arsad (*Banka 1949*); R. Asgar (*W. Java 1943/44*); Asmita (*W. Java 1943/44*); Asnan alias Jasin (*W. Java 1954*); A. Atjil (*Centr. E. Borneo 1932*); Atmadja (*W. Java 1943/44*); Atmawidjaja (*W. Java 1943/44*); Bardan (*Centr. Java 1943/44*); J. H. Becking (*cf.* also Fl. Mal. I, vol. 1; *E. Java 1943/44*); L. Bertsch (*SE. Borneo 1949*); E. Boelens (*W. Java 1951–52*); Dr de Boer (*S. Borneo 1950*); L. Budding (*W. Borneo 1949, 1953*); Dah(a)ri (*S. Borneo 1949*); Danoesoekarto (*E. Java 1943/44*); Depari (*E. Java 1943/44*); A. Dilmy* (*E. Borneo 1953; W. Java 1954; Centr. Java 1954*); Dimun (*E. Java 1943/44*); Djaja (*W. Java 1943/44*); Djajenghardjo (*E. Java 1943/44*); Djamaloedin (*S. Sumatra 1952*); Djodjo (*W. Java 1943/44*); Djoenaedi Natawiria (*W. Java 1943/44*); Moh. Eddi (*W. Java 1943/44*); Eming (*W. Java 1944*); R. Endjum Natasoewardi (*W. Java 1943/44*); D. Endoen (*Timor 1953*); Engking (*W. Java 1943/44*); H. Esche (*W. Java 1951–56; W. Borneo 1953; Sumatra East Coast 1954*); Bapa Goding (*W. Java 1944*); L. Godjali (*W. Java 1954*); Goenari (*Centr. Java 1944*); G. A. L. de Haan* (*Halmahera 1952*); Z. Hamzah (*W. Borneo*

(*) An asterisk behind a name refers to a separate entry. As the complete list was only available when the supplement was already in the press the majority of the collectors' names have no separate entry in this Supplement.

FORMAN

1953); Hardjo (*E. Java 1944*); Hardjoprawiro (*E. Java 1954*); Hardjowidjojo (*E. Java 1943/44*); Hasan Noerdjaja (*W. Java 1954*); Moh. Hasim (*W. Java 1943/44*); F. H. Hildebrand* (*W. Java 1943/44, 1952–57; Centr. Java 1943/44; E. Java 1954*); Hoeminto (*W. Java 1953–54*); Hoetabarat (*Sumatra East Coast 1952*); W. Horsting (*Banka 1949*); Ibnoe Sjoekoer Mertowidjojo (*E. Java 1943/44*); Idris (*W. Java 1943/44, 1949*); H. Iking (*W. Java 1949–50*); S. Ilham (*W. New Guinea 1949*); Joenoes Dali (*W. Java 1954, 1957; S. Sumatra 1956*); Kandar (*E. Java 1954*); Karsoemah Hardjosoewito (*W. Borneo 1953*); Kartodikoesoemo (*E. Java 1944*); M. Kasbin alias Atmosoebroto (*E. Java 1944*); Katijo (*E. Java 1954*); van der Kloot (*E. Java 1949*); Koeslan (*E. Java 1952*); Koespardjo Martoprawiro (*E. Java 1944, 1952*); Koo Giok Ien (*E. Java 1951*); Dr A. (J. G. H.) Kostermans* (*W. New Guinea 1949; Morotai 1949; Banka & Billiton 1949; E. Borneo 1951*; *SE. Borneo 1952, 1955; Centr. Java 1954; Banka 1955; Tarakan & Nunukan 1955; NE. Borneo 1955; W. Java 1956*); J. Made Djingga (*Bali 1949*); Mangsoed (*Centr. Java 1954; E. Java 1954*); Mardjoeki (*Centr. Java 1943/44*); Marta (*W. Java 1943/44*); Martono Tjikrowidagdo (*E. Java 1943/44*); Martowijono (*E. Java 1944*); M. Miftah (*E. Java 1954*); S. Moeljosoekarto (*E. Java 1943/44*); Moenandar (*E. Java 1944*); A. Moenir (*S. Sumatra:* Palembang *1955*); Moeslihat (= Muslihat)* (*Centr. Java 1954–55; W. Java 1954*); Moestadjab (*E. Java 1944*); Momo (*W. Java 1954*); A. Muis (*Tarakan 1951*); Nasir (*W. Java 1950*); A. Nasution (*Sumatra East Coast 1954*); Nataädmadja (*W. Java 1943/44*); Natadiwangsa (*W. Java 1944*); Natasoeanda (*W. Java 1944*); Ngabetan (*E. Java 1950*); R. Oesman (*S. Sumatra 1951; W. Java 1953*); Oetja (*W. Java 1943/44, 1954–57*); Ojo Karmadisastra (*W. Java 1944*); Padmosiswojo (*W. Java 1951–56; E. Java 1952*); Pairan (*E. Java 1944*); M. Pakih (*W. Java 1944*); Pandjaitan (*S. Sumatra 1952*); Parmadisastra (*W. Java 1949*); Parwoto (*Centr. Java 1944*); Patah (*W. Java 1943/44*); K. Paymans* (*Tarakan & E. Borneo 1951*); St. Pennek (*Tarakan & E. Borneo 1951*); Pideman (*S. Sumatra 1952*); Prawiranata (*W. Java 1952*); M. Ramelan (*Centr. Java 1943/44*); Ranawikarta (*W. Java 1944*); R. S. Riman (*Centr. Celebes 1949*); Ronggoer (*S. Borneo 1954*); P. van Rijk (*W. Java 1951*); Saäman (*Billiton 1949*); Sabana (*Borneo 1954*); Sachri (*W. Java 1943/44*); Saleh (*W. & E. Java 1944*); M. Samikoen (*Centr. Java 1954*); R. Samikoen (*Centr. Java 1943/44*); Sardjo Martosoediro (*E. Java 1954*); Sarwa (*W. Java 1944*); Sasaki (*W. Java 1943/44*); O. Sastrapradja (*W. Java 1944*); Satjawinata (*Centr. Java 1954*); Satni (*SE. Borneo 1955*); E. G. Sauveur (*cf.* also Fl. Mal. I, vol. 1; *SE. Borneo 1951*); G. K. Sawang (*SE. Borneo 1953*); Seman (*E. Java 1943/44*); W. Shields (*W. Java 1951–52*); Siman alias Djojonoto (*Centr. Java 1944*); Sinar (*SE. Borneo 1952*); G. Sinulinga (*Sumatra East Coast 1952*); M. Sirait (*Sumatra East Coast 1954*); M. Siregar (*S. Borneo 1952*); N. Siregar (*Sumatra East Coast 1952*); Soebardi (*Centr. Java 1953*); M. Soedarma (*W. Java 1943/44*); Soedarman (*E. Java 1956*); Soedarsono (*W. Java 1950*); Soedewo II (*W. Java 1943/44*); R. Soediarto (*Java 1943/44; W. & Centr. Java 1954*); Soediono (*E. Java 1943/44; W. Java 1944*); Soehanda (*W. Java 1943/44*); Soejono (*E. Java 1943/44*); Soekandar (or Sukandar) (*E. Java 1943/44*); Soekardono (*E. Java 1944*); Soekarija (*S. Sumatra 1953; W. & E. Java 1954; E. Java 1956*); Soekarjapoerja (*Centr. Java 1944*); Soemarmo (*E. Java 1943/44*); Soemarto (*Centr. & E. Java 1943/44*); Soemitro Soerjo (*W. Java 1943/44*); Soemodinoto (*E. Java 1943/44*); Soenardi alias Wadijosoedarmo (*Centr. Java 1944*); Soengeb (*Centr. Java 1943/44*); Soepangat (*E. Java 1954*); Soepardi (*W. & Centr. Java 1944*); Soeparlan (*E. Java 1952*); Soepono (*E. Java 1952, 1956*); Soeratman (*W. Java 1943/44; E. Java 1944*); R. Soeroso (*E. Java 1943/44, 1953*); R. Soeroto (*W. Java 1943/44*); Soeseno (*E. Java 1944*); Soetarso (*E. Java 1943/44*); Soetomo (*Centr. Java 1943/44*); Soewanda (*SE. Borneo 1955; E. Java 1957*); Soewarno (*Centr. Java 1944, 1952*); G. Soelaiman (*W. Borneo 1949, 1952*); Tangkilisan* (*Morotai 1949*); Tarini Hardjawanarga (*W. Java 1943/44*); Tarjudin (*W. Java 1950*); Tarkim Adiwinata (*W. Java 1944*); Ir Tideman (*W. Java 1954*); Tirta (*W. Java 1944*); Tjakrawinata (*W. Java 1944*); Tjitraredja (*Centr. Java 1943/44*); Tjokrotenojo (*Centr. Java 1944*); Verkuyl (*W. Java 1954*); Versteegh (*E. Java 1954*); Walman Sinaga (*E. Java 1943/44*); Wangsaiatna (*W. Java 1944*); Wasijat (*W. Java 1951, 1953, 1954–57; E. Java 1943/44, 1954–56*); Wina(n)tadipoera (*W. Java 1944*); Wiraätmadja (*W. Java 1943/44*); C. J. van der Zwaan (*cf.* also Fl. Mal. I, vol. 1; *E. Java 1943/44*); A. J. van Zwet (*W. Java 1950*); J. van Zijll de Jong (*cf.* also Fl. Mal. I, vol. 1; *W. Borneo 1949–50*).

Forestry Bureau, Manila, P.I.
Add as collectors in the F.B. series: B. RANARIO (*Luzon 1919*), P. P. SASQUETY (*Samar 1915*), E. VALDEZ (*Luzon 1921*).

***Forestry Bur. Employees**
contributed occasionally to the P.N.H. series (*cf. sub* Philippine National Herbarium).

***Forman,** Lewis Leonard
(1929, London, England; x), botanist, B. Sc. London University (1950); appointed to Kew, March 1951. In 1956 he was for a year on the staff of the Bogor Herbarium, Indonesia.
He is revising the *Menispermaceae.*
COLLECTING LOCALITIES. *1956. W. Java:* Bogor Botanic Gardens (Jan. 31–March 29), Tjibodas (Apr. 3–5), Tjisolok near Palabuhanratu (17); *Bali* (28)*; E. Java:* Blambangan (May 3–4); *Bali* (June 9); *NE. Celebes:* Minahassa (June 21–July 5); *E. Borneo:* Belajan River (Aug. 15–25); *W. Java:* Bogor Botanic Gardens (Sept. 12–Oct. 30); Muara Angké, W of Djakarta (Nov. 1); Bogor Botanic Gardens (up till Jan. *1957*).
COLLECTIONS. *Herb. Kew:* 649 *nos*, incl. 8 from *Bali*, 234 from *Celebes*, 110 from *Borneo;* probably dupl. in *Herb. Bog.*

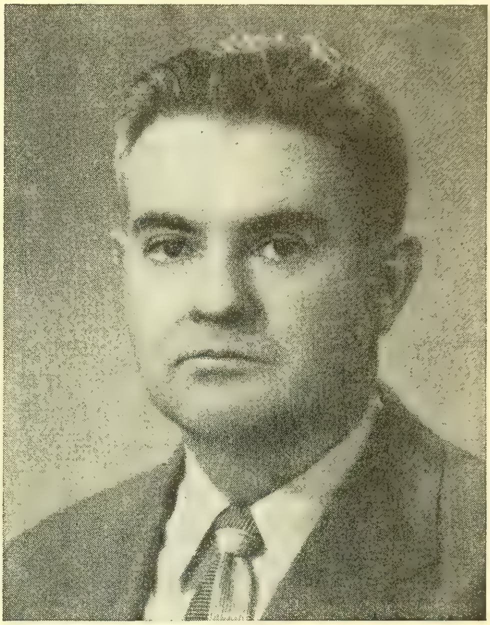
***Fortez,** C., *cf. sub* Philippine National Herbarium.

Fortune, R.
BIOGRAPHICAL DATA. Add: Proc. Linn. Soc. Lond. 156, 1943, p. 8–16; J. R. Hort. Soc. 80, 1955, p. 265–269, 276–280.

Foston, C. A. C.
retired in 1951.
BIOGRAPHICAL DATA. Mal. For. 14, 1951, p. 122–123, with portr.

Fox, Robert Bradford
(1918, Galveston, Texas; x), anthropologist, educated in the University of Southern California (A.B. 1941), of Texas (M.A. 1944), and Chicago (Ph.D. 1954). From 1942–44 Instructor at Texas University, from 1944–46 in the U.S. Navy, from 1946–47 Administrative Director Philippine Institute for the Armed Forces ('GI College') at Manila, from 1947–51 anthropologist in the National Museum there, from 1954–55 Director of the HRAF-Philippines Studies Project in the University of Chicago, and since 1955 at Manila in the National Museum again. His special interests are ethnobotany, social anthropology and ethnology.
COLLECTING LOCALITIES. *Philippine Islands. Luzon:* Zambales Province (*1947–48*), Mt Pinatubo, Mt Lawitan, *etc.*[1]; *Polillo Island* (Nov. *1948*–Feb. *1949*)[2]; *Palawan* (Nov. *1950–51*).
COLLECTIONS. *Herb. Manila* (P.N.H. series), *Harv. Univ.*, and *Univ. Michigan*; > 1000 *nos.*
LITERATURE. (1) R. B. Fox: 'The Pinatubo Negritos: Their Useful Plants and Material Culture' (Philip. J. Sc. 81, *nos* 3 & 4, Sept.–Dec. 1952).
(2) R. B. Fox: 'Notes on the Orchids and Peoples of Northeast Polillo Island' *etc.* (in Philip. Orch. Rev. 3, 1950).

Foxworthy, F. W.
(† Febr. 4, 1950, Berkeley, California).
BIOGRAPHICAL DATA. Mal. For. 13, 1950, p. 119–121; Madroño 10, 1950, p. 178–179.



R. B. FOX

Franck, C. W.
(† 1950, Copenhagen, Denmark).
COLLECTIONS. The plants from New Caledonia in *U.S. Nat. Herb. Wash.* were rightly collected by I. FRANC (information received from Dr MØLHOLM HANSEN, Copenhagen).

Franco, F., *cf. sub* Philippine National Herbarium.

F.R.I., *cf. sub* Forest Research Institute.

***Frick,** Dr A.
COLLECTIONS. *Mus. Techn. Coll. Zürich:* natural history objects collected in the Buitenzorg Botanical Garden in *1889*. It is dubious whether these ought to be regarded as collected by FRICK, as a case containing the specimens was dispatched by the Botanic Garden to Dr FRICK o/b s.s. Soenda, Tandjong Priok harbour, for Prof. SCHROETER.

***Fryar,** Donald
(1909, Gympie, Queensland, Australia; 1954, ?), Forest Ranger who collected plants in the Morobe District, *NE. New Guinea.* In 1953 stationed at Rabaul, New Britain.

COLLECTIONS. Dupl. in *Herb. Leyden;* high numbers in the N.G.F. series (*cf.* New Guinea Forces).

Fryd (not with 'ij'), Aage August
in 1949–50 finally 'bosbeheerder' of Pemalang, stationed at Tegal. In the latter year he left Java and returned to Denmark.

Frijlinck, F. J.
read: of Klappanoenggal (Tjileungsi), W. Java.

Gaag, H. C. van der
COLLECTING LOCALITIES. Add: *1948. SW. Celebes:* Maros (Nov.).—*1949. SW. Celebes:* Watampone; *Centr. Java:* on G. Slamat and vicinity, Bobotsari, Ketenger.
COLLECTIONS. This second collection was identified at Leyden in 1950; in *private herbarium,* for the greater part with watercolour drawings. In total > 103 *nos.*

***Gachalian,** F. S.
on the staff of the Philippine National Museum, occasionally collected some plants in *Luzon, Mindoro,* and > 80 in *Samar* (Dec. *1951*–Jan. *1952*); numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium).

Galang, R. E., *cf. sub* Philippine National Herbarium.

***Galatira,** C. A., *cf. sub* Philippine National Herbarium.

Garai
was a Saribas Dyak who had been years at the Mission School and wrote well. According to HAVILAND he was industrious and intelligent and the former taught him botany as far as time permitted.

***Garcia,** Felicissima C.
B. Sc., M. Sc. Botany, University of the Philippines. Formerly instructor in Botany, Philippine Women's University.
COLLECTING LOCALITIES. *About 1956. Luzon:* Diliman, Quezon City; Naguilian Road, Baguio City, Trinidad Valley, Mt Santo Tomas, Mountain Prov.; Las Pinas, Rizal Prov.
COLLECTIONS. In *Herb. Manila, cf. sub* Philippine National Herbarium; numbered in the P.N.H. series, > 186 *nos.*

Gates, F. C.
(† 1954).
BIOGRAPHICAL DATA. Plant Sc. Bull. 1^2, Apr. 1955, p. 3.

Gaudichaud-Beaupré, Charles
LITERATURE. (4) Line 3 for *receuillies* read: recueillies.

***Gautt,** Paul A.
contributed some plants from *Leyte* (June *1953*) to the P.N.H. series (*cf.* Philippine National Herbarium).

***Gedeh,** H. v. d.
is cited as a collector of *Java* plants (Index Herb. pt II (2) p. 220). This is not a collector (*cf. sub* Houtsoorten Gedeh in Fl. Mal. I vol. 1).

Geerts, J. M.
took his Ph.D. degree in Amsterdam and *not* in Utrecht.

Geerts-Ronner, S. J.
married Dr J. M. (*not* H.) GEERTS.

Gilbert, G.
cf. sub Addenda in Fl. Mal. vol. 1 (1950).
COLLECTIONS. *Herb. Brussels:* at least plants collected in the Buitenzorg Botanic Gardens (*Culta Hort. Bog.*) *1917.*

***Gilliard,** Ernest Thomas
(1912, York, Pa, U.S.A.; x), ornithologist, Associate Curator of Birds, American Museum of Natural History. Honorary D.Sc., Wagner College, Staten Island.
He collected mainly birds and mammals in Venezuela, Brazil, Colombia, Panama, the Philippines, and New Guinea.
ITINERARY. *Papua and Mandated Territory of New Guinea. 1948.* Owen Stanley Range: south slope to 5500 ft *via* the Kokoda Track.—*1950* (Apr.–Aug.). Bismarck Mts (summit of Mt Wilhelm, 15.000 ft), Kubor Mts, Hagen Mts (summit, 12.000 ft).—*1952* (March–Aug.). Mt Kubor, Mt Hagen, Baiyer Valley.—*1953–54.* Middle Sepik River and Chambri Lake (Dec.–Apr.); Victor Emanuel and Hindenburg Mts (Apr.–July, 1954), making zool. coll. between 4000 and 8500 ft.—*1956.* N. coast of New Guinea from foothills of Adelbert Mts to Finisterre Mts (sea-level to 2000 ft, May and June); Mt Hagen (July), 5000–9000 ft.
COLLECTIONS.[1] *Herb. Arn. Arb.:* plants from Mts Wilhelm and Hagen, coll. *1950.*
LITERATURE. (1) *Cf.* Index Herb. II (2).

***Gilliland,** Hamish Boyd
(1911, Salisbury, S. Rhodesia, Africa; x), botanist, educated at Edinburgh University (B.Sc.); graduating D.Sc. at Witwatersrand University, Johannesburg. Appointed Professor of Botany at the University of Malaya in Sept. 1955.
His ecological studies will be published in the Gardens' Bulletin Singapore.
COLLECTING LOCALITIES. *1955 onwards* in *Singapore.*—*1956. Langkawi Islands* (July).
COLLECTIONS. Grasses (in 1957 *c.* 250) in *Herb. Sing.*; ecological material will be presented later on.

***Gilmore,** J.
collected at Chimbu, Western Highlands of the *Territory of New Guinea,* in Dec. *1952.*

Gjellerup, Knud
(† 1950).
BIOGRAPHICAL DATA. 'Den Danske Lagestand 1949–1957', 13th ed. 1957, p. 553 + portr.

Gleason, H. A.
retired in 1951.

Goebel, K. von
BIOGRAPHICAL DATA. Add: Ber. Deut. Bot. Ges. 68, 1955, p. 147–162.

Goldie, A.
COLLECTIONS. *Herb. Copenh.:* dupl. of *Scitamineae.*

Gonggrijp, Louis
(† 1957, Amsterdam, Holland).

***Gonzales**, Benjamin B.
collected at Montalban, Rizal Prov., *Luzon* (Feb. *1953*); in *Herb. Univ. Philip.:* > 60 *nos.*

***Gonzales**, L. G., *cf. sub* Philippine National Herbarium.

Goodenough, J. S.
COLLECTIONS. Also dupl. from *Malaya* in *Herb. Vienna.*

***Goodman**, *cf. sub* Philippine National Herbarium.

***Grant**, William Frederick
(1924, ?; x) was educated in McMaster University, Hamilton, Canada (M.A. Botany, 1949), and in the University of Virginia, Charlottesville, Virginia (Ph.D. Biology, 1953). At present Assistant Professor of Genetics, McGill University, Quebec, Canada. In 1953–55 he was in Malaya on a special Rice Breeding Program (Colombo Plan for the Canadian Government). Most of his spare time was spent on the cytology of some acanthaceous material.[1]

COLLECTING LOCALITIES. *Malaya* (staying Aug. 17, *1953*–Aug. 2, *1955*): at Fraser's Hill (June 20–July 4, *1954*); around Malacca, and at the Sungei Udang Forest Reserve in Malacca at various times in *1954–55*.

COLLECTIONS. About 100 or 200 specimens in *U.S. Nat. Herb. Wash.* (*cf.* Index Herb. II (2)).

LITERATURE. (1) W. F. GRANT: 'A cytogenetic study in the Acanthaceae' (Brittonia 8, 1955, p. 121–150).

***Grassl**, Dr Carl Otto
(1908, ?; x), of the U.S. Sugar Crops Field Station at Canal Point, Florida, returned medio 1957 from a sugar-cane expedition to *New Guinea.* He collected over 40 species of native *Andropogoneae.* A cytological study of these grasses will be made by R. P. CELARIER of Oklahama Agricultural and Mechanical College, in connection with the pastures research program of that institution. GRASSL will use some of the wild grasses in sugarcane breeding experiments.

Gravenhorst, read: Carl Otto.

***Gray**, Edward Charles Gordon
(1930, Blayney, N.S.W., Australia; x), graduate of the Australian Forestry School and Queensland University; after World War II Forest Officer at Bulolo, Territory of New Guinea.

COLLECTIONS. Plants from Bulolo Valley and Aiyura Distr., *NE. New Guinea*, and from Lake Kutubu along Mendi track in the Southern Highlands, *Papua* (May *1956*), numbered in the N.G.F. series (*cf.* New Guinea Forces).

Griffith, W.
COLLECTIONS. A set of dupl. was presented by Kew to *Herb. State Mus. Stockholm* in 1865.

***Griffiths**, John
author of a paper on worm-shells, discovered at an island off the NW. coast of Sumatra (Phil. Trans. vol. 96); at the time in the possession of a beautiful collection of corallines. Evidently *about 1800* a resident of Sumatra.[1]

COLLECTIONS. He sent living material from *Sumatra* to the *Calcutta Bot. Gard.*[2]

LITERATURE. (1) *Cf.* W. MARSDEN: 'The History of Sumatra' (1811, p. 121, 122).
(2) *Cf.* ROXBURGH, Hort. Beng. 1814.

Grim, Herman Niclas (or Nicolaj)
the more exact name of HERMANUS NICOLAAS GRIMM (*cf.* Fl. Mal. vol. 1). His birth-place Wisby at the time was under Denmark. He studied medicine at Copenhagen, and became M.D. in Holland; in 1666 pest physician in Holland (? visited Batavia), in 1671 hospital doctor at Batavia; at least from 1672–75 at Colombo, Ceylon; from 1677–81 in the employ of the Dutch E.I.C. in Java once more. He practised for some time at Nürnberg in Germany (according to KROK in 1680, but he was on the muster-roll of''t Lant van Schouwen', sailing from Batavia Dec. 18, 1681!). From 1683 onwards he practised in Sweden, finally (1710) as pest physician at Stockholm.

According to E. FRIES he was the first Scandinavian who studied extra-European vegetation.[2]

COLLECTIONS. He sold his Indian collections to the Collegium medicum, *Stockholm*, for 80 'riksdalers'.[3]

LITERATURE. (1) Add: H. N. GRIM: 'Thesaurus medicus Ins. Ceylaniae *etc.*' (Bataviae 1677; incl. a catalogue of Ceylon plants).
(2) E. FRIES, Bot. Utfl. 3, 1864, p. 42.
(3) See letter from GRIM to Z. WATTRANG, dated Sept. 10, 1686 (in Brefsamling Svensk. Kungl. Akad. vol. 15, p. 794 seq.).

BIOGRAPHICAL DATA. Add: E. FRIES, Botaniska Utflygter 3, 1864, p. 41–42; KROK, Bibl. Bot. Suec., p. 246–247.

Grimm, Hermanus Nicolaas, *cf.* GRIM, Herman N.

***Grönda(h)l**, Carl Fredric
(1760, Åbo, Finland; 1816, Stockholm, Sweden) had from his youth onwards a special liking for

natural history. In 1781 a student at Åbo, where he also attended medical courses; in 1786 to Stockholm, surgical cand. in 1787; from 1789–90 during a war hospital doctor in Finland, subsequently accompanying two voyages to East India as a ship's surgeon. In 1795 appointed court physician at Stockholm, in 1800 M.D. at Åbo, and probably from at least Nov. 1803 at Stockholm again.[1]

A correspondent of A. J. RETZIUS and C. P. THUNBERG.[1] He asked the latter to intercede for him with the Swedish East India Company. In 1797 he asked THUNBERG whether it would be possible to get a doctor's title for his collections, of which the first set was presented to the Uppsala Museum and 'hopes TH. won't take the question ill'.

The insect *Tortrix gröndaliana* was named after him.

ITINERARY. Evidently accompanying two *East India* voyages of the Swedish East India Company between end *1790* and end *1795*. From the collections at Lund it seems that he also visited S. America.

COLLECTIONS. From his letter (dated Stockholm, April 1797)[1] one would derive that his first set was presented to *Uppsala*, but I myself did not see many specimens in the THUNBERG herbarium. Numerous specimens in *Herb.* RETZIUS (= *Lund*), at least from Cap Verd, *Ind. Or.*, the Cape, Ile de France, China, and Amer. Merid. No sheets marked Java were seen by me, so it is still doubtful whether he collected in the Malaysian region.

LITERATURE. (1) MS letters to THUNBERG in Library University Uppsala, written between 1788 and 1807.

BIOGRAPHICAL DATA. SACKLÉN, Sveriges Läkare Historia 1, 1822, p. 419–421.

Groenhart, Pieter

In 1951 leader of the biological group of an Indonesian Moluccan expedition (itinerary *etc. cf. sub* D. R. PLEYTE), in 1953 leader of an expedition to Sumatra West Coast (itinerary *etc. cf. sub* VAN BORSSUM WAALKES), in 1954 of an expedition to Bantam (itinerary *etc. cf. sub* ADELBERT). At the end of 1954 he retired on age limit and returned to Holland.

COLLECTIONS. *Herb. Bog.:* lichens collected on above-mentioned expeditions.

***Guerrero** Jr, U., *cf. sub* Philippine National Herbarium.

Guggitz, M.

COLLECTIONS. *Herb. Vienna:* plants from *N. Borneo* and *Poelau Datok* (off the coast of W. Borneo!).

***Guia**, B. I. S. de

collected at Antipolo, Rizal Prov., *Luzon* (Dec. *1953*), in *Herb. Univ. Philip.*

***Gull**, B.

collected *Cassia fistula* at Coepang (Kupang), *Timor* (Nov. 24, *1867*); specimens with *Herb.* F. v. MUELLER in *Herb. Melbourne.*

Guppy, H. B.

COLLECTIONS. Add: Also in *Herb. Brit. Mus.*, chiefly ferns.

***Gutierrez**, Hermes

Botany Aid and Botanical Collector, National Museum, Manila, Philippines.

COLLECTING LOCALITIES. *About 1957. Luzon:* Irosin and Mount Bulusan, Sorsogon Prov.; Manila and suburbs.

COLLECTIONS. *Herb. Manila*, numbered in the P.N.H. series (*cf.* Philippine National Herbarium).

***Gutteridge**, Dr

collected at Merauke, *S. New Guinea*, orchids and odd things in *1943*; in *Herb. Brisbane*.

***Gyldenstolpe**, Sofia Margareta Emilia (Greta) Heijkenskjöld

(1894, Skinnskatteberg, Sweden; x), married Count NILS C. G. F. GYLDENSTOLPE in 1917. She was interested in botany since childhood and accompanied her husband on a zoological expedition to New Guinea.[1]

COLLECTING LOCALITIES. *1951. E. New Guinea:* Mt Hagen District (Aug.–Nov.), bivouacs in Wahgi Valley (*c.* 1600 m), at Nondugl (*c.* 1600 m), and in the Wahgi Mts near Weiga (Oct. 1–3, *c.* 2300 m).

COLLECTIONS. *C.* 130 species in *Herb. State Mus. Stockholm.* Ferns identified by Dr ALSTON, phanerogams by Dr VAN STEENIS. Besides those she collected insects, mosses,[2] and lichens in New Guinea.

LITERATURE. (1) A popular account of the expedition will be published in Sweden under the joint authorship of her and her husband under the title 'Orört land' (Wahlström & Wildstrand, Stockholm).

(2) E. B. BARTRAM: "Additional mosses from Northeast New Guinea" (Svensk Bot. Tidskr. 47, 1953, p. 397–401).

Haan, G. A. L. de

later economic co-ordinator of Prov. Maluku (= Moluccas).

COLLECTIONS. He made a sample collection in *Halmaheira* of some 50 plant specimens. As the collection got a poor judgment, he probably abolished the original plan of professional collecting.

***Haan**, Raphaël den

(1921, De Rijp, N.H., Holland; x), official in West New Guinea from end Dec. 1949 onwards. About 1955 District Officer at Enarotali.

COLLECTING LOCALITIES. *West New Guinea:* Mt Dejai (3000 m) near the Wissel Lakes.

COLLECTIONS. 4 *nos* from the summit of Mt Dejai, inserted in RAPPARD's collection (see there).

***Haas**

COLLECTIONS. In Herb. Dr J. BRAND (now *Herb. Leyden*): some weeds from Klaten (coll. *1935*), *leg.* HAAS.

***Haas,** R. S.
collected in *New Britain*, Bismarck Archipelago, in Feb. *1945*; numbered in the N.G.F. series (*cf.* New Guinea Forces).

***Hachisuka,** Marquis Masauji
(1903, Tokyo, Japan; 1953, Atami, Japan), ornithologist who after school years in Japan, was educated at Cambridge University (1922–27), and returned home after several months of travel through the United States, Canada, and Hawaii. In later years he travelled extensively in Europe, Africa, Korea, and China, and conducted an expedition to the *Philippines* in *1928–29*.

Author of numerous articles and books on birds[1]; D.Ph. of India, D.S. of the University of California and Hokkaido.

COLLECTIONS. Some ferns specimens on Mt Apo, *Mindanao* (P.I.), in Feb. *1929*. Specimens in *Herb. Brit. Mus.*

It is possible that he collected ferns only.

LITERATURE. (1) *Cf.* Tori 13, *no* 63, 1953, p. 8, 34–47.

BIOGRAPHICAL DATA. Memorial Number, Tori (Bull. Ornith. Soc. Japan) 13, *no* 63, 1953, p. 1–134, portr., incl. Engl. necrology on p. 6–8.

Haenke, Thaddäus Peregrinus Xaverius
Add: studied botany at Prague from 1780–86, and in Vienna with J. N. VON JACQUIN from 1786–89.

Author of several MSS, now mainly in the National Archives at Buenos Ayres and the Bot. Inst. Madrid. Some of the later MSS, relating to S. America, were published there. The MSS in Madrid consist of 12 bound volumes and quantities of loose papers, now being arranged by the librarian (Mr A. H. G. ALSTON *in litt.*). They contain data belonging to the specimens, some drawings (partly in colour), and some scraps of specimens.

ITINERARY. *1792.* On the stay in the *Philippines* the following additional information: *Luzon*, visiting Sorsogon (March 10); after anchoring near Manila (27), HAENKE visited the provinces of Pampanga, Ilocos, Cagayan and Pangasinan; June 20 joined by NÉE, who had visited before then the provinces of Albay, Camarines, Tayabas and Laguna; from mid-Sept. at Laguna de Bay for investigations on cinnamon, visiting Taal Volcano, *etc.;* leaving *Mindanao* on Nov. 22.

LITERATURE. (1) In the reference of A. MALASPINA, p. 210b first line from top read: 'corbetas' instead of 'corbatas'. At the end of the paragraph delete '(*non vidi*)'.

Add: J. F. REVELLO: 'Los artistas pintores de la expedición Malaspina' (Univ. B. Aires 1944) (*n.v.*).

BIOGRAPHICAL DATA. Bol. Soc. Esp. Hist. Nat. 54, Secc. Geol. 1957, p. 195–203.

***Haenseler**
collected *Cyperus pallescens* DESF. in *Malacca*; with *Herb.* SWARTZII in *Herb. State Mus. Stockholm*; plants from Spain and *Malacca* in *Herb. Copenhagen.*

***Hagasa**
collected at Quezon City, *Luzon* (Jan. *1954*); plants in *Herb. Univ. Philip.*

Hagerup, Olaf
in 1911 a student, M. Sc. in 1923. During his stay in *Sumatra*, he was a guest of his brother.

ITINERARY. Left Copenhagen June 23, *1916*; back there Oct. 22, *1917*. A few additional data on collecting localities: Prapat Toba (Nov. 25, *1916*); *P. Nias* (Jan. *1917*), and *P. Pagai* (Feb. *1917*), both situated west of Sumatra; Padang Sidempoan (Feb. *1917*).

COLLECTIONS. As during World War I the material was held up at Singapore, much of it mouldered and had to be thrown away after the Schweinfurth boxes were opened (oral inf.).

***Hallewas,** P. H., *cf. sub* Boswezen Nieuw Guinea.

Hallier, J. G.
COLLECTIONS. Line 12: *Monaco* must be substituted by *Munich.*

Hamilton, Francis Buchanan
ITINERARY.[1] Replace: He made 4 voyages as surgeon to an Indiaman, *viz*: in the 'Duke of Montrose' sailing May 22, 1785 for Bombay, returning May 1787; in the 'Duke of Montrose' to Bombay and China, *1788–89*, sailing by way of *Malaysia* (*cf.* Fl. Mal. vol. 1); in the 'Phoenix' to the Coromandel Coast and Bengal, 1791–92; in the 'Rose' to Bengal, 1794.

LITERATURE. (1) *Cf.* D. G. CRAWFORD, Hist. Ind. Medic. Service 1600–1913, vol. 2, London 1914, p. 62.

Hance, H. F.
COLLECTIONS. Add: A *Scirpus*, *no* 1365, from *Singapore*, in *Gray Herb.* In *Herb. Stockholm:* 249 dupl. China and Hongkong.

Hancock, W.
visited *Sumatra* and *Java* in *1892* (*not* 1862). He collected mostly ferns.

Haniff, M.
COLLECTIONS. Also dupl. in *Herb. Copenh.*
BIOGRAPHICAL DATA. Change 1932 into 1930.

Hanseler, see HAENSELER.

Hara, Keizô
(born 1909), made another collecting trip to *West New Guinea* with T. INOKUMA in *1943.* At the time Assistant in the Faculty of Agriculture, Tokyo Imp. University. In 1953 he was a technician in the Government Forest Experiment Station, Meguro, Tokyo.

Harreveld, Ph. van
(† 1957, 's Gravenhage, Holland).

***Hart,** Alexander John
(1928, Kojonup, W. Australia; x), Forest Officer, Port Moresby; graduate of the Australian Forestry School.

COLLECTIONS. Widespread collections in *Papua*, usually with M. F. C. JACKSON; numbered in the N.G.F. series (*cf.* New Guinea Forces).

Hartmann, C. H.
COLLECTIONS. Fern dupl. were also sent to CHR. LUERSSEN; *Scitamineae* to *Herb. Copenh.*

Hasan, see ALI & HASAN.

***Hasan I**
Indonesian employee of the Mountain Garden at Tjibodas, assisted A. M. NEERVOORT (see there) in collecting plants from *1947–49*.

***Havel,** Jacoslav Joseph
(1930, Stehelceves, Bohemia, Czechoslovakia; x) commenced high school in Prague, but left in 1948 for Germany and later Australia. In Australia he worked for the W.A. Forest Department, completing his high school education by correspondence. He studied forestry in Perth and Canberra, graduated April 1955, Dip. Forestry (Canberra), B. Sc. For. (W.A.). He joined the New Guinea Forest Department engaged on reafforestation in Bulolo Valley.

COLLECTING LOCALITIES. About *1955 onwards. Mandated Territory of New Guinea:* in Watut and Bulolo Valleys in connection with forestry activities.

COLLECTIONS. In the N.G.F. series, *Herb. Lae* (*cf.* New Guinea Forces).

***Heather,** William Aloysius
(1923, Ashfield, N.S.W., Australia; x), Regional Forest Officer at Rabaul (New Britain); graduate of the Australian Forestry School, Canberra, and Sydney University.

COLLECTIONS. Plants from Sogeri (*Papua*) and *New Britain* numbered in N.G.F. series (*cf.* New Guinea Forces), after 1945.

***Heberer,** Gerhard Richard
(1901, Halle/S., Germany; x), anthropologist, educated at the University of Halle/S. (D.Sc. 1924); University Assistant at Halle and Tübingen; in 1932 Private Lecturer there; from 1936 Extraordinary Professor in the University at Frankfurt/M.; from 1938–45 Professor of General Biology at Jena; since 1947 teaching anthropology at Göttingen.

He accompanied the expedition of RENSCH to the Lesser Sunda Islands in 1927 (*cf.* I. RENSCH-MAIER in Fl. Mal. I, 1, also for Itinerary).[1] Together with W. LEHMANN he undertook the anthropological part of the expedition and planned to make limnological studies besides.

COLLECTIONS. He evidently collected some plants, at least some duplicates in *Herb. Bog.* Diatoms were sent to VON FABER at Buitenzorg.

LITERATURE. (1) Author of some chapters in B. RENSCH: 'Eine biologische Reise nach den Kleinen Sunda-Inseln' (Berlin 1930); 'Die Inland Malaien von Lombok und Sumbawa' (with W. LEHMANN, Göttingen 1950).

BIOGRAPHICAL DATA. Wer ist wer? ed. 12, 1955.

***Hellendoorn,** van
collected plants in *Sorong*, W of New Guinea, Oct.–Dec. *1949*; in *Herb. Leyden*; mosses to Prof. VAN DER WIJK at *Groningen.*

***Hellwig,** F. E.
Pacific trader who accompanied some German expeditions because of his large experience with the natives; he made ethnographical collections.[1] In Nov. 1902 he was sent out to Wuvulu by the firm of HERNSHEIM & Co. at Matupi, and travelled with Dr DEMPWOLFF (see below). In July 1910 appointed at the 'Museum für Völkerkunde' in Hamburg as Overseer.

ITINERARY. *1902–04.*[2] *Südsee-Expedition* (Malaria expedition) with the fleet-surgeon Dr DEMPWOLFF o/b the schooner 'Gazelle' to *Wuvulu* and *Aua*, W of the Hermit Islands, N of former Kaiser Wilhelmsland. HELLWIG on *Wuvulu* till mid-Dec. *1902*, on *Aua* (Aug.–Dec. *1903*) and in *1904* once more to *Wuvulu.—1908–10. Hamburg Südsee-Expedition* in the 'Peiho' (*cf.* Dr G. DUNCKER).

COLLECTIONS. *Herb. Hamb.:* few plants, possibly partly together with Dr W. MÜLLER (see there); hardly of any value.

LITERATURE. (1) Author of 'Tagebuch der Expedition' (in G. THILENIUS, Ergebnisse der Südsee-Expedition 1908–1910, 1 Allg., 1927).

(2) *Cf.* PAUL HAMBRUCH: 'Wuvulu und Aua' (Veröff. Mus. Völkerk. Hamburg II, 1, 1908, 180 pp., pl. 1–37, many fig.; chapter on 'Flora und Fauna' p. 17–18).

BIOGRAPHICAL DATA. In HAMBRUCH *l.c.* p. 10–11; portr. in THILENIUS, Ergebn. Südsee-Exp. 1908–10, 1 Allg., 1927, pl. 1.

Henderson, M. R.
in 1948 he was appointed Assistant Director, and finally Director; in June 1954 he retired and settled at Aberdeen.

Author of 'Malayan Wild Flowers' (1949–54).

***Herbert,** Desmond Andrew
(1898, Diamond Creek, Australia; x), educated in the University of Melbourne (D.Sc.); Botanist and Plant Pathologist W.A. 1918–21; 1921–24 Professor of Plant Physiology, University of the Philippines; from 1924 at Brisbane University, successively as Lecturer, Associate Professor of Botany (since Dec. 1946), and Professor of Botany.

COLLECTIONS. He brought living *Philippine* plants to Sydney, *e.g. Begonia coccinea.*

BIOGRAPHICAL DATA. Who's who in Australia ed. 13, 1947.

Heringa, Jod
evidently the collector inserted under ANONYMOUS, HERINGA, and ? JODNER in Fl. Mal. 1. The

illegible name on the labels must be the abbreviation 'Jod Her.'. In 1870 he was a member of the 'Geneeskundige Vereeniging in Nederlandsch-Indië'.[1] In 1876 he is mentioned with the same unusual Christian name as a resident of Poerweredjo in E. Java.[2]

COLLECTIONS. > 439 *nos* from the vicinity of Padang, partly collected in *1869.*

LITERATURE. (1) *Cf.* Regeerings-Almanak voor Nederlandsch-Indië for 1870, p. 352. The suggestion I owe to Mr E. WESTERBEEK of the Documentation Department of the 'Ministerie van Zaken Overzee', The Hague.

(2) *Cf.* Nat. Tijd. N.I. 36, 1876, p. 429.

Herre, A. W. C. T.

In 1940–41 he went to Asia once more, visiting the Philippines and Malaya.

COLLECTING LOCALITIES. *Culion* (add: Apr. 22, *1931*).

BIOGRAPHICAL DATA. Who's who in America 26, 1950–51.

Herzog, Th.

The cited moss from the Finisterre Mts was *ex Herb.* HERZOG, and collected by an unnamed missionary of the 'Rheinische Mission'.

Heutz Jr, Johan Bastiaan van

In the Cyclopaedia (Fl. Mal. vol. 1) the 'van' was dropped.

Heyne (or Heine), Benjamin

(born Jan. 1, 1770, Döbra near Pirna, Germany) was educated at Dresden.[3a] According to recent information[8] he sailed from Copenhagen with I. G. KLEIN in Sept. 1790, arriving at Tranquebar Jan. 11, 1792. In Aug. 1793 the Rev. Mr JOHN of Tranquebar, at the request of Dr ROXBURGH, selected him as a suitable person to attend to the plantation at Samulcottah; in Sept. HEYNE arrived there from Tranquebar, and his appointment was approved of on Oct .4, 1793.[4] When ROXBURGH was ordered to proceed to Bengal, HEYNE was appointed, in March 1794, to "act as the Company's Botanist during the absence of Dr ROXBURGH".[5] He was, locally, appointed an Assistant surgeon on the Madras Medical Establishment on Apr. 30, 1799[6]; surgeon in Jan. 1807; the office of Company's Botanist at Fort St George held by HEYNE was abolished in May 1808. His furlough to Europe was granted in 1811 (sailing in 1812, *cf.* Fl. Mal. 1); in 1813, when in England, he was elected to the Linnean Society; he returned to Madras, where he arrived on March 30, 1815. In April of the same year appointed Botanist and Naturalist. A member of the Gesellschaft Naturforschender Freunde Berlin.

COLLECTIONS. Several dupl., possibly from India only, in the ROYLE collection in *Herb. Liverpool*; probably originally given to his friend Dr KLEIN who collected in Madras for the English E.I.C. During a visit to Liverpool Mr ALSTON discovered labels with KLEIN's handwriting.[7] Some dupl. from India with *Herb.* VAHL in *Copenhagen.*

LITERATURE. (3a) Inf. from the 'Archiv der Brüder-Unität', Herrnhut, Germany, Feb. 5, 1958, *in litt.*; the keeper of the records wonders whether HEYNE was qualified to call himself Doct. Med.. A copy of his birth certificate was provided by the Lutheran minister at Döbra b. Pirna.

(4) *Cf.* Madras Publ. Consultations 16 Aug. 1793 and *ibid.* 4 Oct. 1793 (inf. *in litt.* by Commonwealth Relation Office, London).

(5) *Cf.* Madras Publ. Consultations March 1794; Public letter from Madras, July 25, 1794; approved in Public Despatch to Madras 10 June 1795 (inf. as under (4)).

(6) *Cf.* Despatch to Madras 10 June 1801 (inf. as under (4)).

(7) *Cf.* Liverpool Bull. 6, *no* 3, 1957, p. 19–42.

(8) Dr H. MØLHOLM HANSEN *in litt.* 19.12.1957, citing from a MS of KAY LARSEN: 'Dansk-ostindiske Personalia and Data 1–3' (København 1912), and from letters and reports published in 'Neuere Geschichte der Evangelischen Missions-Anstalten zur Verkehrung der Heiden in Ostindien' vols 46, 48, 50, and 61, and from unpublished letters to VAHL, HORNEMANN, and JACOB GUDE in Copenhagen.

BIOGRAPHICAL DATA. Add: Bot. Tidsskr. 52, 1955, p. 56–57; HARMS in E. & P. Pfl. Fam. 2nd ed. 19^1, 1940, p. 117.

Hildebrand, F. H.

retired in Sept. 1954 and went to Holland.

After the war he published numerous tree lists of various islands and districts of Indonesia, mimeographed by the Forest Research Station at Bogor.

Hillebrand, W.

BIOGRAPHICAL DATA. Asa Gray Bull. n.s. 3, 1957, p. 193–198.

***Hislop, J. A.**

(1912; x), arrived in Malaya September 1, 1948; in 1953 Game Warden for East Region, Pahang. He took the probationer gardener's course at Edinburgh, Royal Botanic Garden.[1]

COLLECTIONS. *Herb. Sing.:* plants from G. Padang (4000 ft) in Trengganu, *Malay Peninsula* in July *1952*, and some small odds and ends.

LITERATURE. (1) Author of: 'Journey to Ulu Tekai' (Mal. For. 19, 1955, p. 64–70).

***Hjortberg, Gustaf Fredrik**

(1724–76), chaplain who accompanied 3 voyages of the Swedish East India Company to China between *1747–53*. From letters to LINNAEUS it is evident that he made drawings and collected at least zoologically. He made a diary on the voyage 1748–49.

Later minister at Wallda, N. Halland.

COLLECTIONS. *Herb. R. Acad. Sc. Stockholm* (*cf.* Index Herb. II (2)), probably with the BERGIUS herbarium. Evidently no localities known, but possibly from the China voyages.

***Ho,** A.

COLLECTIONS. *Herb. Arn. Arb.:* plants from *Br. N. Borneo* (*cf.* Index Herb. II (2)).

Hoed, G. den

COLLECTIONS. *Herb. Leyden:* some tens of *W. Java* dupl. from Poentjak Pass, Tjikopo, Telaga Warna, Djakarta, Sukabumi, Pasar Ikan, *P. Purmerend* (Bay of Djakarta), *etc.*, all of them collected in *1948.*

HOOGLAND

***Hoffman,** Johannes Paulus

from Doesburg (Gelderland), Chief Surgeon of the Dutch East India Company, sailed in the 'Leymuyden' to Batavia in June 1767, arriving March 7, 1768. Till Feb. 1769 serving in the 'Oudcarspel' and subsequently stationed at Batavia; since Sept. 1772 town-apothecary and discharged from the Company's service. In 1779 he returned to the Netherlands.

He evidently promised N. L. BURMAN to make botanical and zoological collections for him[1], but as yet there is no evidence that he actually collected.

He was also a correspondent of P. J. BLADH (see there), but in that case there neither is evidence of his having collected plants in Java.

LITERATURE. (1) *Vide* MS concept letter to HOFMAN, Med. Dr. Batavia, of BURMAN, dated Apr. 30, 1768 (S 48b, p. 26, in Un. Library Amsterdam), in which he reminds him of his promises and offers him his 'Flora indica'.

Hoffmannsegg

COLLECTIONS. *Java* dupl. in *Herb. Vienna.* Evidently including plants from primeval forest.

Holmberg, P. J.

COLLECTIONS. In *Herb. Sing.*

Holstvoogd, C.

COLLECTING LOCALITIES. *W. Java.* Add: Malabar (*1939*), Sindanglaja (July 5, *1939*), Pulusari G. Kasur Estate (*1940*), Tjitèrè (Oct. 21, *1949*), Muara Angké (Dec. 12, *1949*).

COLLECTIONS. About 500 *nos* presented to *Herb. Leyden* (1953).

Holttum, R. E.

From 1949–54 Professor of Botany, Raffles College, University of Malaya; in 1951 or 1952 D.Sc. at Cambridge, and in 1954 honorary doctor in the University of Malaya; in Nov. 1954 he retired and settled at Kew.

In 1953 and 1954 he wrote books on plant life, orchids, and gardening in Malaya.

In Nov. *1957* he arrived at Bogor, *Java*, for a stay of some months, working in the Herbarium, and certainly occasionally collecting plants.

Co-editor of Flora Malesiana for the ferns.

Hombron, J. B.

LITERATURE. (2) line 2, read: montagnes d'Amboine *etc.*

Hoogerwerf, A.

COLLECTING LOCALITIES. Add: *1953.* Lesser Sunda Islands: the islands of *Komodo*, *Padar*, and *Rintja*, off W. Flores (May 21–July 6).[4]

COLLECTIONS. Add: *Herb. Bog.:* 21 plants from *P. Dua* (Bantam) (pres. *1952*); coll. from *Komodo etc.*

LITERATURE. Add: (4) A. HOOGERWERF: 'Rapport over een naar Komodo, Padar en Rintja (Kleine Sunda Eilanden) gemaakte dienstreis van 21 Mei tot 6 Juli 1953' (mimeographed, Bogor, April 1954, 253 pp., 91 photogr.).

***Hoogland,** Ruurd Dirk

(1922, Leeuwarden, Fr., Holland; x), botanist, educated at Groningen and Leyden Universities; Ph.D. degree Leyden 1952; Botanist Flora Malesiana Foundation, 1949–52; since 1952 Systematic Botanist with the Commonwealth Scientific and Industrial Research Organisation, Division of Land Research and Regional Survey, Canberra, A.C.T.

COLLECTING LOCALITIES & ITINERARIES. **1952.** *Malay Peninsula: Singapore* (Oct. 30–Nov. 2), and Kepong (2–6), no collections; *W. Java:* Bogor (7–27), visiting Djakarta, Bandung, Tjibodas, *etc.* (coll. *nos* 2883–3038).—**1953.** *New Guinea*, with J. S. WOMERSLEY (see there) visiting various parts of the *Territories of Papua and New Guinea* (March 14–July 5; coll. in the N.G.F. series; cryptog. *nos*

3175–3230); with the 4th Archbold Expedition (*cf.* L. J. BRASS) at Menapi, *Papua* (Apr. 17–May 2); in the Northern Distr. of Papua, occasionally assisted by A. G. FLOYD, G. MCDONALD, B. W. TAYLOR, and J. S. WOMERSLEY (see those) (July 5–Oct. 4), collecting from Popondetta (July 8–18, *nos* 3231–3385; 27–Aug. 4, *nos* 3441–3486; Aug. 30–31, *nos* 3734–3752), Iwaia (July 20–24, *nos* 3386–3440), Horata (Aug. 5–13, *nos* 3487–3618), Patikiari (14–19, *nos* 3619–3683), Divinikoari (20–23, *nos* 3684–3733), Anonda (Sept. 2–14, *nos* 3753–3895), Kokoda (17–28, *nos* 3896–4040); *Philippines* (Nov. 14–Dec. 8): attending 8th Pacific Science Congress, Manila, collecting at various localities in *Luzon* (*nos* 4041–4143).—**1954.** *Papua* (June 1–Oct. 4): Northern and Milne Bay Districts, collecting from Wanigela (June 21–26, *nos* 4144–4202; July 5–10, *nos* 4256–4267; Sept. 2, *nos* 4636–4638; Sept. 22–Oct. 1, *nos* 4774–4841), Guruguru (June 28–July 3, *nos* 4203–4255), Tapio (July 12–25, *nos* 4268–4376), Aku (27–Aug. 1, *nos* 4377–4430), Lake Ridubidubina (Aug. 3–20, *nos* 4431–4519), Budi Barracks (Aug. 23–Sept. 1, *nos* 4520–4635), Medino (6–17, *nos* 4639–4773); *West New Guinea* with P. VAN ROYEN (see there), all collections under his numbering (Oct. 6–Nov. 11).—**1955.** *Territory of New Guinea* (May 14–Sept. 28): Madang Distr., collecting in Gogol and Ramu Valleys from Madang (June 2–11, *nos* 4845–4876), Mawan (14–25, *nos* 4877–4936), Utu (28–30, *nos* 4937–4957), Jal (July 7–15, *nos* 4958–5001), Usino (21–26, *nos* 5002–5035), Faita (July 28–Aug. 5, *nos* 5036–5058), Koropa (9–13, *nos* 5059–5090), Bembi (16–20, *nos* 5091–5130; Sept. 3–16, *nos* 5171–5233), Gurumbu (Aug. 24–Sept. 1, *nos* 5131–5170).—**1956.** With R. PULLEN in the *Territory of New Guinea:* Dunantina, Finintegu, and Sosomepari (June 6–13, *nos* 5241–5325); Centr. Range, E. Highland: Miruma (Upper Asaro Valley, June 15–20, *nos* 5326–5411), Daulo camp (Asaro-Mairi Divide, ± 8000 ft, June 22–30, *nos* 5412–5506), Mt Kerigomna (± 10.000 ft, July 4–12, *nos* 5507–5630), Lake Aunde (Mt Wilhelm, ± 10–15.000 ft, July 18–26, *nos* 5631–5791); W. Highland: Wankl near Mt Hagen (± 7–8000 ft, Aug. 8–18, *nos* 5792–5970), near Mt Hagen station (Aug. 21–22, *nos* 5971–6000), Tomba on S. slopes of Mt Hagen (± 8–9000 ft, Aug. 27–Sept. 7, *nos* 6001–6175), wide area round Mt Hagen (*e.g.* Korn, Banz, Baiyer River, Sept. 10–22, *nos* 6176–6277).

COLLECTIONS. *Herb. Canberra* (*C.S.I.R.O.*): *c.* 2250 *nos;* dupl. in *Herb. Lae, Leyden, Arn. Arb., Kew, Brit. Mus., Brisb., U.S. Nat. Herb. Wash., Melbourne, Sydney, Bogor, Manila.* and *Geneva.*

Wood samples deposited with the division of Forest Products, C.S.I.R.O., Melbourne; Dept of Forests, Lae; and C.S.I.R.O. Herb. Canberra.

***Hoogstraal,** Harry

(1917, Chicago, Ill., U.S.A.; x), zoologist, educated in the universities of Chicago, Illinois, and London.

Leader of the Chicago-Philippine Expedition in 1946–47[1], during which EDAÑO (see there) did most of the botanical collecting (*cf.* also ALSACID, CASTRO, CELESTINO). At present Head of the Department of Medical Zoology of a U.S. Naval Medical Research Unit in Cairo, Egypt.

COLLECTIONS. A few numbers in *Luzon* and *Mindanao*; numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium); also in *Herb. Chicago.* In 1939–41 he collected in Mexico.

LITERATURE. (1). H. HOOGSTRAAL: 'Philippine Zoological Expedition 1946–1947. Narrative and Itinerary' (Fieldiana: Zool. 33, *no* 1, 1951, 84 pp., pl. 1–7, textfig. 1–7).

HOSOKAWA

Hornemann

mentioned as collector in the Addenda, Cyclopaedia of Collectors (Fl. Mal. 1) p. 604, did *not* collect himself in Malaysia, but the plant mentioned was from *Herb.* HORNEMANN (= *Copenhagen*), owned formerly by JENS WILKEN HORNEMANN (1770–1841), editor of the 'Flora Danica', who from 1801 was lecturer in botany at Copenhagen University, and since 1817 professor there.

Hornstedt, C. F.

COLLECTIONS.[3]

LITERATURE. (3) C. G. G. J. VAN STEENIS: 'Account of Javan plants collected by C. F. HORNSTEDT in 1783–1784' (Act. Hort. Berg. 15, 1949, p. 39–43, fig. 1).

Horsfield, Th.

COLLECTIONS. Some dupl. from *Java* in the ROYLE collection, *Herb. Liverpool.*

Hosokawa, Takahide

(1909, Kumamoto, Japan; x), botanist, educated at the Botanical Institute Taihoku Imp. University, Formosa (M.Sc. 1932, D.Sc. 1945). From 1932–43 respectively subassistant, assistant, and lecturer, in Taihoku Imp. University; in 1947 lecturer at Kumamoto Women's College, in 1948 Professor in the same College; in 1949 nominated Assistant Professor of Kyushu University Fukuoka, in 1951 Professor there.

In the years 1933–38 he paid several visits to Micronesia, studying the flora of Palau, Yap, Truk, Ponape, Kusaie, the Mariannes, and Jaluit (Marshall), resulting in several papers.[1]

COLLECTING LOCALITIES. In Malaysia: on Mt Apo, *Mindanao, P.I.* (a week in Sept. *1936*).[2]

COLLECTIONS. Complete set (*c.* 4500 sheets) in *Herb. Taiwan Univ., Taipei;* about 3000 sheets of dupl. in *Herb. Kuyshu Univ.* The collection on Mt Apo about 1600 sheets.[3]

LITERATURE. (1) *Cf.* lists in MERRILL, A Botanical Bibliography of the Islands of the Pacific (1947), and in SACHET & FOSBERG, Island Bibliographies (1955).

(2) T. HOSOKAWA: 'On the alpine heath in the Tropics of Eastern Asia' (Botany & Zoology 10, 1942, p. 723–728).

(3) T. HOSOKAWA: 'A preliminary note on the botanical trip on Mt Apo, Philippines' (Trans. Nat. Hist. Soc. Form. 30, 1940, p. 333–336).

Hosseus, C. C.

In 1912 he emigrated to The Argentine, and made botanical explorations in Patagonia and The Argentine from 1913–15, resulting in numerous papers; in 1916 appointed Professor of Botany at Cordoba University and Director of the Botanical Museum there; resigning in 1946.

New plants from Siam were described by himself.

COLLECTIONS. Also dupl. in *Herb. Munich*; 1 map of Siam dupl. (160 *nos*) in *Herb. Hamb.*; evidently the total collection numbered > 512.

BIOGRAPHICAL DATA. Ber. Deut. Bot. Ges. 68a, 1955, p. 303–306, with portr. and bibliogr.

Houtsoorten Gedeh

Line 10 read: *Ternstroemia houtsoortiana.*

***Howison**

is cited as the collector of *Urceola elastica* in *Penang* (*cf.* FAUJAS-SAINT-FOND in Ann. Mus. Hist. Nat. Paris 1, 1802, 271).

***Hughan,** A.

COLLECTIONS. *Herb. Melbourne: New Guinea* plants (*cf.* Index Herb. II (2)).

Hunger, F. W. T.

(† 1952, Voorschoten, Holland).

BIOGRAPHICAL DATA. Ber. Deut. Bot. Ges. 68a, 1955, p. 33–36, incl. bibliogr.

Hunter, William

M.A. in 1777, M.D. in 1805, of Marischal College, Aberdeen.

BIOGRAPHICAL DATA. CRAWFORD, Hist. Ind. Med. Serv. 1, 1914, p. 207.

***Husni Karim**

(1929, Padang, W. Sumatra, Indonesia; x), during 1956 Student-Assistant of Dr W. MEIJER, Faculty of Agriculture, Pajakumbuh.

COLLECTING LOCALITIES. *Cf. sub* AMIRUDDIN.

COLLECTIONS. Made with AMIRUDDIN (see there), and SAFRI SJATER, under the joint name of Kongsi Tiga.

***Ibalo,** L., *cf. sub* Philippine National Herbarium.

***Icarañgal,** O.

student, Forestry College, University of the Philippines, Laguna.

COLLECTING LOCALITIES. *About 1956–57. Luzon:* Mt Makiling, Laguna Prov.; Masawa, Quezon Prov.

COLLECTIONS. *Herb. Manila*, numbered in the P.N.H. series (*cf.* Philippine National Herbarium).

Idjan

COLLECTING LOCALITIES & COLLECTIONS. In *Ternate* and *Halmaheira* he made a collection with MOCHTAR BIN MUSA in *1951*, *viz* 399 *nos* of which part was in a bad state and not preserved; in *Herb. Bog.* (for itinerary *cf. sub* D. R. PLEYTE).— In *1953* he accompanied an expedition to *Sumatra West Coast* (itinerary *cf. sub* VAN BORSSUM WAALKES), but to my knowledge all collected plants were incorporated in the number series of the latter.

***Inam,** D., *cf. sub* Boswezen Nieuw Guinea.

***Inger,** Robert Frederick

(1920, St Louis, Mo, U.S.A.; x), zoologist, educated at University of Chicago. Associated with the Chicago Natural History Museum since 1940; Assistant Curator Division of Fishes since 1949.

In 1950 he conducted (with D. DWIGHT DAVIES) the Bornean Zoological Expedition of the Chicago Natural History Museum, collecting and studying especially fishes and amphibians.

ITINERARY & COLLECTIONS. *Cf. sub* D. DWIGHT DAVIES. The specimens were collected in connection with ecological studies.

***Ingram,** K.

contributed to the N.G.F. series (*cf.* New Guinea Forces) during World War II, 1939–45.

Inokuma, Taizo

(born 1904).

COLLECTING LOCALITIES. *1943. Dutch New Guinea.*

***Irving,** Earl

collected 8 plants in the *Palawan* group (June *1948*), numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium).

***Isidro,** R. F., *cf. sub* Philippine National Herbarium.

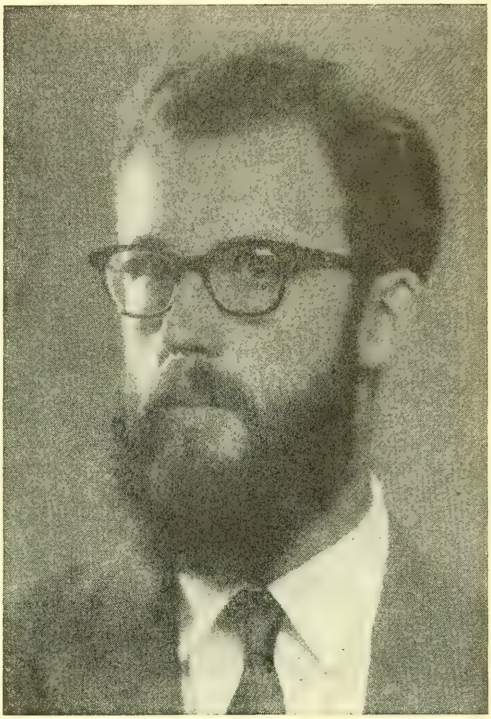
***Ismaël**
(1933, Pajakumbuh, W. Sumatra, Indonesia; x), Student-Assistant for forest botany at the Faculty of Agriculture, Pajakumbuh.
COLLECTING LOCALITIES. *W. Sumatra. 1957.* During trip with W. MEIJER (see there) in the Taram-Tjampago region (Aug.).
COLLECTIONS. *Herb. Fac. Agr. Pajakumbuh,* > 86 *nos*; living plant of *Cypripedium curtisii* in *Hort. Pajakumbuh.*

***Iwanggin,** Gerrit
(1928, Kaipoeri, Japen Isl. N of New Guinea; x), since 1953 at Hollandia, attending the Bosbouwschool there, and in the employ of the Forestry Service.
COLLECTING LOCALITIES. *1957. North New Guinea:* in the vicinity of Hollandia, *e.g.* at Hamadi, and Polimac; Babrongko (Lake Sentani) (Apr. 3–9); *W. New Guinea:* Warsamson (E of Sorong) (Aug. 19–Sept. 17).
COLLECTIONS. > 200 *nos* in *Herb. Manokwari*; dupl. in *Leyden*; numbered in the B.W. series.

Jack, W.
COLLECTIONS. A valuable evaluation of JACK's genera and species was published by Dr MERRILL.[11]
In 1953 Dr J. M. COWAN methodically searched the *Herb. Edinburgh* for JACK specimens and found 64 in all (incl. 1 dupl.). No record of how and when they were acquired was found, but it is presumed that these are the specimens sent to Lady HASTINGS (*cf.* Cyclopaedia, Fl. Mal. vol. 1); they were probably in the University Herbarium which was transferred to the Garden in 1918.[12]
There is a possibility that some of the paintings from RAFFLES's collection (see there) may be helpful in interpreting JACK's Sumatran species.
LITERATURE. (11) E. D. MERRILL: 'William Jack's genera and species of Malaysian plants' (J. Arn. Arb. 33, 1952, p. 199–250, 1 pl.).
(12) J. M. COWAN: 'Some information on the Menzies and Jack collections in the Herbarium, Royal Botanic Garden, Edinburgh' (Not. R. Bot. Gard. Edinb. 21, 1954, p. 219-227).

***Jackson,** Michael Frederick Carew
(1915, Cottesloe, W. Australia; x), Forest Ranger, Port Moresby, made widespread collections from *Papua*, numbered in the N.G.F. series (*cf.* New Guinea Forces) after World War II; partly together with G. McDONALD.

***Jacobs,** Marius
(1929, Rotterdam, Holland; x), botanist, educated at Leyden University (B. Sc. 1954); Assistant of the Flora Malesiana Foundation, and in Feb. 1955 appointed on the staff of the Bogor Herbarium, Java.
COLLECTING LOCALITIES. *1955. W. Java:* Udjung Kulon (Aug. 1–7), Tjibodas Mountain Gardens (22–27).—*1956. Centr. Sumatra,* together with W. MEIJER (who made separate collections)[1]: Kerintji Distr., G. Kerintji (July 23–30), G. Tudjuh (Aug. 2–7), Danau Bento *etc.* (8–10); Pajakumbuh, Harau ravine (15), G. Sago (18–19).—*1957. E. Java,* Besuki Res.[2]: G. Watangan near Puger (May 10), *Nusa Barung* (11–13), G. Raung (S. slope, Gunungsari, 17–19; SE. slope, Baju, 21), G. Merapi (NW. slope, Mailang, 22), G. Baluran (S. foot, 24–25), Blambangan Peninsula (W. part, 28–31, June 2), Djati Ikan Peninsula (N of Blambangan; 2), Kali Pait (N of Gradjagan Bay, 3).


JACOBS

COLLECTIONS. *Herb. Bog.*, including 270 *nos* from Kerintji, 100 *nos* from Pajakumbuh, and 292 *nos* (4701–4992) from *E. Java.*
LITERATURE. (1) Report in Reinwardtia 4, 1958, in the press.
(2) Report in Blumea Suppl. 4, 1958, in the press.

Jaheri
ITINERARY. *1901.* Add: *Misoöl.*

***Jannet,** Monsieur
is mentioned as a donor of plants from the Moluccas (1810), the Philippines (1811), Mauritius (1810–11), Madagascar and the S. Sea Islands (1811), in ROXB. Hort. Beng. 1814. I assume that the plants were *not* collected by himself, but were sent from a botanic garden.

***Jarissetouw**, M., *cf. sub* Boswezen Nieuw Guinea.

Jensen, Hj.

(† 1948, Copenhagen, Denmark). From 1933–36 besides Professor of Plant Physiology at the Veterinary and Agricultural College at Copenhagen.

KALKMAN

Collecting localities. *1900. W. Java*, add: Depok (Dec. 9).—Localities taken from his dupl. labels of the Mortensen *Expedition: 1922. W. Java:* Hort. Bot. Bog. (Jan. 16–18, *nos* 1–18); *Ambon:* Gelala (Feb. 22–March 3); *Saparoea* (March 3–10); *Key* (= *Kai*) *Islands:* Toeal (*Klein Key*) (17–26); *Groot Key:* G. Daäg (Apr. 2–6), Elat (9–10); *Klein Key:* Toeal (12–15); *Aru Islands:* Dobo (18–20), Sg. Workai (21), Papakula (22), Manumbai (23); ? *Klein Key:* facing Toeal (29), Ohoitiel (May 2–3); *Groot Key:* W. Elat (8), Jamtil (9); *Klein Key:* Toeal (11), Godan (12), Ohoidir (13–16), Langoer and Gelanit (16), Toeal (18); *Centr. Java:* pasar (= market) at Wedi (near Klaten), herbs! (June); *ditto* from the Pharmacological Museum at Buitenzorg and Pasar Bogor (19–24); Hort. Bot. Bog. (June 26, July 5), Kultuurtuin (July 3).

Collections. From the *Kai Expedition nos* 19–260 (cryptogams) and 2–416 (s or h) (phanerogams). He collected many *fl.* and *fr.* in alcohol.

Biographical data. Add: Entom. Meddel. 15, 1936, p. 361–362, fig. 104, portr.; J. Sc. Res. 1, 1952, p. 228 (from Naturw. Rundschau); Årsskrift Kgl. Veter.-Landbohøjskole 1949, p. 205–210, with portr. and list of biogr. refer.

Jensen, (Mads) Marius (Rasmus)

(1858, Copenhagen, Denmark; 1916, Denmark), in 1880 cand. pharmacy, with a lively interest in zoology; from 1880–82 zoological assistant at the Zoo. Prominent socialist, founder of children's homes.

Collecting localities. *1901.* Add: *Sumatra East Coast*, Deli (Oct. 1); *Singapore Isl.:* Bt Timah.[1]

Collections. In *Herb. Copenhagen:* some hundreds of specimens.

Literature. (1) V. A. Poulsen: 'Pentaphragma ellipticum sp. nov.' (Vidensk. Medd. Naturh. Foren. Københ. 1903, p. 319–331, pl. 4–5).

Biographical data. Entom. Meddel. 15, 1936, p. 360–361, fig. 103 portr.

Jensma, J.

Collections. The plant collection mentioned in the Cyclopaedia (Fl. Mal. vol. 1), was not collected by Jensma himself, but was a show collection for educational purposes prepared by the Buitenzorg Herbarium. In 1955 the collection was presented to *Herb. Leyden.*

Jeppesen, Hans Lau (*not* 'Leu')

(1892, Ulbølle, Fyn, Denmark; x), planter, in the employ of the Danish East Asiatic Company, from 1916–38 on Mount Austin Rubber Estates, Johore, when he retired to Denmark; returned to Malaya as Manager on Timor Estate in 1946; left for good in 1947, settling in Copenhagen.

Collections. *Herb. Copenh.:* 61 *nos* from S. Johore (*Malaya*), plants from Siam, and 15 from the *Philippines.*

Jespersen, Julius

(† 1950), passed his final medical examination in 1885; army surgeon in the Dutch East Indies from 1886–90, civil at Pasoeroean from 1892–1902; since Nov. 1902 settled at Skovshuved, Denmark.

Biographical data. 'Den Danske Lagestand 1949–1957', 13th ed. 1957, p. 851 with portr.

Jodner, *cf. sub* Heringa, Jod.

***Johannes**, R. L., *cf. sub* Boswezen Nieuw Guinea.

***John**, Dr

donated a plant from the *Malay Islands* to the Botanic Garden at Calcutta in 1808 (*cf.* Roxburgh, Hort. Beng. 1814). Probably the Rev. Dr John of Tranquebar, and not collected by himself.

***Kadir bin Abdul**

(1918, Labuk, N. Borneo; x) was appointed as Labourer in the For. Dept Br. N. Borneo in 1937; since 1951 Forest Guard.

Collections. Mostly botanical collections in various parts of *Br. N. Borneo. Cf. sub* Forest Department British North Borneo.

***Kalkman**, Cornelis

(1928, Delft, Holland; x), botanist, educated at Leyden University, since Feb. 1956 attached to the Forestry Department (Afdeling Boswezen) at Hollandia, West New Guinea, in 1958 transferred to Manokwari.

COLLECTING LOCALITIES. *North New Guinea. 1956.* Vicinity of Hollandia (March 4); SW. side of the Cyclops Mts between Ebeli and Depapre (11); mouth of the Tami River (14–24, 64 *nos*); Nemo near the Mosso River (March 27–Apr. 1; 40 *nos*); vicinity of Hollandia and Cyclops Mts (Apr. 17, May 1, 14, 29, June 3 and 5); vicinity of Manokwari (June 11–16; 38 *nos*); *Meos* (or *Mios*) *Waar* (19–27; 44 *nos*); from July–Dec. numerous times near Hollandia, also near Lake Sentani; Waisiniwai (Demta Distr.) (Dec. 7–13; 40 *nos*). —*1957.* Numerous times in the vicinity of Hollandia; surroundings of Manokwari (Vogelkop), and in the Bostuin (forest garden) (May 25–29); *South New Guinea:* along the Maro River between Merauke and Tajam; near Merauke between Moppa and Nassim; *N. New Guinea:* S and W of Lake Sentani, from Seloki *via* Soeadjaf and Janim besar to Borowai (Aug. 6–14; 62 *nos*).

COLLECTIONS. *Herb. Manokwari* and *Leyden*, numbered in the B.W. series (*cf. sub* Boswezen Nieuw Guinea), *nos* B.W. 3364–3800, 6201→, in 1957 about 450 *nos* in total.

Kalshoven, L. G. E.

Author of 'De plagen van de cultuurgewassen in Indonesië'. 2 vols (1950–1951).

Kamel, G. J.

COLLECTIONS. Some of his drawings are in L'Institut de France, Paris.

BIOGRAPHICAL DATA. Veröff. Int. Ges. Gesch. Pharm. 4, 1954, p. 1–123, 14 tab.

Kanehira, R.

(† 1948, Tokyo, Japan).

ITINERARY. *Before 1934* change into: *1933* (Aug.). Trip *1937* refer to LITERATURE 1a.

COLLECTIONS. Sets of the KANEHIRA & HATUSIMA collection in *Herb. Nat. Sc. Mus. Tokyo* and in *Herb. Res. Inst. for Natural Resources Tokyo.*[5]

LITERATURE. (1a) R. KANEHIRA: 'An account of a trip to the South seas' (Sanrin 657, 1937, 94–101; *ibid.* 658, 1937, 71–75; *ibid.* 659, 1937, 76—81; *ibid.* 660, 1937, 81–87; *ibid.* 661, 1937, 73–79) (probably in Japanese; *n.v.*).

(5) HARA *in litt.* 15.4.1951.

BIOGRAPHICAL DATA. Fl. Mal. Bull. *no* 5, 1949, p. 130–131.

***Karstel,** H. R., *cf. sub* Boswezen Nieuw Guinea.

Kaudern, W.

COLLECTIONS. Add: Ferns in *Herb. Brit. Mus.* (with *Herb.* C. CHRISTENSEN).

LITERATURE. (2) Add: C. E. B. BREMEKAMP: 'List of the Acanthaceae collected in Celebes by Dr. W. Kaudern and Dr. G. Kjellberg' (Svensk Bot. Tidskr. 42, 1948, p. 372–403).

Keers, Wilhelmina Carolina

(† 1957, Baarn, U., Holland).

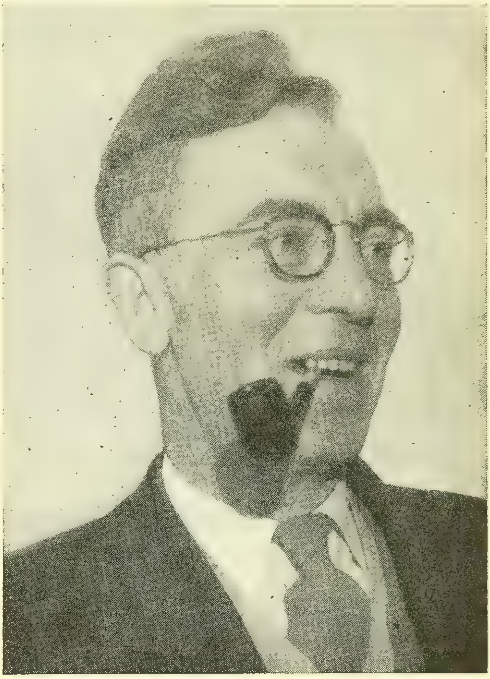
Kehding, F.

COLLECTIONS. Several of his *Malayan* plants with *Herb.* BECCARI in *Florence.*

Keith, H. G.

retired in Jan. 1952, and subsequently accepted a temporary post with F.A.O., until April 1932 as Instructor in the Timber Graders School at Manila, P.I.

COLLECTIONS. Add: Ferns in *Herb. Brit. Mus.*


KERN

***Kern,** Johannes Hendrikus

(1903, Nijmegen, G., Holland; x), from 1922–49 a schoolmaster in Holland. Being an excellent amateur botanist he was offered a position at the Buitenzorg (Bogor) Herbarium in 1949. After his return in Holland in Nov. 1952 he was appointed on the staff of the Flora Malesiana Foundation at Leyden, since July 1957 on the staff of the Rijksherbarium; at present (1957) working on *Cyperaceae.*

COLLECTING LOCALITIES. Oct. *1949*–Nov. *1952. W. Java:* Bogor[1], Puntjak, Tjibodas, Tjibeureum, Tjisarua, Tjibinong, Patjet, Depok (Jan. 29, *1950*), Djakarta, Tanggerang (March 19, *1950*), G. Gedeh-Pangrango (March 22–Apr. 2, Sept. 12 and Dec. *1950*), *P. Amsterdam* (Apr. 15, *1950*), Kuripan (Apr. 23, *1950*), Megamendung, *P. Haarlem* and *Leiden* (Sept. *1950*), Serang, Muara Angkeh, Tg Priok, Rawa Tembaga (Bekasi) (Nov. 18, *1951*; Feb. 2, Sept. 24, *1952*)[2], Tjitjadas, Tjiteureup.—*Centr. Java:* G. Muriah (Nov. 22–Dec. 5, *1951*).—*E. Java:* G. Lawuh above Serangan, and at Tjemorosèwo (Dec. *1951*).

COLLECTIONS. *Herb. Bog.: nos* 7150–8685, collected in *Java*.

LITERATURE. (1) J. H. KERN: 'Een nieuw sawah-onkruid' (Trop. Natuur 32, 1952, p. 127–129, 1 fig.).

(2) J. H. KERN & W. MEIJER: 'Nogmaals de Rawa Tembaga' (Meded. Blad Nat. Hist. Ver. 4, *no* 1, 1952).

Kerr, A. F. G.

COLLECTIONS. Add: His private herbarium, 32.546 spec. (incl. 1022 crypt.) was received in the *Brit. Mus.* in 1942 (ALSTON *in litt.*).

Notes, MSS, *etc.*, have been presented to the Royal Botanic Gardens, Kew-Surrey; orchids and orchid paintings in *Herb. Kew*.

BIOGRAPHICAL DATA. Add: Kew Bull. 1951, p. 9.

Keysser, Christian

LITERATURE. (3) Last line after 181, add: 524–530.

Kiah bin Hadji Mohamed Salleh

In *1949* and *1953* he accompanied J. SINCLAIR (see there) on some trips in *Malaya*.

Kjellberg, G.

COLLECTING LOCALITIES. Add: *S. Sumatra:* Palembang (May *1930*). Possibly from other ports of call too.

COLLECTIONS. Add: A set of the ferns in *Herb. Brit. Mus.* (with *Herb.* C. CHRISTENSEN).

LITERATURE. (1) Add: T. LEVRING: 'Meeresalgen von Singapore und Celebes' (Act. Hort. Gothob. 15, 1944, p. 175–180).

C. E. B. BREMEKAMP: 'List of the Acanthaceae collected in Celebes by Dr. W. Kaudern and Dr. G. Kjellberg' (Svensk Bot. Tidskr. 42, 1948, p. 372—403).

***Klay,** Gerrit

(1910, Modjokerto, E. Java; x), passed his youth in Java, and was subsequently educated in the Colonial Agricultural School at Deventer, Holland. After his return raising cattle in East Java; from 1942—48 official in the Dutch East Indian Sea-Fishery Department, stationed at Pontianak in W. Borneo; from 1952–57 in the Indonesian Sea-Fishery Department at Djakarta. In April 1957 he would leave for Holland.

COLLECTIONS. In *1949* he collected some plants with H. J. SCHOPHUYS (see there) in *W. Borneo*; in *Herb. Bog.*

***Klencke,** J., *cf. sub* Boswezen Nieuw Guinea.

Kleynhoff, Chr.

sailed for Batavia on Oct. 26, 1742. In 1763 he settled at Culemborg, where he was appointed sheriff in 1764, and burgomaster in 1767.

From a concept letter of N. L. BURMAN[3] it is evident that KL. was busy arranging his notes on his plant collections for publication. B. expressed his hope that the vernacular names would be explained, and offered to have his drawings engraved at Amsterdam. Evidently the plan came to nothing.

LITERATURE. (3) Dated May 2, 1768, MS in Un. Library Amsterdam, S48b, p. 28.

BIOGRAPHICAL DATA. A. ETT. in Het Vaderland, July 13, 1957.

Kloss, C. Boden

(† Aug. 19, 1949).

BIOGRAPHICAL DATA. Bull. Raffl. Mus. Sing. *no* 23, 1950, p. 336–346, with bibliogr.

***Koch,** Dr Fr.

physician at Reichenhall, Germany.

COLLECTIONS. Summer *1927* he presented 59 *nos* of *Sumatra* plants from Sibolangit (East Coast) to *Herb. Munich*.

***Kock,** Pater C.

A Roman-Catholic missionary who collected in *W. Bali* on the slope of G. Sangiang (July 1, *1957*). Collection in private herbarium.

Koens, Antoon Johannes

(died).

Koernicke, M. W.

(† 1955, Honnef a/Rhein, Germany).

***Kokkelink,** M. Ch., *cf. sub* Boswezen Nieuw Guinea.

Kollmann, G. J. A.

COLLECTIONS. Line 10 change *Monaco* into *Munich*. Mr ALSTON found a fern labelled 'Java Kollmann' in *Herb. Paris;* the specimen had been sent by KUNZE to BORY.

***Kongsi Tiga**

Cf. sub AMIRUDDIN.

Kools, J. F.

Saccopetalum koolsii KOSTERM. is named after him.

***Koopman,** Pietertje Cornelia

(1901, Nieuwerkerk, Z., Holland; x) studied biology at Utrecht University (1919–24); from 1924–26 teacher in natural history at a secondary school at Tilburg (Br.). In 1926 she married and went to Java. From 1938 onwards teacher at Buitenzorg. After the war she returned to Holland and was appointed at a secondary school in Amsterdam.

COLLECTIONS. When staying in the Mountain Gardens, Tjibodas, *W. Java* (June 29–July 18, and Dec. *1941*), she collected *c.* 125 *nos*; in *Herb. Bog.*

Koorders, S. H.

LITERATURE. (9) Add: H. HALLIER *f.* made some critical remarks on KOORDERS's Minahassa work (1898) in Bull. Herb. Boiss. II, 1, 1901, p. 672–676.

***Koster**, Christiaan

(1922, Madioen, Java; x) motor-fitter who for some time before World War II was employed by the Zoological Museum and the Forestry Service at Buitenzorg; he went to West New Guinea in 1950. From Oct. 1951 in the employ of the Forestry Service at Hollandia, where his work entails the regular collecting of plants.

COLLECTING LOCALITIES. *West New Guinea, after Oct. 1951*: with P. VAN ROYEN (see there) in the vicinity of *Sorong*-Steenkool; in the sample plots near the Prafi, in the island *Noemfoor*, and in the vicinity of Hollandia and Maroeni.—*1956*. Polimac near Hollandia (Jan. 31); Cyclops Mts (Feb. 9–20); *Meos Waar* in Geelvink Bay (June 20–July 6, *c.* 125 *nos*); Oransbari (July 21–23); Kaloal in *Salawati* (Oct. 4–30, *c. 240 nos*); Hollandia (Dec. 12).—*1957*. Vicinity of Hollandia (Jan.), Hamadi near Hollandia (Feb. 1); Cyclops Mts (March 12–22, *c.* 60 *nos*); Tafelberg near Manokwari (July 2); Manggoapi, Manokwari (July 6); Tafelberg (25–26), Soawi-Rendani (31), Amban (Aug. 2); Pami River plateau (Aug. 20–21), Pami River valley 22–27); Sidei (Sept. 17–Oct. 21, *c.* 200 *nos*).

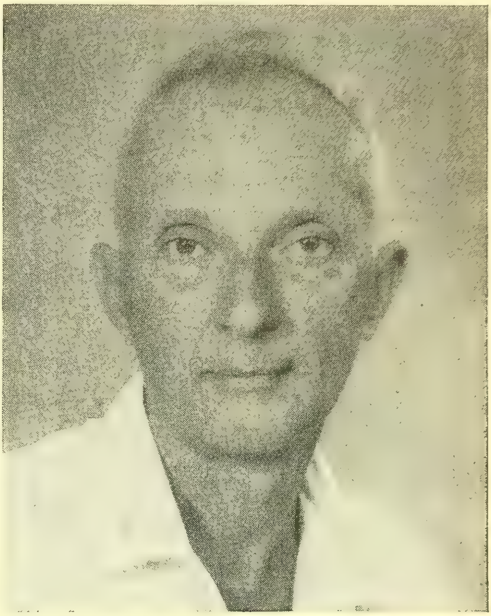
COLLECTIONS. In the B.W. (*cf.* Boswezen Nieuw Guinea) series; *Herb. Leyden* and *Manokwari;* in *1957* ± 900 *nos.*

Kostermans, A. J. G. H.

Since 1956 Head of the Botanical Division of the Forest Research Institute at Bogor.

Several plants were named after him.

COLLECTING LOCALITIES. **1948.** *S. Borneo:* Sampit and vicinity (March 6–Apr. 25). *West New Guinea, cf.* Cyclopaedia.[2]—**1949.** *Expedition to Morotai* (Moluccas): Totodoku in the W. part (May 5–18); G. Para-Para and tour *via* Sambiki and Sangowo River (22–31); Tjao and Totodoku (June 3–16); Military Camp (17–20); Tjao (21); Ngele Ngele and Tjia (23–24); and at other localities. *Banka* (Aug. 23–Oct. 27): Lobok Besar (SE. part), G. Pading, G. Maras, G. Mangkol.—**1950.** *Centr. Celebes:* Malili region; whole collection destroyed by fire at Makassar. *E. Borneo:* Sg. Wain region near Balikpapan (Aug. 20–Nov. 10).—**1951.** *E. & NE. Borneo:* Samarinda (May 5–6); *Sangkulirang Island* (May 19–June 2); Sg. Menubar near Cape Mangkaliat and G. Tapianlobang (June 5–24); Sg. Susuk, NE of Sangkulirang Bay (June 26–July 12); Sg. Kerajaan, N of Sangkulirang Bay (July 15–22); Sekrat Mts, SE of Sangkulirang (26–30); Sg. Menubar and G. Tapianlobang (Aug. 5–6); Sg. Susug (7); Sg. Bambangan at the mouth of the Mahakam River (13—16); and at other localities in the vicinity of Sangkulirang and Samarinda. *Centr. Java:* E. slope G. Muria (Nov. 23–27); E. slope near Djurang (Dec. 4).—**1952.** *E. Borneo:* Loa Djanan, upstream of Samarinda (Apr. 10–29); Loa Haur, upstream of Loa Djanan (May 6–19); Sg. Bambangan and Sg. Tiram near the southern mouth of the Mahakam River (May 19–June 11); Djambu on Sg. Bongan (debouching in the lake region S of Central Kutai) (June 30); from Djambu to Sg. Tulus (on the Peak of Balikpapan), 140 m alt. (July 1); bivouac Beül on the Peak, 700 m alt.; to the summit, 1200 m alt. (5–23); Rempé on Bongan River (24); Tgd. Bangko and area near Sangasanga downstream of Samarinda (Aug. 1–6). —**1953.** *S. Borneo:* vicinity of Sampit (July 20–21); Kualakuajan on the Sampit River and G. Santuai (July 25–Aug. 22). *NE. Borneo* (Oct. 29, *1953*–Jan. 10, **1954**): to *Nunukan* and *Bulungan.* Exploration of the Semoi River system in *E. Borneo* (from May *1954*); at Loa Djanan and Loa Haur, W of Samarinda (Aug. 22–Sept. 8).—**1955.** *E. Borneo:* Sg. Mentawir region near Balikpapan (Feb. 22–25), near G. Mentawir (Feb. 27–March 2), near village Mentawir (March 3–5), Loa Djanan region W of Samarinda (15–16). *Centr. Borneo:* trip along the Bĕlayan River (parallel to the Tĕlĕn), near Long Bleh (March 25–Apr. 8), Mt Kelopok and G. Tamankuling near Tabang (Apr. 12–May 3), near Kembang Djangut (May 6–15). *W. Java:* Udjung Kulon (Aug. 1–7); *S. Sumatra:* with A. DILMY in the Semangus area, Palembang (Sept., 300 *nos*); Tjaban For. Res. near Muara Enim (Musi River) (Nov. 15–Feb. 6). —**1956.** *Centr. Borneo:* Belajan and Kelindjau Rivers (July 20–Oct. 10); Mahakam Estuary (July 15–19); Tundjung Plateau (July 25–Aug. 2); Kelindjau River near village Bentuk (14), near village Melan (15); foot of G. Kelopok near Tabang on Belajan River (Aug. 21—Sept. 2); G. Palimasan near Tabang on Belajan River (6–19).—**1957.** *NE. Borneo:* Sangkulirang Distr.,



KOSTERMANS

G. Medadem (July 27—Aug. 14); basin of Karangan River (Aug. 23—Sept. 8); G. Ilas Bungaän (Berouw = Berau) (Sept. 8–19); G. Ilas Mapulu (Berouw) (20–24).

Occasionally plants were collected in Bogor Botanic Garden, in *Singapore*, *Java*, and Ceylon.

COLLECTIONS.[1] *Nos* 601–1688 and 7800–7912 from *Morotai* (*1949*), in total 1200 *nos*. Collections up to 1949 all numbered at Bogor. All collections in *Herb. For. Res. Inst. Bog.*, dupl. in *Herb. Bog.*>14075.

LITERATURE. (1) A. J. G. H. KOSTERMANS: 'Notes on New Guinea plants' I–III (Bull. Jard. Bot. Gard. Btzg III, 18, 1950, p. 435—448, 3 fig.); *ibid.* IV (Reinwardtia 1, 1952, p. 459–461, 1 fig.); 'Notes on durian (Durio) species of East Borneo' (Trop. Natuur 33, 1953, p. 31–35, 3 fig.).

(2) A. J. G. H. KOSTERMANS: 'Bosonderzoek Kolonisatieobject Momi-Ransiki, Nieuw Guinea' (mimeographed by For. Res. Inst. Bogor, 2 vols, 1948).

(3) A. J. G. H. KOSTERMANS: 'Reisverslag Morotai 8 April–6 Juni 1949' (mimeographed by For. Res. Inst. Bogor, 27 pp.; provisional report).

Kraemer, A. F.

ITINERARY. Last line refer to Literature 4.

LITERATURE. (4) *Cf.* G. THILENIUS, Ergebnisse der Südsee-Expedition 1908–1910, Hamburg 1914 onwards (I. Allg.; II B. Mikronesien).

BIOGRAPHICAL DATA. Portr. in THILENIUS, Ergebnisse *l.c.* I. Allg., 1927, pl. 2.

***Kregten,** Thomas Otto van

(1911, Nijmegen, G., Holland; x) was educated at the Horticultural School at Frederiksoord (Drente, Holland), and subsequently employed in France, at Wageningen, and Utrecht. From 1938–1952 technical representative and adviser of the horticultural division of the Imperial Chemical Industries (Holland) N.V. From Nov. 1952 onwards curator of the Buitenzorg Botanic Garden at Bogor. In Dec. 1954 he was transferred to the new botanic garden Setia Mulia, Sumatra West Coast; at present in Holland.

COLLECTING LOCALITIES. *1954. W. Java*, Bantam (itinerary *cf.* sub ADELBERT).—*1955–57. Sumatra West Coast*, vicinity of the Botanic Garden Setia Mulia.

COLLECTIONS. *Herb. Bog.* In Bantam collected *nos* 1–122, identical with ADELBERT *nos* 253–414, from Feb. 3–8. *Sumatra* plants also in *Herb. Setia Mulia.*

Kreulen, D. J. W.

COLLECTING LOCALITIES. Add: Tosari, Bromo; Tjandi Tikoes; G. Kawi, all in *1921.*

COLLECTIONS. With the herbarium of KLOOS presented to *Herb. Leyden.* The total numbering at least up to 159, possibly not all represented at Leyden.

Kryshtofovich (or **Kryštofovič**), A. N.

Mosses collected by him on Mt Santo Tomas were described by Z. PILOUS (in Preslia 26, 1954, p. 149–152). They were evidently collected in *Luzon* in *1921*, and formed part of the large moss herbarium of Prof. Dr J. PODPĚRA, which is now incorporated in the Bot. Div. Nat. Mus. *Prague.*

***Kühlewein,** M. von

collected *Fagraea auriculata* JACK in Banjoemas, *Centr. Java* (Oct. *1925*); specimen in *Herb. Leyden.*

***Kuneang**

probably spelled this way, was an untrained Dyak employed as a collector by G. D. HAVILAND in Sarawak, *NW. Borneo*, for a couple of months. Labels with his name are not very reliable (*vide* letter from HAVILAND to the Director at Kew, dated Sept. 30, 1891).

Kunstler, H. H.

(1837, Haldensleben, S of Magdeburg, Germany; Feb. 4, 1887, o/b s.s. 'Sisra' sailing from Malacca to Australia; buried in Penang).

COLLECTIONS. He also made excellent entomological collections, *e.g.* for G. HONRATH (Berlin); now in the Brit. Mus.

BIOGRAPHICAL DATA. Add: Berl. Entom. Zeitschr. 31, 1887, p. 353–355.

Laan, Engbertus van der

In 1951 Head of the Division 'Wiskundige Verwerking Proefvelden' of the Dutch Department of Agriculture.

Labitag, G.

After the war he contributed a few numbers to the P.N.H. series (*cf. sub* Philippine National Herbarium).

Labohm, Johan Frederik

(† 1956, Bilthoven, Holland).

***Lagrimas,** Martin

B.S.F., University of the Philippines. Forester and Wood Technologist, Bureau of Forestry and Forest Products Laboratory, Forestry College, Laguna.

COLLECTING LOCALITIES. *1948 onwards. Luzon:* Mt Makiling and Famy, Laguna Prov.; Infanta, Quezon Prov.; *etc.—1952. Mindanao.*

COLLECTIONS. *Herb. Manila*, numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium).

Lam, H. J.

In 1954 he was awarded a honorary Dr's degree at Perth, W. Australia. Following his visit to Australia, he made a tour in New Guinea.

COLLECTING LOCALITIES. Add: *1954. Papua:* Port Moresby and Sogeri (Sept. 28), Brown River (29); *Mand. Terr. of New Guinea:* Lae (Oct. 1), Bulolo (2), Wau (Edie Creek) (3), Bulolo–Lae (4), Lae (5); *North New Guinea:* Hollandia (9), Cyclops (K. Koejaboe) (10), Holtekang (E of Hollandia) (12), Hollandia–Depapre (15), Depapre (16).

COLLECTIONS. Add: *Herb. Leyden:* 129 *nos New Guinea* (*1954*).

Lamster, J. C.
(† 1954, Holland).

***Landon,** F. H.
(1909, U.K.; Sept. 1956), was educated in forestry at Oxford University (B.A.); from 1932 onwards a member of the Malayan Forest Service; later Chief Research Officer in the Forest Research Institute at Kepong, Selangor.

He occasionally collected in the C.F. series (*cf.* Conservator of Forests series in Fl. Mal. vol. 1).

Landon, Sylvanus
A. HAMILTON (in 'A New Account of the East Indies' 2, 1744, p. 144) mentions a Mr SYLVANUS LANDEN, who had been Chief of Borneo and who expressed his astonishment that the English E.I. Company should have settled at Bandjermasin. Possibly identical.

Langlassé, E.
On his travels in Mexico and Colombia, *cf.* R. McVAUGH: 'The travels and botanical collections of Eugène Langlassé in Mexico and Colombia, 1898–1899' (Candollea 13, 1951, p. 167–211).

***Laraya,** S., *cf. sub* Philippine National Herbarium.

LaRue, C. D.
(† 1955, Michigan, U.S.A.).
BIOGRAPHICAL DATA. Plant Sc. Bull. 1^4, 1955, p. 6.

***Lasschuit,** J. A., *cf. sub* Boswezen Nieuw Guinea.

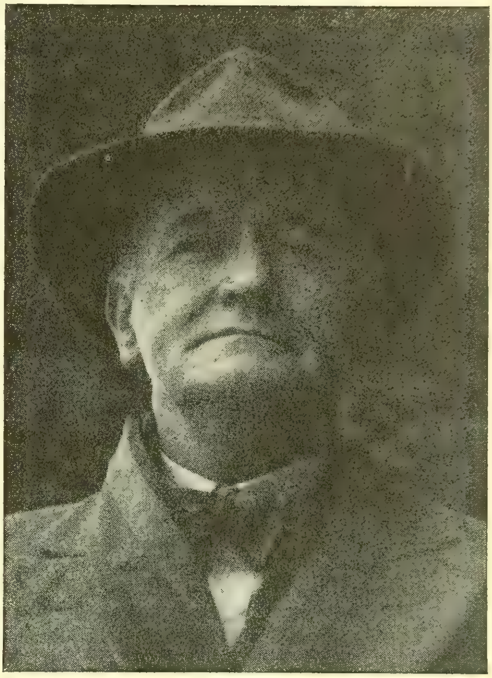
Latif, S. M.
LITERATURE. (1) Add: 'Bunga Anggerik permata belantara Indonesia' ('s-Gravenhage 1953).

Lauterbach, C. A. G.
COLLECTIONS. About 200 *New Guinea* dupl. at *Kew* (purch. from Berlin), some *leg.* KÄRNBACH.

LITERATURE. (7) Add: S. HATUSIMA: 'A revision of the genera from New Guinea described by C. LAUTERBACH' (Bot. Mag. Tokyo 65, 1952, p. 109—111).

***Layosa,** Helen S.
collected at Quezon City, *Luzon*; in *Herb. Univ. Philip.*>115 *nos; cf.* also *sub* Philippine National Herbarium.

***Lebeck,** H. J.
(† June 12, 1800, Java) a Dutchman, son of the government secretary LEBECK. Evidently in the 1790s a regular visitor of C. P. THUNBERG's house. From his letters written to the latter[1], it is evident that he was a resident of Sweden in the years 1794–95, and wanted to qualify himself in botany, signing as a friend and pupil; an acquaintance of GRÖNDAHL (see there). In 1795 he got a valuable testamur of the Academy at Uppsala, and saw a possibility to be stationed at Coromandel and said to have good connections in Ceylon. As at the time no Dutch ships were sent to Ceylon because of the war, he finally decided to sail in a Swedish ship and left Göteborg Dec. 1795 with destination Bombay. In India he came into contact with Rev. Dr JOHN, ROTTLER, and KLEIN, became (according to his own information) a honorary member of the learned society at Tranquebar (? United Brotherhood, *cf. sub* J. C. KOENIG) and got a diploma of the 'Naturforschende Freunde' in Berlin. He made an overland journey to Madras, and was in Ceylon too. Since end 1798 he was at Batavia, as merchant, assay-master and mint-master of the Dutch East India Company.


LANE-POOLE

Besides plants, he collected insects, minerals, shells, snakes, birds, *etc.* THUNBERG named the genus *Lebeckia* after him.

COLLECTIONS. He sent collections to THUNBERG, and in *Herb.* THUNBERG (= *Uppsala*) are numerous sheets from Coromandel, Tranquebar, Malabar, and also from *Java.* The latter must have been collected from end *1798–1800.* Before his departure to Java he asked THUNBERG for an introduction to his Dutch friends, promised him the first right to his collections and asked for equipment, chemicals, *etc.* he needed for collecting. In 1800 he sent plants and wrote (Apr. 15) of the difficulties for a beginner, as he nearly had described *Nypa* and *Chamaerops* as new, if he had not just in time discovered them in RUMPHIUS!

His India plants were evidently sent to ROTTLER, who partly identified his collections together with KLEIN's, and sent them to VAHL at *Copenhagen* (probably with ships of the Danish East India

Company), who would take care of further dispatch.

LITERATURE. (1) Several MS letters in Dutch in Library University Uppsala.

BIOGRAPHICAL DATA. All from the MS letters (see above); the Rijksarchief in The Hague could not find any information, nor the Commonwealth Relations Office in London.

***Leden**, W. van der, *cf.* sub Boswezen Nieuw Guinea.

Ledermann, Carl Ludwig

(born at Cernier near Neuchâtel; 1958, in hospital at Volkach near Würzburg, buried at Untereisenheim, Germany) was educated at Heidelberg and in the Netherlands, and was trained in gardening. From 1904–09 he stayed in West Africa (Congo and Cameroons). In 1914 he returned to Europe and, although of Swiss nationality, he volunteered in the German army. After World War I he lost his savings as a result of the inflation. For some time advisor on cotton culture to Pascha MOHAMMED ALI in Egypt. In the thirties he was taken in by a befriended family with whom he moved to Untereisenheim near Würzburg in 1939.

In 1930, when having a severe depression he destroyed his correspondence, diaries, *etc.*, as being too personal. What was left, including two collecting books from the South Sea and some unfinished MSS, will be sent to the Herbarium Berlin-Dahlem now.

COLLECTIONS. Evidently also dupl. in *Herb. Edinb.*

BIOGRAPHICAL DATA. H. HIRSCH, Bot. Inst., Würzburg, *in litt.*, 21.2.'58.

Ledoux, J. A.

In 1956 he still lived at Kota Tinggi and sent plants regularly to the Singapore Botanic Gardens.

***Leefers**, C. L., *cf. sub* Boswezen Nieuw Guinea.

Leefmans, S.

(† 1954, Haarlem, Holland).

BIOGRAPHICAL DATA. Vakbl. Biol. 34, 1954, p. 21–23; Tijdschr. Plantenziekten 60, 1954, p. 67 seq.; Entom. Ber. 15, 1954, p. 65—132; Peng. Alam 34, 1954, p. 3–5, with portr.; in F. I. BROUWER: 'Leven en werken van E. Heimans' (thesis, J. W. Wolters, Groningen, 1958) p. 106–107.

Leeuw, C. de, *cf.* C. DE ZEEUW.

***Legarda Jr**, B., *cf. sub* Philippine National Herbarium.

***Lelang**

collected plants in the *Malay Peninsula;* DERRY's or CURTIS's Collector or Forest Guard (Mr J. PURSEGLOVE *in litt.*).

Lemann

was mentioned in the Cyclopaedia (Fl. Mal. vol. 1) as a collector of *Burmannia* in Malacca, of which a specimen was in *Herb. Boiss.* (Geneva). Recently Mr J. SINCLAIR from Singapore, when studying *Annonaceae* and *Myristicaceae* at Geneva, found quite a number of specimens from LEMANN, collected in Malacca (*Malay Peninsula*). On the labels was also the name of W. GRIFFITH. As several sets of the latter went to the late Dr CHARLES MORGAN LEMANN (1806–52) (*cf.* also Fl. Mal. I, 1, p. 201b), the facts are probably that one of LEMANN's sets went to *Herb. Boiss.* and that *not* LEMANN, but GRIFFITH is the collector.

***Liew**

collected in the *Malay Peninsula;* possibly the assistant of Mr CORNER of that name (Mr PURSEGLOVE *in litt.*).

***Lim**, B., *cf. sub* Philippine National Herbarium.

***Lim**, Luis, *cf. sub* Philippine National Herbarium.

***Lind**, James

(1736, Scotland; 1812, London, England), surgeon of the East India Company, who accompanied some voyages to the East. In 1768 graduated M.D. Edinburgh. In 1772 with BANKS to Iceland. In 1777 appointed physician to the Royal Household at Windsor.

ITINERARY. In the Indiaman 'Drake', *1762–63*, visiting India and China.—Again as Surgeon of the 'Hampshire', *1765–67*.

COLLECTIONS. *Herb. Brit. Mus.*: plants from China, the Cape, St Helena, Johanna Isl. and the *East Indies.* The collection might include some Malaysian plants.

BIOGRAPHICAL DATA. BRETSCHNEIDER, Hist. Bot. Discov. China, 1898, p. 152; D. G. CRAWFORD, Hist. Ind. Medic. Serv. 1600-1913, vol. 2, 1914, p. 58; BRITTEN & BOULGER, Biogr. Index, 2nd ed. by RENDLE, 1931.

***Lizardo**, L., *cf. sub* Philippine National Herbarium.

Llanos, Antonio

Dr QUISUMBING when visiting the Herbarium of the Jardin Botanico in Madrid, did not see any plants of him (*cf.* 'A Report of my Trip' 1954, p. 45).

Lobb, Thomas

COLLECTING LOCALITIES. Line 4 from below, before Mt Ophir insert: *Malay Peninsula.*

COLLECTIONS. Add: He also collected living plants.

Lohman = C. DE SAVORNIN LOHMAN (see there).

***Long**, L. U., *cf. sub* Boswezen Nieuw Guinea.

Lopez, J. A., *cf. sub* Philippine National Herbarium.

***Loreja**, Miss Milagros

collected at Tabaco (Albay Prov.), and at Los Baños, *Luzon*, in *1953;* > 75 plants in *Herb. Univ. Philip.*

Lorentz, H. A.
wrote also an account of the Wichmann Expedition.[2]

LITERATURE. (2) H. A. LORENTZ: 'Eenige maanden onder de Papoea's' (Leiden 1905).

***Lorenzo**, B., *cf. sub* Philippine National Herbarium.

Lotsy, Johannes Paulus
Line 20 read: *Oberonia lotsyana* J.J.S.

***Loupulua**, G. N., *cf. sub* Boswezen Nieuw Guinea.

***Loureiro**, E.
From plant lists at Kew it appears that he collected in *Penang* in *1870*.

***Lugtmeyer**, C., *cf. sub* Boswezen Nieuw Guinea.

***Lumsdain, Dr**
is mentioned in ROXBURGH, Hort. Beng. 1814, as the donor of a *Sumatra* plant to the Calcutta Botanic Garden in *1812*. A certain JAMES LUMSDAINE, 'a native, but well qualified' (probably a country-born European or Eurasian), was recommended by the Calcutta Medical Board for appointment as temporary Assistant Surgeon on an expedition to the East, and he was appointed from July 17, 1797. This expedition never took place, but LUMSDAINE was appointed Acting Assistant Surgeon for Bencoolen in Nov. 1797 He was confirmed in the Bengal Service from Sept. 9, 1799, became full surgeon, and retired on July 5, 1825.[1] Possibly identical.

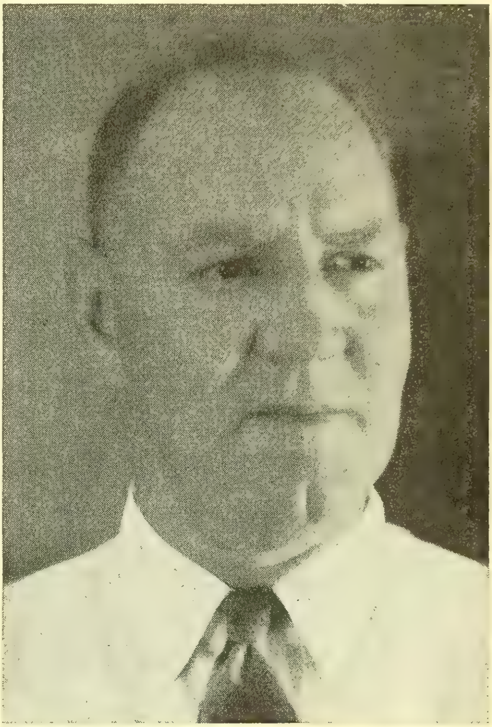
LITERATURE. (1) *Cf.* D. G. CRAWFORD, A History of the Indian Medical Service 1600-1913, 1, 1914, p. 502-503.

Lundquist, E.
After the war, from 1947–50 once more in the D.E.I. Forest Service, stationed in New Guinea; from 1951-55 making some travels to Indonesia in the employ of the Forest Service of West Germany and the Krupp Company, making investigations on various bambu species; in 1956 filming in Bali, and from July of that year up to May 1957 inclusive, lecturing at the University of Indonesia at Bogor as Extraordinary Professor. Subsequently on leave to Sweden, but planning to go back to Bogor for a two-year's term.

ITINERARY. *1941. W. & SW. New Guinea* (May-Aug.).[3] From Babo to the Vogelkop (western peninsula), ascending Motori River to Anakasi; valley of the Jakati; to the S. coast, touching Kaimana; Oemar River and Peronggo River; back to Oemar; Aindoea valley, Upper Aindoea; Namaripi River; camp on the Aindoea; village Aindoea; walking and sailing along the coast to the west: Jakopa, Patawai and hinterland, Boeroe and hinterland; Lakahia Bay; Omba River (60 km from the coast and back); Lakahia and Tarera, Kaimana, Argo(e)ni Bay and crossing to Babo. For dates *cf. sub* AËT who used slightly different names for his collecting localities.—*1956. Bali*, in the mountains.

COLLECTIONS. He sent living orchids from *Bali* (coll. *1956*) to *Göteborg* Botanic Garden.

LITERATURE. (3) E. LUNDQUIST: 'Papoea's waren mijn makkers' (Utrecht, without date; transl. from a Swedish book); 'In eastern forests' (1955, transl. by F. H. LYON); mimeographed report in Dutch (1941).



MCADAM

BIOGRAPHICAL DATA. Portr. in LUNDQUIST 'Papoea's *etc.*' facing p. 33.

***Lutterveld**, W. van, *cf. sub* Boswezen Nieuw Guinea.

Mabesa, C.
occasionally contributed some numbers to the P.N.H. series (*cf. sub* Philippine National Herbarium) after the war.

***McAdam**, James Bannister
(1910, Preesall, Lancashire, England; x), was educated at Queensland University and received Diploma of Australian Forestry School, Canberra, in 1933. He served with the Queensland Forest Service from 1929–37; District Forester, Territory of New Guinea, 1938–41; from 1942–45 War Service inclusive with N.G.V.R. and A.N.G.A.U. 1942 and 1943; from March 1944 to demobili-

sation in command C.R.E. New Guinea Forests which was responsible for the Forest Resource Surveys under which the N.G.F. collections were commenced. In 1946 Acting Secretary, Department of Forests of Territory of Papua and New Guinea under Provisional Administration; since 1951 Director of Forests in those territories.

MCKEE

Terminalia macadamii EXELL and *Canarium macadamii* LEENHOUTS were named in his honour.

COLLECTING LOCALITIES. *1938.* Coastal areas of *New Britain* (Bismarck Archipelago) with J. L. D'ESPEISSIS. Mid of the year moving to *Mand. Terr. New Guinea*, collecting in the Wau-Edie Creek, and Black Cat localities from 2000′ to 7500′ alt.—*1939.* Wau area.—End *1943* or Jan. *1944* Milne Bay, *SE. Papua.*

COLLECTIONS. *Nos* 1–200 with J. L. D'ESPEISSIS (mostly the latter's effort), possibly only partly in *Herb. Brisbane; nos* 201–300 and 401–*c.*450 from Wau region with field notes in *Brisbane*, dupl. and wood specimens destroyed during the war; 18 *nos* from Milne Bay in *Brisbane* too. Dupl. in *Lae*, some in *Leyden.*

*__MacArtney,__ George, Earl of

(1737, Lissanoure, Antrim, Ireland; 1806, Chiswick, Mdx., England), was educated in the University of Dublin, M.A. 1759; subsequently to London, entering the Society of the Middle Temple, but remaining only a short period, making arrangements for a tour of Europe, preparing for his career of a public life. In 1765 envoy extraordinary to Russia; on his return entering parliament and becoming chief secretary for Ireland (1769–72); 1775 Governor of the Caribbee Islands; 1780 Governor of Madras, returning to England in 1786; in 1792 created Earl in the Irish peerage; Embassy to China 1792–94;[1] Baron in 1796; Governor of the Cape of Good Hope in 1796. In 1799 he returned to England, suffering much from gout, and determined to retire from public life.

ITINERARY. *Cf. sub* Sir G. L. STAUNTON.

COLLECTIONS. He is cited to have collected *Hypolythrum latifolium* L. C. RICH. in *Sunda Strait* (*cf.* Bot. Tidsskr. 24, 1901, p. 37). It seems possible that the plant was in fact collected by STAUNTON, or one of the gardeners.

Mr HEMSLEY informed BRETSCHNEIDER (*cf.* Hist. Bot. Disc. China 1898, p. 162) that some of the sheets belonging to this collection (of the Embassy to China, 1792–94), in the British Museum, bear STAUNTON's name, some that of MACARTNEY; he did not think that they represent different collections.

LITERATURE. (1) See 'A Journal of an Embassy from the King of Great Britain to the Emperor of China in the year 1792, 1793, and 1794' by the Earl of MACARTNEY [in J. BARROW, Some account of the public life and a selection from the unpublished writings of the Earl of MacArtney 2, 1807, p. 161—517, (519)-(531)].

BIOGRAPHICAL DATA. J. BARROW, Some Account of the Public Life and a Selection from the Unpublished Writings of the Earl of MacArtney (London, 2 vols, 1807, with portr.).

*__McDonald,__ Gregory

(1931, Mareeba, Queensland, Australia; x), in the employ of the Forestry Service, contributed to the N.G.F. series (*cf.* New Guinea Forces) plants collected in the eastern half of *New Guinea*, after World War II.

MacFarlane, S.

ITINERARY. After the 4th line insert: *viz* Hood's Point, *Darnley Island, Warrior Island* (July 5), *Tauan Isl.* (6), Saibai Swampy, Cape York, *Tauan Isl.* (15), Katau on the mainland (17), *Warrior Isl.* (18), *Darnley Isl.* (24), *Yule Isl.* (28), Redscar Bay (3);

MacGregor, Sir W.

p. 338b first line add after—: E of Port Moresby: Cloudy Bay (Sept. 28); Merani (leaving Oct. 8); back at Moresby (26).[7a]

COLLECTIONS. Add: *Herb. Copenh.: Scitamineae* dupl.

LITERATURE. Add: (7a) C. H. HATTON-RICHARDS: 'Travels with the Hon. Sir William MacGregor, K.C.M.G.' (Trans. R. Geogr. Soc. Australas. 8, 1890 (1891), p. 45–62).

*__McIntosh,__ Donald Henry

(1927, Sydney, N.S.W., Australia; x), graduate from the Australian Forestry School and New South Wales University; Forest Officer, Keravat, New Britain, after 1945.

COLLECTIONS. Small collections in *New Britain*, numbered in the N.G.F. series (*cf.* New Guinea Forces).

***McKee, H. S.**
(1912, Clough, N. Ireland; x), botanist, educated at Campbell College, Belfast, and at Oxford University (Ph. D.); from 1936–38 employed by the South African Co-operative Deciduous Fruit Exchange in London; from 1938–40 in the Queensland Agriculture Department; since 1940 employed by the Commonwealth Scientific Research Organization (C.S.I.R.O.). In the later part of World War II he was seconded to the Tropical Scientific Section, Austr. Army for work in New Guinea; from 1954–56 seconded to the South Pacific Commission, with HQ at Noumea (New Caledonia), subsequently in the Botany Department of Sydney University, N.S.W.

In 1954–55 he made a trip to New Guinea in connection with food and nutrition problems.

ITINERARY & COLLECTING LOCALITIES. *c.* **1944–45.** Staying in *NE. New Guinea* (Mandated Territory): Lae, Aitape, Finschhafen, Madang, and Wau.—**1954.** *Papua:* Port Moresby (Nov. 7); *N.E. New Guinea*, Mandated Territory: Goroka (12, 15); Daulo, Chimbu Divide (16); Minj, Aiyura (18), Goroka (18–19), Daulo-Chuave Road (21), Goroka-Daulo Road, Ko(r)tuni *via* Goroka, Wau (26), Kaisinik *via* Wau (27), Zenag *via* Mumeng (28), Kaiapit, Lae; *New Britain* (Bismarck Archipelago) (Dec. 2—3): Rabaul, Keravat, Napapar, Vunapau; *Solomon Islands:* Sohano in *Buka Isl.* (7), Baracoma, Yandina, Honiara, Auki; *New Britain:* Rabaul; *NE. New Guinea:* Finschhafen, Lae, Wau, Zenag, Lae; *North and South New Guinea:* Hollandia (12); Merauke and in Merauke Distr. (17–23): Koeprik and Nopah (21–22), Jobar and Boeti (23); Hollandia (24–25), Ifar and Dojobaroe in Sentani Distr. (27), Hollandia (28–30), slopes Cyclops Mts (31).—**1955.** Hollandia (Jan. 1), grassy headland on Lake Sentani (2), Ifar, Hollandia (Kota Baroe) (3); *Biak* (4); Hollandia.

COLLECTIONS. *Herb. Brisbane:* few plants coll. *c. 1944–45.* Collection *1954–55* in *Herb. Sydney, Lae;* dupl. in *Herb Leyden*, and possibly elsewhere.

The forestry departments in both parts of New Guinea rendered considerable help; in total *nos* 1155–1941 from *New Guinea and neighbouring islands* (*1954–55*), including 342 from Goroka (1700–2600 m alt.), 104 from Merauke Distr., and 163 from Hollandia and the Cyclops Mts.

Other collections, made in the Pacific, mostly in New Caledonia, were sent to *Herb. Paris.*

***Maclang,** F., *cf. sub* Philippine National Herbarium.

***McVittie,** Mrs C. A.
from *1948 onwards* occasionally contributes a few numbers to the P.N.H. series (*cf. sub* Philippine National Herbarium), *e.g.* from *Luzon, Polillo Isl.*, and *Mindanao.*

***Madlangbayan,** E., *cf. sub* Philippine National Herbarium.

Magnus, P. W.
COLLECTIONS. His whole herbarium in *Herb. Hamburg.*

***Maille & Saunders**
COLLECTIONS. *Herb. Vienna:* plants from *Borneo*, without further indications.

Main
Indonesian clerk of the Buitenzorg Herbarium. In May-June *1949* he assisted KOSTERMANS on an expedition to *Morotai* (*Moluccas*). In the second half of *1949* he assisted Miss Dr POLAK (see there) in collecting plants in *West Borneo.*

Maingay, A. C.
COLLECTIONS. Also dupl. from *Malaya* in *Herb. Vienna*, and in *Leningrad.*

***Mair,** H. Knowles C.
(1909, Toongabbie, N.S.W., Australia; x), B.Sc. of Sydney University. In succession Agrostologist, C.S.I.R.O., Canberra; Superintendent of Agriculture and Curator, Botanic Gardens, Darwin (Northern Territory); Officer in Charge, Army Farms Administration, Australian Army during World War II (serving on the Australian mainland and New Guinea); Forest Botanist, Australian Army Forest Survey Units; at present Senior Botanist, National Herbarium, Botanic Gardens, Sydney.

COLLECTING LOCALITIES. *1945. NE. New Guinea:* near Madang, and on *Kar Kar Island; New Britain* (Bismarck Archipelago) (May-June): near Jacquinot Bay, Open Bay, Wide Bay, Nantambu.

COLLECTIONS. He contributed to the N.G.F. series (*cf.* New Guinea Forces).

***Majuyap bin Majuni**
(1912, Jesselton, Br. N. Borneo; x) was appointed Forest Scaler in Br. N. Borneo in 1940; resigned in 1947 and later employed in the Agricultural Department.

COLLECTIONS. He collected at Sandakan and Jesselton, *Br. N. Borneo*, *cf.* also *sub* Forest Department British North Borneo; at least partly numbered S.H.

***Malinka,** G. M., *cf. sub* Boswezen Nieuw Guinea.

Mallonga, A. C., *cf. sub* Philippine National Herbarium.

***Manayon**
collected at Quezon City, Manila, and Las Pinas (Rizal), in *Luzon;* > 43 *nos* in *Herb. Univ. Philip.*

***Mangold,** Rudolf Paul
(1929, Buitenzorg (Bogor), Java; x), since 1953 on monthly pay of the Forestry Service in West New Guinea, onwards of 1958 Forest Guard.

Collecting localities. *West New Guinea. 1954.* Anggra-Meos (May 27); Tafelberg near Manokwari (Sept. 28, 30).—*1955.* Oransbari (Oct. 6—20).—*1956.* Maripi near Manokwari (May 11); Sidei (July 4, 17, and Aug. 22); Rendani near Manokwari (Oct. 1); Arfai near Manokwari (Oct. 2–4); Wosi, Rendani (Oct. 9); Wasidori (Oct. 10, 11, 20); Amberiwar (Nov. 29); Wanabo (Nov. 30); Rendani (Dec. 19).—*1957.* Rendani (Jan. 3), Bakaro (4–5), Amban-Kol. (7), Bakaro, Amban-Kol. (8), Roodi (15), all in the vicinity of Manokwari; Siwi, Sioriep (Feb. 5), Oenak (6), Mt Moendi (7–8), Mt Tisi (9–10), Mt Lehoema (11–12), Mt Steriro (14), in the subdiv. Ransiki; Sarmi, at Takar, Wennen, *etc.* (Apr. 21, 23, 27, 29).

Collections. *Cf. sub* Boswezen Nieuw Guinea.

***Manuputty**, T., *cf. sub* Boswezen Nieuw Guinea.

***Manza**, A. V., *cf. sub* Philippine National Herbarium.

***Maradjo**, Pilihan

(1912, Labuh Gunung, near Pajakumbuh, W. Sumatra, Indonesia; x), from March 1956 onwards engaged by W. Meijer as helper and plant collector for the Faculty of Agriculture, Pajakumbuh. Formerly employed in tea plantation Halaban, Mt Sago near Pajakumbuh, and working as a tobacco farmer.

Collecting localities. *1956—57. W. Sumatra.* From Sept. 1956 onwards independently collecting at the base of Mt Sago, at Kebon Surian, Batu nan lajak, Batu basurat, Batu badindung, Batu nan putih, Air Andaleh, Halaban, Batang Pinago, for the greater part situated above Kp. Labuh Gunung.—*1957.* During expedition of Aug. in Taram-Tjampago region (*cf.* W. Meijer) partly collecting independently; limestone hills E of Mt Sago (Sept. 2) near Halaban.

Collections. *Herb. Fac. Agr. Pajakumbuh*, > 200 *nos* Mt Sago, 86 *nos* from Taram-Tjampago region. Dupl. in *Herb. Bog.*, *Leyden*, *Sing.*

Marche, E.

Literature. (1) Add: 'Rapport général sur une mission à la Presqu'île Malacca et aux Iles Philippines' (Arch. Miss. Scient. III, 10, 1883, 331–372, 3 maps).

***Martin**, Dr. L.

presented *Cyperaceae* and *Gramineae*, collected at Bindjei, Deli (*Sumatra East Coast*) to *Herb. Munich* (*cf.* Accessions Katalog, *no* 365) (pres. 1892). In March 1892 he presented a small collection of wood samples.

***Martyn**, Harvey Siddick

(1919, Papar, Br. N. Borneo; x), since 1937 in the employ of the Forest Department at Sandakan, lately as Junior Ass. Conservator. In 1955 he got a Colombo Plan Scholarship for study in Australia.

Collections. *Cf. sub* Forest Department British North Borneo.

***Mati**, Oeny

collected at Quezon City, *Luzon*, in *1952;* plants in *Herb. Univ. Philip.*

***Matias**, A., *cf. sub* Philippine National Herbarium.

Matthew, Ch. G.

Collections. Add: Dupl. in *Herb. Brit. Mus.* and *Paris* (*Herb.* Christ).

***Mauran**, F., *cf. sub* Philippine National Herbarium.

***Mayer**, Frederick William Shaw

(1899, N.S.W., Australia; x), naturalist, collector for Tring Museum, England, from 1922–53; subsequently in charge of the Fauna Section of the Hallstrom Livestock & Fauna Station at Nondugl, Mandated Territory of New Guinea.

Over the years he made zoological collections in Malaya, Indonesia, and New Guinea.

Collecting localities. *1951.* Central Highlands of *NE. New Guinea:* Mt Giluwe (7300 ft) (first half of the year); Hagen Range (11000 ft) (Feb.).

Collections. *Herb. Brit. Mus.: c.* 80 *nos* from *New Guinea* (*1951*), small but good collection (identified by Dr Van Steenis in Jan. 1953). On occasion he preserved a botanical specimen and sent it to the B.M.

His zoological collections, small mammals and bird skins, in Tring and the B.M.; they resulted in several papers by Rothschild and others.

Mayer, S.

He visited Blakan Mati,[3] probably one of the small islets near Singapore.

Literature. (3) S. Mayer: 'Reise nach Hinterindien und in den Sunda Archipel' (Allg. Bot. Zeitschr. 1896, p. 31–32, 51–52).

Mayr, E.

Under the portrait vol. 1 p. 353 read: E. Mayr.

Mc . . ., *cf. sub* Mac . . .

Mead, John Phillips

(†1951).

Biographical data. Mal. For. 14, 1951, p. 58–59.

Meer, Pieter van der

Line 6, behind *Addenda*, insert: *sub* Hoed.

***Meimban** Jr, J. R., *cf. sub* Philippine National Herbarium.

***Mellerborg**, Claës Erik

(1773, Nyköping, Sweden; 1828, Java), was educated in theology and medicine, and had the good fortune to live for some time in C.P. Thunberg's house as companion of the latter's son; a pupil of Thunberg. He stayed at Uppsala till June 1805, then Med. Fil. Kand., and went to Göteborg where he was to accompany an Indiaman's voyage to China as a ship's surgeon. The voyage did not come off because of the war, and instead, he went to Pomerania (Germany) as a Medical Officer in 1806. From there he travelled in Europe, visiting Poland, Frankfurt, Berlin, Hanau, Göttingen, Greifswald, Augsburg (Dec. 1809–March 1810), Karlsruhe, Danzig, Strassburg, Paris (Aug. 1810), Bayonne, and Spain (1811).

In 1817 he evidently visited Norway (letters from Trontjem and Rorås), and from 1817–25 he possibly lived at Uddeholm (several letters from there), Sweden. The thought of a voyage to foreign countries still haunted him, and in 1825 he is planning a voyage to Brasil in 1826. But a letter from Helsingör (dated July 30, 1826) tells of his being o/b the brig 'Themis', owned by a wholesale dealer Wallis, with destination East India.

He collected all sorts of things, including insects.

Collections. Many sheets in *Herb.* Thunberg (= *Uppsala*), mostly from his voyage in Europe, often cultivated plants. Mr Kern (Leyden) saw a specimen of *Cyperus laevigatus* (= *lateralis*) 'e *Java*', collected by Mellerborg, from the *Herb. State Mus. Stockholm*, but considers the locality to be very doubtful. It seems possible, however, that material from *Java* was forwarded to Thunberg.

Insects from Java in Zool. Mus. Stockholm.[1]

Literature. (1) *Cf.* W. Horn & I. Kahle, Ueber entom. Samml. *etc.* (Entom. Beihefte II–IV, 1935/37, p. 172).

Biographical data. Several letters from Mellerborg to C. P. Thunberg in Library University of Uppsala in vol. xxM; autobiography in *l.c.* no 211; in the cited MS vol. his name, year of birth, and death (Java), is mentioned on p. 163.

***Melville,** Ronald

(born 1903), from 1930–34 Plant physiologist attached to the research staff of the Imperial College of Science and Technology; 1934–50 Botanist in the Museums Department, Kew; in 1950 transferred to the Herbarium as botanist for Australasia.

He collected in the *Malay Peninsula* when passing through Singapore in 1953, on his way home from Australia.

Collecting localities. *1953. Malaya* (Aug. 15–31): *Singapore Island;* neighbourhood of Kuala Lumpur, including the Sungei Buloh Forest Reserve and the Kanching Forest Reserve; *Klang Island* near Port Swettenham; Fraser's Hill and Pine Tree Hill.

Collections. *Herb. Kew:* 147 *nos* from *Malaya*, numbered 4700–4846; partly also in *Herb. Kepong.*

***Mendiola,** N. B., *cf. sub* Philippine National Herbarium.

Mendoza, Demetrio R.

(1904, Guinayangan, Quezon Prov., Luzon, P. I.; x), graduated B.S.F. in the University of the Philippines (1937), and M.S. in the University of Santo Tomas, Manila (1953). From 1928–41 Ranger, Bureau of Forestry, Philippines; from 1935—41 Instructor in Botany and Dendrology, College of Forestry, U.P.; from 1947 onwards Assistant Curator, Philippine National Herbarium, and finally Senior Botanist.

D. R. MENDOZA

Author of papers on economic botany, ecology, and morphology.

Collecting localities. *Philippines. Luzon:* Mt Makiling, Laguna Prov.; Llavac, Famy, Laguna Prov. (pre-war); Guinayangan, Quezon Prov.; Manila and suburbs; Antipolo, Rizal Prov.; *Mindanao:* Mt Hilong-hilong and suburbs in Surigao and Agusan Provinces (Feb.–March *1949*), with P. Convocar (see there).

Collections. *Herb. Manila; Herb. Harv. Univ.; Herb. Leyden.* Numbered in the F.B. (pre-war) and the P.N.H. series (*cf. sub* Philippine National Herbarium).

***Menzies,** Archibald

(1754, Stix House, near Aberfeldy on the Tay, Scotland; 1842, Notting Hill, England) went to Edinburgh and worked under the botanist Dr John Hope; in 1781 he took his degree in medicine in Edinburgh, and in 1782 he entered the Navy as assistant surgeon. When stationed for several years on the 'Assistance' he had an opportunity to study the flora of coastal eastern America and the West Indies. His first correspondence with Sir J. Banks dates from May 1784.

In 1786 he was appointed surgeon on the 'Prince of Wales' (see below), in 1791 on the 'Discovery' as naturalist.

On retiring from the Navy he practised in London.

Menziesia J.E.Sm. and several plant species were named after him.

ITINERARY. *Voyage in the 'Prince of Wales' and the 'Princess Royal', 1786–89.*[1] Sailing (Sept. 1786) under Capt. Colnett, visiting Nootka Sound, NW. American coast, Hawaii, New Zealand, China (leaving Feb. 1789); off the Isle of Wight on July 14, 1789. Menzies may have left the ship in China returning home independently, but there is no certainty whether, nor when exactly *Sumatra* was visited (a specimen in *Herb. Linn. Soc. London* is dated Feb. *1789*!).—*Voyage in the 'Discovery' and 'Chatham', 1791–95.*[2] Sailing from Falmouth (Apr. 1, 1791) under Capt. Vancouver, for the North American Pacific by way of the Cape of Good Hope, New Holland (Australia), New Zealand, Tahiti and Hawaii, and the Sandwich Islands; the home voyage was made *via* Valparaiso and St Helena.

W. MEIJER

COLLECTIONS. He made botanical and zoological collections. He bequeathed his large herbarium of cryptogams, *Gramineae*, *Junci*, and *Carices*, to the *Edinburgh* Botanic Garden. Several plants were given to Banks during lifetime. Many plants remained with his family till about 1871, when they were presented to the New College Edinburgh; these were acquired by the *Brit. Mus.* by exchange in 1886.[3] Also dupl. in *Herb.* Martius (=*Brussels*), *Herb.* Lambert (now in *Brit. Mus.*, *Geneva*, and also dupl. at *Oxford* and *Cambridge*), *Herb.* Smith (*Linn. Soc. London*), and *Herb. Vienna.* He collected *Ophioglossum* and other ferns in *S. Sumatra* in *1789.*[4] It is not known to me whether the 'Prince of Wales' touched that island. An undated specimen from *Singapore* is in Edinburgh.

LITERATURE. (1) *Cf.* Proc. Linn. Soc. Lond. 156th sess., 1943/44, p. 171–172 (1945), and Banks' Correspondence (VI: 181) (according to Alston). As the documents concerning this voyage were seized by the Spaniards on the NW. Pacific Coast, very little is known of this expedition.

(2) Daily Journal by Menzies, 5 vols MS. in the British Museum (Add. MS. 32641) (*n.v.*). A transcript was in the possession of F. R. S. Balfour who intended to present it to the Linnean Society. Parts of the Journal, resp. dealing with British Columbia, California, and the Sandwich Islands, were published.

(3) *Cf.* G. Murray & J. Britten, History of the collections contained in the Natural History Department of the British Museum 1, 1904, p. 168.

(4) *Cf.* J. M. Cowan: 'Some information on the Menzies and Jack collections in the Herbarium, Royal Botanic Garden Edinburgh' (Not. R. Bot. Gard. Edinb. 21, 1954, p. 219—227).

BIOGRAPHICAL DATA. Backer, Woordenb. 1936; Proc. Linn. Soc. Lond. 156th sess. 1943/44, p. 170–183 (1945); portr. at the Linn. Soc. Lond. and at Kew, reproduced in Madroño 1, 1923, facing p. 262.

***Mercado**, J., *cf. sub* Philippine National Herbarium.

Merrill, Dana True

COLLECTIONS. Instead grasses, read: grasses and *Cyperaceae*.

Merrill, E. D.

(†1956, Jamaica Plain, Mass., U.S.A.).

BIOGRAPHICAL DATA. Fl. Mal. Bull. *no* 1, 1947, p. 30; Kew Bull. 1947, p. 38; Asa Gray Bull. n.s. 2, 1953, p. 335–370, photos; Jaarb. Kon. Ned. Ak. Wet. A'dam 1955–56, p. 1–7; Nature 177, 1956, p. 687–688; J. Arn. Arb. 37, 1956, p. 197–216, portr., completed bibliogr.; Taxon 5, 1956, p. 21; Proc. Linn. Soc. Lond. 168, 1957, p. 51–56; Bull. Nat. Res. Counc. Philip. *no* 41, 1957, p. 4–5.

Meurs, L. van

(†May 5, 1953, Djakarta, Indonesia).

***Meijer**, Willem

(1923, The Hague, Holland; x), botanist, educated at the University of Amsterdam, where he took his Ph.D. in 1951; towards the end of that year he went to Java as Assistant of the Herbarium Bogoriense. After a short European leave he returned to Indonesia in Feb. 1955 as Lecturer in Botany in the Faculty of Agriculture, Pajakumbuh, Sumatra West Coast; Sept. 1956 Professor of Botany there. He specialized in hepaticology, but also studies mosses, ferns and phanorogams, and is turning his attention to tropical forest botany, economic botany, and ecology. Repatriated in 1958.

Collecting localities. **1951.** *Singapore Island:* harbour, jungle near Bot. Garden (Dec. 11). *W. Java:* from Dec. onwards many numbers from *Hort. Bog.* and environs of Bogor.—**1952.** *W. Java:* Antjol (Jan. 4, with van Borssum Waalkes); Bekassi, Rawa Tembaga[1] (Feb. 2, with Kern and Pleyte); Tjitjadas, Tjiteureup, Tjileungsir (8, with Kern and Pleyte); N. slope of G. Pangrango above Tugu (10, with Kostermans and Van Borssum Waalkes); G. Gegerbintang (29, with Kostermans and Pleyte); Tugu, Gunung Mas, Tjisampai, G. Mandalawangi (March 12–24); Tjileungsir-Lulut, limestone hills (Apr. 9, with Kern and Pleyte); Tjibodas, G. Gedeh (May 3, 25, June 2). *Trip to E. Borneo* with Kostermans[2, 3, 7]: Samarinda, Mahakam (June 16); Kota Bangun (17, 18); along Bongan River from Kenohon Prian, near Muara Muntai, southwards to S. Langgar (24), Pringtali (25), to bivouac Tegumbit (26), staying at Tegumbit (27, 28), bivouac Tulus (100 m) (29, 30), short trip to Béwai terrace (400 m) and Béul terrace (700 m) (30), staying at Tulus and exploring the forest between S. Semon (100 m) and Béwai terrace (July 1–5); Béul bivouac (600–700 m) (6), exploring the terraces of Béul, Sembuni (800 m) and Berikan Bulu (900 m); Sulai Mandau (1000 m) and summit region of the *Peak of Balikpapan* (Gunung Beratus) (7–18)[2, 7]; back at Djambu, along Bongan River, and visiting swamps (25); Muara Muntai (27); returning to the coast[3], at Tjandjong Bangko (July 31, Aug. 1); *via* Sanga Sanga and Air Putih to bivouac on S. Mukun (2); proceeding to S. Bangko (3), environs S. Mukun (4–7). *W. Java:* above tea estate Tji Anten, S of Leuwiliang (Sept. 21); Rawa Tembaga (24; with Kern); Depok (Oct. 1; with Kern, Kostermans and Van Borssum Waalkes)[4]; Tugu, forest above tea estate G. Mas (3, 4)[5]; Tjibodas-Tjibeureum on G. Gedeh (22; with Kern and Gembong); Antjol (Nov. 12, with Hoogland); forest above tea estate Tji Anten, S of Leuwiliang (13, with Hoogland); Tugu, Tjisampai (14, with Hoogland); environs of Bandung, Dago (18), G. Tangkuban Prahu (21).—**1953.** Tjibodas on G. Gede(h)[6] (Jan. 19–21, Feb. 28–29, March 1–2, 29, June 16–17, 20–21); climbing G. Gedeh (July 23), Rawah Denok (25), Tjibeureum-Rarahan (26); Lebak Saät (27–30), visiting the Aloon aloon of G. Gede(h) (28), and summit of G. Pangrango (29); Tjibodas (30, 31); Tjisarua (31, Aug. 6); Tjampea and G. Djambu, Leuwiliang (7); Antjol (8); *Island Hoorn* in the Bay of Djakarta (10); Muara Angké (23); *E. Borneo* (partly with Kostermans)[7]: *Island Tarakan,* oil-field Pamusion (Oct. 24–26); *Island Nunukan:* village at northern extremity (from Oct. 28), first collecting near forest garden, from Nov. 2–24 deeper inland, with bivouac I as base camp; bivouac Simengkadu at southern extremity (26–30), collecting in marsh, dryland, and mangrove forest; back to the village (Dec. 1), and by proa to S. Binusan (5, coll. 6–7); back at *Tarakan* (11); oil-field Pamusion (11–12), Sesanip (13), Amal (14), G. Tjankol (15), Sesanip (16), Kp. Empat (17), G. Tjankol (19).—**1954.** *W. Java:* several times in the nature reserve above Tjibodas, G. Gedeh (Jan. 21, March 17, June 22—25, Aug. 7)[8]; Depok (Feb. 21, with Kern, Van Borssum Waalkes, and Kostermans)[4], Tjilintjing (Feb. 25); *Centr. Java:*[9] Jogja (= Djokja) (Apr. 28), Dieng Plateau (29), Telaga Balekambang, Telaga Warna, T. Terus, T. Lumut (30); *W. Java:* Tjisarua selatan (= Zuid) (July 21), Antjol (27), Djasinga, Tjurug, and Djungus Iwul (with Hildebrand, Aug. 4), Janlappa (Aug. 20). Trip to *Sumatra West Coast* (with J. Douglas): Padang Tinggi (Oct. 19, 20, 22) (detecting *Rafflesia arnoldii*), Bukittinggi, Karbau canyon, Subang Pass (21).—**1955.** *Sumatra West Coast:*[11] on various trips in the *environs of Pajakumbuh,* Harau canyon, marshes near Sarilamak, nothern slopes of G. Sago, above Padang Mengatas, above Halaban, above Padang Lawas, and to Bukit Nantigo; trips to summit *G. Sago*[10] along ridge above P. Mengatas (June 28—30), Batang Palupuh (May 16), Merapi, trip to the summit (March 6, June 12–13); trip to Pasaman, Panti-Sukamenanti (June 18), coastal marshes near Sasak (19), Panti (20); trip to *G. Singgalang,* ascending from S. Tanang (July 5), summit region (6–7), ridge to Tandikat (7), descending from Danau (8) along road to Kota Tinggi; Tandikat, Kandang Empat (23), ascent of western slope (24), descending (25); Anei canyon (Aug. 4). *W. Java:* Tjibodas, plant sociological sample plot of 1 ha of forest between 1450–1500 m (Aug. 20–27)[8]. *Sum. West Coast: trip to Manindjau,* Matur-Manindjau (Nov. 11), Manindjau Lake, N. side (12), Batu Sangkar (21), Gunung Bungso near B. Sangkar (22), from Batu Sangkar to Sitangkai, Sawah Lunto and Singkarak (23), trip to Taluk, W. Indragiri (*Centr. Sumatra*) (24), limestone hills near Buo (26); trip to Tandjung Pauh, NE of Pajakumbuh (Dec. 9–10)[11].—**1956.** *Sumatra West Coast.* Many trips on N. slopes of *G. Sago*[10], to summit along Air Kesimbukan above Padang Mengatas (March 16–18), along ridge above shelter between Bt Laku and Bt Pinago (June 18–20), same ridge with Jacobs (Aug. 19), and with Vermeulen (Dec. 15), crater (June 7). *Centr. Sumatra, W. Indragiri trip* (Jan. 4—26):[12] leaving Pajakumbuh (4), driving by way of Sitangkai, Muaro, Sidjungjung, Kilirandjau, to bivouac Dewan I in the hilly country between Lubuk Djambi and Kilirandjau near the western boundary of Indragiri; collecting in the vicinity, moving (14) to a bivouac near Taluk at Pulau Lawas on the river Air Hitam; moving to *W. Sumatra:* Sungei Langsat (24), collecting on a limestone hill, Bukit Lawang, near Siaur (25); return at Pajakumbuh (26); sandstone region Taram, Lubuk Bangku, NE of Pajakumbuh (Feb. 5); limestone caves near Buo (March 3). *W. Java:* Tjibodas (Apr. 15). *Sumatra West Coast:* trip to summit *G. Singgalang* (June 30–July 1); *trip to Kerinchi:* Indarung near Padang (July 14), P. Tinggi, Pintu Angin, Lubuk Selasih, Danau di Atas near Alahan Pandjang (5); together with M. Jacobs from Padang southwards along the coast (19), till S. Penuh (20), K. Aro, tea plantation (21), ascent of *G. Kerinchi* (= Kerintji)[13], to bivouac Pondok

Patjet at 2000 m alt. (22), towards shelter Padang Bungo at 3000 m (23), towards summit (3800 m) and back to Pondok Patjet (24), exploring forest in plant sociological sample plots at 2000 and 1700 m near Pondok Patjet and S. Kering (26–28), from K. Aro to Gunung Labu with JANSZ (29), once more exploring the plant sociological plots (see above) (30–31, Aug. 1, 3), once more to Padang Bungo (2), back to K. Aro and to base of G. Tudjuh (4), crater rim and lake of G. Tudjuh (5), back to K. Aro (6), exploring Rawah Bento (8–9), Air Panas and lake of Kerinchi (10), back to Padang—Pajakumbuh along Muaro Sako (11), Painan (12); trip to Harau—Lubuk Bangku, sandstone region NE of Pajakumbuh (15), G. Bungso, N of Pajakumbuh (16); G. Sago (18–19), and JACOBS returning to Java; G. Merapi, surroundings pasanggrahan 'Amor naturae', 1400 m (Nov. 18–19). Trips with Dr P. VERMEULEN to Harau (Dec. 12), G. Sago (13—16), Karbau canyon, Matur, Manindjau (18), Manindjau, Tiku, Pariaman, Anei (19).—**1957**. Various trips on G. Sago, exploration of the region of Kp. Padang Pandjang and Si-kabu[2] between Pajakumbuh and G. Sago; Padang, Bungus, Painan, coastal flora at the bay and along Singkok (Feb. 22–24); various excursions for investigations of weeds in wet rice-fields in kabupaten Lima puluh Kota and Agam; Taram (Apr. 22, 30), Udjung guguk, Baso (27), Kota Baru (29), Karbau canyon (May 7); surroundings of Tandjong Djati and Suliki N of Pajakumbuh (8); trip to summit *G. Singgalang* (24–26); sandstone hills E of Taram (July 30), Lake Singkarak (Aug. 5); forest of Tjampo region, E of Taram (20–28), Bukit Bungso near Batu Sangkar (Sept. 7), Padang Simawang near Lake Singkarak (8).

COLLECTIONS. *Herb. Bog.*: *c.* 3000 *nos* of flowering plants and 6000 bryophytes; *Herb. Fac. Agr. Pajakumbuh: c.* 3000 *nos* of flowering plants; dupl. at *Leyden*, *Sing.*, *Kew*, *Brit. Mus.*, *Berl. Dahl.*, and *Geneva*.

The numbers of the more important collections run as follows: *E. Borneo*, Balik Papan region 460–1136, *Tarakan-Nunukan* 1851–2605; *W. & Centr. Sumatra*, W. Indragiri 4076–4454, Kerinchi 6063–6704, Taram-Tjampo region 6934–7094. *Nos* 1–176 and the above mentioned collections were numbered in the field; the others, also the bryophytes, after study, mainly chronologically.

The bryophytes are separately numbered, and besides preceded by a B.

Living orchids from *E. Borneo* and some plants from *Sumatra* (Padang Tinggi and Pajakumbuh) in *Hort. Bog.*

LITERATURE. (1) J. H. KERN & W. MEIJER: 'Nogmaals de Rawah Tembaga' (Med.–Blad Nat. Hist. Ver. Indon. 4, 1952, p. 5–7).

(2) Typed report on trip to Peak of Balikpapan and E. coast of Borneo near Samarinda in Libr. Herb. Bog. and Fl. Mal., 1953.

(3) W. MEIJER: 'The fern Dipteris conjugata growing at sea-level along the east-coast of Borneo' (Peng. Alam 34, 1954, p. 17–20, fig. 1–2); 'Collecting bryophytes in Borneo' (Bryol. 57, 1954, p. 261—272, 4 photogr.).

(4) Typed report on Nature Reserve Depok, in Libr. Herb. Bog. and Fl. Mal.

(5) W. MEIJER: 'Orchideeën jacht op West-Java' (Orchideeën n.s. 15, 1953, p. 4–6, *etc.*).

(6) W. MEIJER: 'Plantensociologische waarnemingen in de topregionen van Gede en Pangrango' (Peng. Alam 34, 1954, p. 9–17); 'Een bezoek aan de toppen van Gedeh en Pangrango' (Buxbaumia 8, 1954, p. 41–48); typed report on some botanical investigations on Mt Gedeh-Pangrango, 1953, in Libr. Herb. Bog. and Fl. Mal.

(7) W. MEIJER: 'Orchideeën-waarnemingen in Oost-Borneo' (Orchideeën 16, 1954, p. 84–86; *ibid.* 17, 1955, p. 4–7).

(8) W. MEIJER: Typed check list of flora of Tjibodas, 1956, in Libr. Herb. Bog. and Fl. Mal.; 'Op zoek naar de boomvarens van Tjibodas' (Peng. Alam 35, 1955, p. 45–53, fig. 1–5).

(9) W. MEIJER: 'Een tournee naar Midden-Java' (Buxbaumia 9, 1955, p. 11–17).

(10) Typed report on Mt Sago near Pajakumbuh, 1956, in Libr. Herb. Bog. and Fl. Mal.

(11) W. MEIJER: 'Oriëntaties in Midden-Sumatra' (Buxbaumia 10, 1956, p. 19-24); 'Explorasi botanis di Sumatera tengah' (Berita Fak. Pajakumbuh 1, 1956, p. 5–10, with Engl. summary).

(12) Typed report on W. Indragiri, 1956, in Libr. Herb. Bog. and Fl. Mal.

(13) W. MEIJER: 'Een tocht naar de top van de Kerinchi (3800 m)' (Buxbaumia 11, 1957, p. 26–32).

Meijer Drees, E.

COLLECTIONS. Add: He possibly also collected in Banka.[2]

LITERATURE. (2) E. MEIJER DREES: 'Verslag van een oriënterende tournée ten behoeve van het vegetatie onderzoek in het boscomplex Lubuk Besar op Banka' (mimeographed, Buitenzorg, Java).

Micholitz, W.

COLLECTIONS. Add: *C.* 90 *Philippine* ferns at *Kew Herb.*

Middelaer, Frederik Hendrik Victor
(† 1953, Australia).

Miklucho-Maclay, N. N.

COLLECTIONS. At least some in *Herb. Melbourne.*

BIOGRAPHICAL DATA. Add: D. FISCHER, Unter Südsee-Insulanern. Das Leben des Forschers Mikloucho-Maclay (Leipzig 1956); Poetesjestwië na bereg Maklaja (Moskau 1956).

***Militante**, P. J.
collected in Dec. *1952* at Pilar, Bataan Peninsula, *Luzon;* plants in *Herb. Univ. Philip.*

***Miniado, J. A.,** *cf. sub* Philippine National Herbarium.

Mjöberg, Eric Georg (*not* P.)
educated at Stockholm College, Ph. D. Lund, 1910.

After his return to Sweden he fell seriously ill, which finally, after ten years, resulted in his death.

COLLECTIONS. Plants from Australia in *Herb. State Mus. Stockholm;* no botanical Sumatra collections extant, as the fragmentary collection (mostly of ethnographical interest) mouldered away (oral inf. by Mrs MJÖBERG, 1957).

LITERATURE. (1) Add: 'I tropikernas villande urskogar' (Stockholm).

BIOGRAPHICAL DATA. Vem är det? 1937, p. 578; Sarawak Mus. J. 8, 1957, p. 1–7.

Mochtar bin Musa
(1929, Semarang, Java, Indonesia; x), Indonesian, since August 1948 in the employ of the Botanic Gardens at Bogor (Kebun Raya Indonesia), and from October of that year of the Herbarium Bogoriense; since 1950 'mantri'.

COLLECTIONS. *Herb. Bog.: c.* 300 *nos* together with IDJAN on an expedition to *Ternate* and *Halmaheira* in *1951* (itinerary *etc. cf. sub* D. R. PLEYTE).

***Mochtarno**, *cf. sub* RAPPARD.

Möller, Hj.
(† 1941, Stocksund, Sweden), made his Java/Burma trip with support of the Battram stipend. Burma was visited after his return from Java; end November 1897 found him back at Lund again. From 1904–06 secretary and assistant at the Institute of the Swedish Seed Control Society at Svalöv; from 1906–17 teacher at Kalmar, Falun, and Västerik; from 1917 onwards he did bryological work at the State Museum Stockholm, living at the nearby Stocksund.

Stereophyllum mölleri BROTH. was named after him.

COLLECTING LOCALITIES. *W. Java* add: Garoet-Tjipanas (May 2).

COLLECTIONS. His *Java* collection is labelled 'Plantae Javanicae'. In 1907 the *State Mus. Stockholm* bought 500 *Java* plants; also mosses (pres. 1906) and *Algae* (1917/18) from *Java*.

BIOGRAPHICAL DATA. Add: Svensk Bot. Tidskr. 35, 1941, p. 371–375 with portr.

***Molesworth**, Miss B. E. G., *cf.* B. E. G. M ALLEN.

Monod de Froideville, Ch.
He made a study tour to the Lesser Sunda Islands.[2] Early in 1951 he returned to Holland and settled at Bergen.

LITERATURE. (2) CH. MONOD DE FROIDEVILLE: 'Voorlopig verslag van een dienstreis naar Timor en Soemba' (mimeographed report, illustrated, 22 pp., Bogor 1949).

Montigny, Louis Charles Nicolas Maximilian
(1805, Hamburg, Germany; 1868, France), accompanied LAGRENÉ's French Embassy to China in 1843, and returned from Canton to France in July 1845. In Jan. 1847 appointed Consular Agent at Shanghai, in 1850 promoted to the rank of 2nd Consul, home on leave in July 1853, in Oct. 1855 1st Class Consul, and in July 1858 Consul General at that port. In February he was transferred to Canton, and resigned in August 1862.

BIOGRAPHICAL DATA. Rev. Hort. 1869, p. 52–53; BRETSCHNEIDER, Hist. Bot. Disc. China 1898, p. 536–538.

Moorhouse, S. W.
Calamus moorhousei FURTADO was named after him.

Moquette, J. P.
COLLECTIONS. The *Borneo* orchids were bought by him.

***Morris**
employed by the Borneo Abaca Ltd, Tawau, North Borneo.

COLLECTIONS. From time to time he sends specimens for identification to *Sandakan Herb.*, numbered in the SAN series of the Forest Department Br. North Borneo, *e.g.* at Tawau 3 Dec. *1956.*

Mortensen, O. Th. J.
(† 1952). He made a zoological world collecting trip to Japan, the Philippines, Australia, New Zealand, Hawaii, California, Panama, *etc.*, in 1913–16.

COLLECTING LOCALITIES. During the Danish Expedition to the *Kai Islands*, he collected a *Thalassia* on the N. coast of Doe Roa (= *P. Doeroa*) (Apr. 25, *1922*).

COLLECTIONS. Above-mentioned plant is *no* 227 in the number series of HJ. JENSEN (see there).

BIOGRAPHICAL DATA. Entom. Meddel. 15, 1936, p. 358–360, fig. 102 portr.; Vidensk. Medd. Dansk Naturhist. For. 114, 1952, p. v–xx, with portr. and bibliogr.

***Morwood**, R.
forest officer, employed by the Department of Forests at Lae, Territory of New Guinea; collected in the N.G.F. series (*cf.* New Guinea Forces) in *E. New Guinea.*

***Motan bin Alang**
Sakai Forester, joined in 1947 as tree climber and Herbarium collector at the Forest Research Institute at Kepong, Selangor, Malaya. He collected in the C.F. series (*cf.* Conservator of Forests series in Fl. Mal. vol. 1).

Moulton's collectors
COLLECTIONS. Dupl. in *Herb. Brit. Mus.*

Mousset, J. P.
Part of his ferns was elaborated by ROSENSTOCK.[3]

COLLECTING LOCALITIES. The locality Alkmaar is the sugar factory (s.f.) of that name in *E. Java.*

COLLECTIONS. Some dupl. in *Herb. Brit. Mus.*
LITERATURE. (3) *Cf.* Fedde, Rep. 8, 1910, p. 163—164, 278—279.

Müller, George
was murdered by Bornean natives.

***Müller (-Wismar),** Dr Wilhelm
(died before 1927), ethnologist and linguist who accompanied some German Southsea expeditions, including the well-known 'Südsee-Expedition der Hamburgische Wissenschaftliche Stiftung' in the 'Peiho', 1908–10 (*cf.* also *sub* G. DUNCKER).
COLLECTIONS. Possibly he collected a few specimens together with F. E. HELLWIG (see there).
BIOGRAPHICAL DATA. Portr. in THILENIUS, Ergebn. Südsee-Exp. 1908–10, 1. Allg., Hamburg 1927, pl. 1.

***Mundo,** A. del
collected at Concepcion, Sta Domingo, Quezon City, Pangasinan, and Los Baños, in *Luzon* (*1953–55*); plants in *Herb. Univ. Philip.*

***Muni,** Mrs D. S.
contributed some plants from *Luzon*, and *Polillo* (*1949*) to the P.N.H. series (*cf. sub* Philippine National Herbarium).

Muñoz, José
In *1904* he collected in *Luzon* also.

***Murao,** S., *cf. sub* Philippine National Herbarium.

Murphy, M.
COLLECTIONS. A *Cyperus tenuiculmis* from Port Moresby, *Papua* (coll. Jan. *1905*), in *Bern. P. Bish. Mus. Hawaii.*

Muslihat
or MOESLIHAT of the Indonesian Forest Service collected in the Ja series, Tjibeureum near Cheribon, Feb. 18, *1955.*

N.G.F., *cf. sub* New Guinea Forces = New Guinea Forests.

Nakai, T.
(† 1952, Tokyo, Japan).
BIOGRAPHICAL DATA. Bot. Mag. Tokyo 66, 1953, p. 775–776, portr. and addit. bibliogr.

Nano, J. F., *cf. sub* Philippine National Herbarium.

Naumann, F. C.
COLLECTIONS. From ENGLER's Übersicht (see LIT. 3) it is evident that 2 species were collected in the *Lucipara Islands.* As the present author supposed that she might have overlooked these islands when extracting the itinerary from the 'Reisebericht' (see LIT. 1), she consulted the book once more. It appeared that the 'Gazelle' did not touch the Lucipara Islands, but passed them between May 28 and June 2, *1875.* The plants must have been collected when a small boat was sent to inspect the possibility of anchoring near the W. side of the islands. In vol. 1 of 'Die Forschungsreisse *etc.*' (p. 157) no mention is made of a landing of a party.

***Nautje,** Barnabas
(1937, Kondjobandoe, South New Guinea; x) attended the Bosbouwschool at Hollandia, N. New Guinea; onwards of 1957 in the employ of the Forestry Service.
COLLECTING LOCALITIES. *1957. N. New Guinea:* Hamadi near Hollandia (March 19, 28); *S. New Guinea:* Asmat area, at Erma, Sauwah, Komor (June 23–Aug. 6).
COLLECTIONS. About 125 *nos*, numbered in the B.W. series, in *Herb. Manokwari*, dupl. at *Leyden.*

***Navarro,** L., *cf. sub* Philippine National Herbarium.

***Neck,** Jacob Cornelisz. van
(1564, Amsterdam, Holland; 1638, Amsterdam' Holland), an educated man who went to sea at an early age. He was appointed Admiral in command of two early successfull Dutch voyages to the East. After his return he settled at Amsterdam, holding several important offices.
ITINERARY. *1598–99.*[1] Sailing from Texel (May 1, *1598*), rounding the Cape of Good Hope; Nov. 19 Sumatra in sight, sailing 5 days along the coast; Sunda Straits, passing Krakatau and Cibissy (= Sebesi), anchoring off Samor (a high fertile mountain in *S. Sumatra;* ? possibly G. Radjabassa, and the place Soemoer) (24); *W. Java:* Bantam City (Nov. 27–Jan. 10, *1599*); VAN NECK leaving for the home voyage (11), watering at Samor (*S. Sumatra*) and bringing the sick on land (12–18); rounding the Cape (Apr. 7); St Helena; arrival at Texel (July 17); back at Amsterdam (27). VAN WAERWIJCK and VAN HEEMSKERCK proceeded to the Moluccas in Jan. 1599 with part of the fleet. —*1600–1603.*[2] Sailing from Texel (June 28, *1600*), rounding the Cape of Good Hope; anchoring near Bantam City (*W. Java*) (March 30–May 1, *1601*); *Ternate* (June 2–July 30), also visiting *Tidore;* by way of the *Philippines: Coyo* (Aug. 19), and another Philippine island (22), to Macao; Patani in S. Siam; on the home voyage visiting Bantam in *W. Java* again (Sept. 27–Dec. 1, *1602*); St Helena; back at Amsterdam in July *1603.* One of the ships returned after the first visit to Bantam, but this time VAN NECK accompanied the fleet to the Moluccas *etc.*
COLLECTIONS. He brought home a collection of fruits, *etc.*, described by CLUSIUS,[3]
LITERATURE. (1) 'Reisverhaal van Jacob van Neck (1598–99)' (by Dr H. T. COLENBRANDER after an old MS in Bijdr. & Med. Hist. Genootsch. 21, 1900, p. 194–329). Many other publications on this voyage, *e.g.* J. C. VAN NECK & W. VAN WAERWIJCK: 'De 2e scheepvaart *etc.*' (works edited by the Linschoten Vereeniging, 1938–42).

(2) 'Journael van de Tweede Reys, gedaen by den Heer Admirael Jacob van Neck, naer Oost-Indien, met zes scheepen in den Jare 1600' (Amsterdam, 32 pp.); 'De tweede Voyagie van Jacob van Neck, naer Oost-Indien' (appended to 'Wonderlijcke Voyagie, bij de Hollanders gedaen, door de Strate Magalanes *etc.*', Amstelredam 1648).

(3) *Cf.* C. CLUSIUS, Exoticorum libri *etc.* 1605, p. 36, 82, *etc.*

BIOGRAPHICAL DATA. H. TERPSTRA: 'J. van Neck, Amsterdams admiraal en regent' (Amsterdam 1950); WINKLER PRINS, Encyclop. 14, 1952, p. 300–301.

Nedi

COLLECTING LOCALITIES. Add: *1955. E. Borneo:* Blajan River near Samarinda (March 21).

Née, L.

For additional information and a correction *cf. sub* HAENKE.

COLLECTIONS. According to Mr A. H. G. ALSTON (*in litt.*) NÉE's collection in *Madrid* is arranged geographically and contains over 1000 Philippine specimens.

***Neervoort,** Anthonie Marie

(1911, 's-Gravenpolder, Z., Holland; x) passed the examination of the Horticultural School at Frederiksoord (Drente, Holland) in 1931. From 1932–38 garden architect in Holland, from 1938–July 1939 assistant on the rubber estate Kawoeng at Madjenang, Java; from 1939–July 1951 Assistant Curator, later Curator of the Buitenzorg Botanic Gardens, for the greater part stationed at Tjibodas. After his return to Holland he settled as a garden architect at Mook (Limburg); in 1957 appointed officer for Nature Preservation, stationed at Utrecht.

COLLECTING LOCALITIES. *W. Java:* Buitenzorg Botanic Gardens (July–Aug. *1939*), Tjibodas (*1939–42*); Mountain Garden Tjibodas and Nature Reserve G. Gede(h) (*1942*–Nov. 11, *1944*); Mountain Garden Tjibodas, Nature Reserve G. Gede(h), G. Pangrang(g)o, Geger Benteng, Gunung Putri, Puntjak, *etc.* (*1947–49*).

COLLECTIONS. *Herb. Bog.:* cultivated plants from Bogor and Tjibodas (dupl. of the Herb. Hort. Tjibod.), and forest plants from abovementioned localities, partly collected with assistance of HASAN I, NURTA, and occasionally ATMAWISASTRA (NEERVOORT *c.s.* on the labels). *Herb. Tjibodas:* plants from the Tjibodas Garden, the Nature Reserve, *etc.*, coll. *1947–49* (earlier collections were burnt in 1946). *Herb. For. Res. Inst. Bog.:* cultivated *Eucalypti* from the Tjibodas Garden.

Besides he made numerous zoological collections on behalf of others, and a large collection of *Musci* for Prof. VAN DER WIJK at Groningen.

Nelson, David

BIOGRAPHICAL DATA. Add: BRETSCHNEIDER, Hist. Bot. Disc. China 1898, p. 152–153.

Nesvadba, Miss

Eurasian school teacher, former pupil of the agrostologist P. JANSEN, who before his retirement was director of a teachers' seminary in Amsterdam.

COLLECTIONS. *C.* 20 grasses from Medan, *Sumatra East Coast*, collected *c. 1930*, in *Herb.* JANSEN (for the greater part in *Herb. Leyden*).

New Guinea Forces now **New Guinea Forests**

The N.G.F. series, originally started during World War II, was continued after 1945. The plants are preserved in *For. Herb. Lae*, *Brisbane*, *Canberra* and eventually dupl. in *Herb. Arn. Arb.*, *Kew*, *Leyden*, *Bogor*, *Sing.*, and *Imp. For. Inst. Oxford.*

The collections reached about 1200 numbers when transferred to Civil Administration; the location to end of 1945 were *Biak* 8, *Morotai* 14, *Noemfoor* 19, *New Guinea* mainland 798, *New Britain* 112, Bougainville (not included here in the Malaysian region) 51, *Admiralty Islands* 33, *Papua* 100. Main collectors were L. S. SMITH and H. K. C. MAIR, both botanists. After the war collections have been expanded considerably, mainly by Mr J. S. WOMERSLEY, but with considerable contributions by E. ALLAN, J. H. BARRETT, A. FLOYD, D. FRYAR, E. GRAY, A. HART, W. HEATHER, M. F. C. JACKSON, G. MCDONALD, D. MCINTOSH, J. SCHACHT, and others.

Newton, F.

COLLECTING LOCALITIES. Add: *Java, e.g.* Cheribon.

COLLECTIONS. *Herb. Univ. Lisbon:* some *Hepaticae* from *Portuguese Timor*. The Timor plants at Kew include a few *Java* specimens.

N.G.F., *cf. sub* New Guinea Forces.

***Nicholson,** Donald Ian

(1928, Sydney, N.S.W., Australia; x) was trained at Sydney University and the Australian Forestry School, Canberra from 1945–48, and worked at the Forestry & Timber Bureau Canberra as a Research Officer from 1949–1954. He joined the Colonial Service in 1954, and was sent for 1 year to E. Africa being stationed at E.A.A.F.R.O. Kikuyu, Kenya; since 1957 Ecologist at Sandakan, North Borneo.

COLLECTIONS. In SAN (= Sandakan) series in North Borneo, *e.g.* Lumat (Beaufort District) (9.4.1957); *Herb. Sandakan etc.*

Nielsen, Einer, *cf.* E. STEEMANN NIELSEN in Cyclopaedia of Collectors (Fl. Mal. vol. 1).

Nieuwenhuis, Anton Willem

(† 1953, Leiden, Holland).

For the name of his wife read: M. J. T. NIEUWENHUIS-VON UEXKÜLL GÜLDENBANDT.

***Normann,** C.

COLLECTIONS. *Herb. Copenhagen:* 19 *nos* from Nagasaki and *Singapore* (*1870–71*).

Norris, Sir W.
COLLECTIONS. Also dupl. (distrib. Kew) in *Herb. Leningrad.*

Nur bin Mohamed Ghose, M.
was awarded the British Empire Medal in 1955.

VAN OOSTSTROOM

***Nurta**
Indonesian employee of the Tjibodas Mountain Garden, assisted A. M. NEERVOORT (see there) in collecting plants from *1947–49.*

Nyman, E. O. A.
COLLECTING LOCALITIES. *1897–98. W. Java* add: G. Salak (May 23, 1897; Oct. 1897; June 23, 1898); Hort. Bog. (March, June 18, 1897); Tjisolok (Sept. 1897).

Ocampo, M., *cf. sub* Philippine National Herbarium.

***Ocfemia,** R. N., *cf. sub* Philippine National Herbarium.

***Odenthal**
collected *Dendrobium rimannii* RCHB. *f.* in Madiun, between Magetan and Plaosan (*Centr. Java*) (*cf.* Bull. Jard. Bot. Btzg III, 16, 1939, p. 129).

Oever, Hendrik ten
(† 1957, Zeist, U., Holland).

Ogata, Dr Masasuke
(1883–1944) was associated with the Pharmaceutical Institute, Faculty of Medicine, Tokyo Imp. University.
COLLECTIONS. His collection of ferns is deposited for the greater part in the *Herb. Takeda Medicine Industrial Co., Jyusô, Osaka.*

***Ohna,** H. S.
collected in *Negros* (Dec. *1952*); plants in *Herb. Univ. Philip.*

***Olah,** Prof. Dr L. M.
Hungarian cytologist, for some years on the staff of the Treub Laboratory, Bogor, collected 6 plants at Kandang Badak, G. Gedeh-Pangrango, *W. Java;* in *Herb. Bog.*

Oldham, R.
COLLECTIONS. *Herb. State Mus. Stockholm:* dupl. Japan and Korea.

***Ooststroom,** Simon Jan van
(1906, Rotterdam, Holland; x), botanist, educated at Utrecht University, taking his Ph.D. degree in 1934. From 1927–34 Assistant of the Botanical Museum and Herbarium at Utrecht, and subsequently Assistant, afterwards Curator of the Rijksherbarium at Leyden.

He collected plants on numerous European trips, and was awarded the Buitenzorg Fund in 1949.

Author of several taxonomic papers, mainly dealing with *Convolvulaceae;* co-editor of the Flora Neerlandica.

COLLECTING LOCALITIES. *1950. P. Penang* (Jan. 17); *Malay Peninsula:* Port Swettenham (19); *Singapore* (21–22); *W. Java:* Buitenzorg (= Bogor) (26–27), Depok (29), Buitenzorg (Jan. 30–Feb. 25), Tjisarua Zuid (Feb. 26), Buitenzorg (Feb. 28–March 10), Tjibodas-Tjibeur(r)eum (March 12), Buitenzorg (13–14), Patjet and Tjipanas (16), Buitenzorg (17–18), Tanggerang and Kamal (19), Pasar Minggu (21), Tjibodas (22–27), Kandang Badak and G. Pangranggo (28–29), Tjibodas (Apr. 1–3), Batavia (= Djakarta) and *P. Amsterdam* (5–8), Buitenzorg (14–22), Kuripan (23), Tjibodas and G. Gegerbintang (Apr. 29–May 2), Tjibodas (May 7–15), Telaga Warna (May 13), Buitenzorg (19).

COLLECTIONS. *Herb. Leyden:* plants from *Penang* (*nos* 12491–12511), Port Swettenham (12512–12520), *Singapore* (12521–12540), and from *W. Java* (12541–14184), in total 1644 numbers, of which dupl. in *Herb. Bog.*

***Orden,** T., *cf. sub* Philippine National Herbarium.

Osbeck, P.
In 1758 appointed member of the Royal Swedish Academy of Sciences.

ITINERARY. For the name of the ship read: 'Prins Carl'. On the outward voyage the ship skirted the S. coast of *Java* from East to West.[4]

COLLECTIONS. Also in *Herb.* RETZIUS (= *Lund*), and in *Herb.* BERGIUS (= *Acad. Stockholm*).

LITERATURE. (4) *Cf.* ROB. E. FRIES in Svensk. Linné-Sällskap. Årsskr. 33–34, 1950–51, p. 33 and map.

BIOGRAPHICAL DATA. Add: Svensk. Linné-Sällskap. Årsskr. 11, 1928, p. 173 (on sepulchral monument).

***Ostenfeld,** Carl Emil Hansen

(1873, Randers, Denmark; 1931, Copenhagen, Denmark), botanist, educated at Copenhagen University. From 1895–96 with the Ingolf Expedition in the N. Atlantic; Mag. Sc. in 1897; Ph.D. in 1906, on the botanical results of his visits to the Farøer (1897 and 1903). Since 1900 on the staff of the Botanical Museum in Copenhagen; in 1918 appointed Professor of Botany at the Agricultural College, in 1923 at Copenhagen University.

In 1914 he visited Australia, invited by the British Association for the Advancement of Science. An accident during the voyage prevented him from fulfilling his original purpose of taking part in the annual meeting to be held in the capitals of the different states. Instead, he investigated West Australia.[1] The home voyage was made by way of *Java* and Sabang (*P. Weh*, N. of Sumatra). In the latter island he collected some plants in Nov. *1914*.

COLLECTIONS. The plants from *P. Weh* (*1914*) in *Herb. Copenhagen.*

LITERATURE. (1) See Contributions to West Australian Botany in Dansk Bot. Ark. 2, 1916–18, and in Biol. Meddel. Kgl. Vidensk. Selsk. 3, 1921.

BIOGRAPHICAL DATA. J. Bot. 69, 1931, p. 79–80; Ber. Deut. Bot. Ges. 49, 1931, Gen. Vers. Heft 1932, p. (164)-(168); Entom. Meddel. 15, 1936, p. 459–460, fig. 143 portr.; bibliogr. in C. CHRISTENSEN, Den Dansk. Bot. Lit. 1880–1911, København 1913, and in Bot. Tidsskr. vol. 34, 36, 37, 38, 40, and 41.

***Otek bin** ?

(died prewar), was appointed as Forest Guard in Br. N. Borneo, stationed at Tawau.

COLLECTIONS. *Cf.* Forest Department British North Borneo. He collected at Tawau, *Br. N. Borneo.*

***Otto-Surbeck,** Rosa Lydia

(1909, Gunung Malaju, Asahan, Sumatra; x), daughter to H. SURBECK (see there); married to a Mr OTTO, now manager of the Ltd Company established by his father in law.

COLLECTING LOCALITIES. *N. Sumatra,* in Sumatra East Coast and Tapanuli provinces. *1953.* Pematang Siantar (Aug.–Dec.).—*1954.* Prapat (Jan.), Simelungun (Dec.).— *1955.* Balige (Porsea) (Jan.), Seribu Dolok (Jan.), Lima Pulu (Apr.), Simelungun (July).

COLLECTIONS. *Herb. Zürich,* dupl. in *Herb. Leyden;* excellent material.

Ouwehand, C. D.

(† 1951, Katwijk, Holland).

Overdijkink, Gerard

Line 1 insert: in 1908; line 3 for 1911 read: 1913.

P.N.H. series, *cf.* Philippine National Herbarium.

Palm, B. T.

(† 1956, Lyckorna, Bohuslän, Sweden).

MRS OTTO-SURBECK

***Palo,** M. A., *cf. sub* Philippine National Herbarium.

***Pancho,** Juan V.

B.S.A., M.Sc. Botany, University of the Philippines. Instructor in Botany, College of Agriculture, University of the Philippines, and later a fellow at Cornell University, Ithaca, N.Y.

COLLECTING LOCALITIES. From *about 1953 onwards. Luzon:* Mt Makiling, Laguna Prov.; Baguio City, Bontoc, Banawe, Mt Polis, Mt Data, Mountain Prov.; *Mindanao:* Compostela and Mt Apo, Davao Prov.

COLLECTIONS. *Herb. Manila,* numbered in the P.N.H. series (*cf.* Philippine National Herbarium).

***Paniza,** I. P.

on the staff of the Philippine National Museum, collected in *Mindoro* (Apr. *1948*), and in *Panay Isl.* (March *1949*), respectively *c.* 60 and 70 plants, numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium).

Parkinson, S.

LITERATURE. (1) Add: For the new and mostly unlisted technical names in this Journal see E. D. MERRILL in 'The Botany of Cook's Voyages' (Chron. Bot. 14, 1954, p. 346–363).

Parks, J. D.
Biographical data. Add: J. R. Hort. Soc. 80, 1955, p. 270.

***Parsons**, W., *cf. sub* Philippine National Herbarium.

Pascua, A., *cf. sub* Philippine National Herbarium.

***Pasma, C.**
collected some weeds on the S.f. Nieuw Tersana, Cheribon, *W. Java*, in *1914*. The material was sent to C. A. Backer, *Herb. Bog.*

***Paymans, K.**
Forest Officer, educated at Wageningen Agricultural College. He entered the Indonesian Forest Service after World War II, and repatriated in 1956. He made small collections in Borneo.

Collections. In *Nunukan Isl.* (Feb. *1951*), and on G. Merundan, Kota Waringin, *SW. Borneo* (Nov. 4, *1953*); material in *Herb. Bog.*, dupl. in *Herb. Leyden.*

***Pease**, Arthur Stanley
(1880, Somers, Conn., U.S.A.; x), graduated at Harvard University in 1902 and Ph.D. in 1905. He taught Greek and Latin at Harvard University (1906–09), the University of Illinois (1909–24), Amherst College (1924–26), and at Harvard again (1932–50), becoming Professor Emeritus in 1950.

As an avid plant collector and amateur botanist he accompanied M. L. Fernald in the early explorations of NE. North America. In 1926–27 he made a trip aound the world on the Dollar S.S. line and collected some plants at most stops.

Itinerary. *1926–27*. During his world trip he collected in the Orient at Hongkong, Manila (*Luzon*, Jan. 20–21, *1927*), *Singapore* (25–27, visiting a rubber plantation near Johore on the 26th), *Penang* (28–29), and Colombo.

Collections. In Gray *Herb.*: > 37000 *nos*, mostly from NE. North America, but including plants from various parts of the world and some tens of the Malaysian region. During his world trip he specially collected inconspicuous and not too succulent plants. He numbered at home.

***Pelzer**, Karl J.
a transient visitor who collected together with Añonuevo (see there) in *Mindanao* (March–Nov. *1950*), in *Basilan*, and *Jolo (1950)*.

Perrottet, G. S.
Collections. Also dupl. in *Herb. Florence.*

Peyer
owner of a coffee plantation in Deli, Sumatra East Coast (*cf.* Kränzlin in Reichenbach *f.*, Xenia 3, p. 94 *sub Dendrobium compressum*).

Philippine National Herbarium
In the P.N.H. series[1] is collected:

1. by the following *members of the Museum Staff:* G. L. Alcasid*, P. Añonuevo*, A. P. Castro*, M. Celestino*, E. Conese*, P. Convocar*, G. E. Edaño*, R. B. Fox*, F. S. Gachalian*, R. E. Galang, H. Gutierrez*, D. R. Mendoza*, M. A. Palo, I. P. Paniza*, E. Quisumbing*, J. Ramos, M. D. Sulit*.

2. by other *miscellaneous collectors, viz:* C. Abella*, R. R. Abiguela, F. Aguda Jr, Brother Alfred, B. Arce, R. Ardieta, F. Arcilla, R. Astudillo, M. Balintay*, J. S. Ballesteros, A. Baluyot, J. Bartolome, M. Basaca, A. Belleza, H. O. Beyer, Wm. Beyer*, D. T. Blanco, L. G. Breuner Jr*, F. Buencamino, J. A. Calupig, E. Canicosa, E. Celo, Centro Escolar Univ. Students, F. O. Chinte, F. G. Concepcion, H. C. Conklin*, H. Copeland, F. Corpus, R. C. Cortez, H. Corvera*, E. D. Dana, Reg. S. Davis, A.W. Day* (= Mrs K. B. Day), C. Digbas, L. Ebalo, D. Estrada, E. S. Evidente, Fabella, V. Fabian, E. C. Fariñas*, H. A. Fischer, Forestry Bur. Employees, C. Fortez, F. Franco, C. A. Galatira, F. C. Garcia*, P. A. Gautt*, L. G. Gonzalez, Goodman, U. Guerrero Jr, H. Hoogstraal*, L. Ibalo, E. Irving*, R. F. Isidro, G. Labitag, M. Lagrimas*, S. Laraya, Helen S. Layosa*, B. Legarda Jr, B. Lim, Luis Lim, L. Lizardo, J. A. Lopez, B. Lorenzo, C. Mabesa, F. Maclang, Mrs C. A. MacVittie, E. Madlangbayan, A. C. Mallonga, A. V. Manza, J. Martinez, F. Martinez, A. Matias, F. Mauran, J. R. Meimban Jr, N. B. Mendiola, J. Mercado, J. A. Miniado, Mrs D. S. Muni*, S. Murao, J. F. Nano, L. Navarro, M. Ocampo, R. N. Ocfemia, T. Orden, J. V. Pancho*, W. Parsons, A. Pascua, K. J. Pelzer, Plant Industry Bur. Employees, E. R. Punzalan, P. O. Quintana, D. S. Rabor*, C. A. Ramos, Z. Regondola, O. H. Reinking, C. J. Rivera, M. Rivilla, P. A. Rodrigo, F. A. Roy, Q. Ruiz, F. M. Salvoza, F. E. Skinner*, W. G. Solheim II, J. D. Soriano*, M. Soriano, M. L. Steiner*, E. Tabat, E. R. Tadena, C. Tadeo, F. Tamesis*, B. T. Tesoro, A. Turqueza, L. B. Uichanco, A. F. Umali, C. (or O.) M. Valderrama, R. Valera, J. Velasco, E. A. Verzosa, A. B. Viado, M. Villarta, R. F. Wendover, Wintermitz, J. Yench*.

Literature. (1) See E. Quisumbing: 'Botanical expeditions in the Philippines (1946–1953)' (Proc. 8th Pac. Sc. Congr. 1953, vol. 4 Bot., 1957, p. 501–542, with map).

Names with asterisk, see separate entry.

Phillips, P.
(† 1951, Perth, Australia).

Biographical data. Mal. For. 14, 1951, p. 174.

***Pickles**, Gordon Harold
(1931, Westerham, Kent, England; x), was educated in forestry at Oriel College, Oxford (B. A. 1955). After taking his final examination he joined a Borneo expedition (see below) under the leadership of G. Arnold, accompanied also by a geologist and a zoologist, aiming at a survey of the Plieran valley and the Usun Apau Plateau.

ITINERARY. *The Oxford University Expedition to Borneo, 1955–56.*[1] Flying from London airport (July 8, *1955*) to Sarawak; air reconnaissance (Aug. 3); starting up the Rajang (= Rejang) River (4); *Camp 1* in the Plieran valley in primary rainforest (Sept. 12–Oct. 15); *Camp 2* in the Plieran valley in dwarfed forest (Kerapa type) (Oct. 24–Nov. 15); *Camp 3* on the Usun Apau Plateau in high Kerangas forest (Dec. 18–Jan. 25, *1956*); *Camp 4* in moss forest on Mt Kalulong (Feb. 8–28); reaching Kuching *via* R. Baram (March 17); arrived Liverpool (May 21).

COLLECTIONS. In the Plieran valley he was assisted by AHMAD BIN TOPIN and by AINI BIN HAJI MAHAMAD (see there), who both did a small amount of individual collecting, and in those cases their name together with PICKLES's occurs on the herbarium sheet. In *Oxford Univ. For. Herb.*, *Herb. Sing.*, and *Herb. Sarawak*, numbering SAR 2905–3958; in total 615 numbers of trees were collected. Remaining dupl. will be distributed later; in *Herb. Leyden:* 318 dupl. (purch.).

LITERATURE. (1) As yet nothing is published on the expedition, but in due time G. ARNOLD will publish some papers and a book of the story of the expedition.

Pineda, A.

He made a trip with J. DE CUELLAR (see there) to the extreme north of *Luzon.*

***Plant Industry Bur. Employees,** *cf. sub* Philippine National Herbarium.

Pleyte, D. R.

In Dec. 1954 he was transferred to the new botanic garden 'Setia Mulia' near Padang, Sumatra West Coast, as Supervisor but was replaced at Bogor in 1955.

Hibiscus pleijtei BORSS. was named after him.

ITINERARY. **1948** (additional). *Misoöl* (Sept. 7–Oct. 22): 1 week collecting from Waigama, subsequently to the mouth of the Kassiem River and upstream to Fakal (a little N of the centre of W. Misoöl); base camp at Fakal (Sept. 15–Oct. 9); Solal, situated more to the NE on the coast.—**1951.** *Expedition to Halmaheira*, forming part of the investigations of G. A. L. DE HAAN; the botanical-zoological group under P. GROENHART: sailing from Tandjong Priok (Aug. 13); arrival at Ternate (28); stay in *Ternate* (Aug. 28–Sept. 7), visiting the Peak, collecting for 3 days in the top region, and the remaining days in the vicinity of the town of Ternate; crossing by motorlaunch (Sept. 8) to *Halmaheira:* Djailolo (8–12); leaving (13) for Goal, staying –21, visiting Telaga Rano (18–19); Tosoa (22–23); to the Siu Mts, making bivouac on the Ake (Kali) Mumar (24–25); to the upper reaches of the Kakatua ma tawe (*c.* 700 m alt.) (–Oct. 8); Oct. 9 to the Ake Biaur (–Oct. 11); Oct. 12 to Tolewang (sago swamps); PLEYTE and IDJAN ill (rhengas poisoning?) and to Tobelo for medical treatment; Oct. 24 leaving for Kau, where most of the members suffered from illness; after return PLEYTE and IDJAN leaving (31) for Babaneigo and *via* Dodenga to *Ternate* (arriving Nov. 5); back at Bogor (Nov. 21).–**1953.** Northern Moluccas, with the zoological exploration in the 'Samudera' by A. M. R. WEGNER of the Bogor Zool. Museum: *Central Halmaheira* and *Obi* (May–June). With P. GROENHART, J. VAN BORSSUM WAALKES (itinerary see there) *etc.* to *Sumatra West Coast:* collecting on G. Talang (June 30–July 3).—**1954.** *W. Java.* With P. GROENHART, A. G. L. ADELBERT (itinerary *etc.* see there), *etc.* to Bantam (Feb.).—Possibly in **1955** in *Sumatra West Coast.*—**1956.** *S. Moluccas* (itinerary see *sub* VAN BORSSUM WAALKES).

PICKLES

COLLECTIONS (additional). From *Halmaheira* and *Ternate* (*1951*) 425 *nos* were brought back to *Herb. Bog.*, but part of the material was in a bad state and part was burnt in the drying oven, leaving *c.* 350 *nos*, and those collected by MOCHTAR and IDJAN (see those). The *Sumatra* specimens are numbered in the series BORSSUM WAALKES (see there); 180 *nos S. Moluccas* (*1956*).

Many living plants in *Hort. Bog.*

P.N.H. series, *cf. sub* Philippine National Herbarium.

Polak, Betje

in 1952 appointed Professor of Botany in the Medical College at Djakarta.[4] In June 1954 she went on leave to Holland and was appointed as pedologist at Wageningen in 1955.

COLLECTING LOCALITIES. *1948. W. Borneo. Cf. sub* ENOH.—*1949. W. Borneo:* from Pontianak visiting Sumur Bor, Mempawah, Andjongan, Mandor, Sungai Kunjit and Pasir Pandjang near Singkawang (between June 26 and July 3); a tour to the Kapuas and the Kapuas Lakes (Sept. 18–Oct. 30)[5], *e.g.* near Semitau, Pulau Madjang, Danau Pentulak, Pulau Sepandan, *etc.*—From *1948–50* incidentally some plants in *Java.*

PURSEGLOVE

COLLECTIONS. > 600 *nos* from above-mentioned tours in *Herb. Bog.* The plants on the Kapuas tour were collected with the assistance of MAIN (see there). Some living plants, orchids and others, in *Hort. Bog. Cf.* also *sub* ENOH.

LITERATURE. (3) Add: B. POLAK: 'De Rawa Lakbok. Een eutroof laagveen op Java' (Landbouw 21, 1949, p. 178–222, 5 photos, map).

(4) Author of: 'Kort verslag ener tournée naar de Rawa Pening' (Mimeographed, Bogor, 1950); 'Construction and origin of floating islands in the Rawa Pening (Centr. Java)' (Contr. Gen. Agr. Res. Stat. *no* 121, p. 1–11, 2 fig., 4 photos, map).

(5) B. POLAK: 'Verslag ener tournée naar de Kapuas en Kapuasmeren van 18 September–30 October 1949' (Mimeographed, Bogor, 1950).

***Polo,** Marco

of Venice (Italy), the enterprising merchant and explorer, travelled from 1275–95 in Asia. He brought seeds from a dye plant from *Sumatra* (*1292*) to Venice where he returned in the end of 1295. The seeds are sometimes assumed to have been those of the sappanwood (*Caesalpinia sappan* L.) but are more probably those of *Indigofera tinctoria.* They did not germinate (*cf.* E. H. F. MEYER, Gesch. d. Botanik 4, 1857, p. 127–128).

In his MSS he gave some botanical information, especially on economic plants (*cf. l.c.* p. 122–131).

BIOGRAPHICAL DATA. Encyclop. N.I. 8, 1939, p. 1717–1719; BRETSCHNEIDER, Hist. Bot. Disc. China 1898, p. 1–5; in 'Les explorateurs célèbres' (Genève/Paris 1947), p. 30–32 with portr.

Potts, John

BIOGRAPHICAL DATA. Add: J. R. Hort. Soc. 80, 1955, p. 269–270.

Poulsen, V. A.

evidently also collected at Tjibodas-Gedeh in *W. Java* (Jan. *1895*).

***Prayan** or **Prayon,** Franciscus Albertus

(† June 21, 1765, Batavia, Java), is certainly identical with the mysterious collector PRYON (*cf.* Fl. Mal. 1, p. 418) on whom no data could be found. According to the ship's muster-roll[1], PRAYAN, a native of Cologne (Germany), sailed to the East Indies for the Chamber Amsterdam of the East India Company, on December 7, 1756. In 1759 he was third physician at Batavia.

COLLECTIONS. Possibly labelled PRYON, and collected about *1759–64*; they were sent to N. L. BURMAN.[2]

LITERATURE. (1) Amsterdam *no* 884 in the Alg. Rijksarchief, The Hague. As the names were written down from hearing, there is no conclusive proof that PRAYAN, and not PRAYON, is the right name.

(2) In a MS concept letter to PRAYON at Batavia, dated April 17, 1764, BURMAN thanks him for the seeds and plants sent from East India and asks for more material for his Flora Indica (S 48b, p. 3 in Un. Library Amsterdam).

***Pritzel,** Ernst

(died at the end of the war, *c.* 1945), Ph. D., botanist (taxonomy and plant geography), about 1900 teacher in Berlin. He accompanied F. L. E. DIELS (see there) on some of his travels.

COLLECTIONS. Australia plants (pres. 1901) in *Herb. State Mus. Stockholm.* Possibly including some from Malaysia. *? Herb. Berlin.*

Pryon, *cf. sub* F. A. PRAYAN.

Pulle, A. A.

(† 1955, Utrecht, Holland).

BIOGRAPHICAL DATA. Vakbl. Biol. 35, 1955, 65–67; Act. Bot. Neerl. 4, 1955, p. 157–159, portr.; Taxon 4, 1955, p. 54–57, portr.

***Pullen,** Royal

(1925, Sydney, N.S.W., Australia; x), joined C.S.I.R.O. Division of Land Research and Regional Survey, Canberra, in March 1956, as botanical collector.

COLLECTIONS. Collected with R. D. HOOGLAND (see there) in the Central Highlands of *Territory of New Guinea, 1956.*

***Punzalan,** E. R., *cf. sub* Philippine National Herbarium.

***Purseglove,** John William

(1912, Derbyshire, England; x), was educated at Manchester University (B. Sc., honours in Botany, 1934), at Gonville & Caius College, Cambridge University (1934–1935), and the Imp. College of Tropical Agriculture in Trinidad (1935–36). Agricultural Officer in Uganda, 1936–52; seconded from the Colonial Agricultural Service as Lecturer in Tropical Agriculture, Cambridge University, 1952–54; in 1954 appointed Director, Botanic Gardens, Singapore. He resigned in 1957, and was appointed Professor of Botany at the Imp. College of Trinidad.

He travelled extensively in Africa south of the Sahara.

Durio purseglovei Kosterm. was named after him.

Collecting localities. *Malay Peninsula.* From *1954 onwards.* A little in *Singapore*, Port Dickson, *etc.—1955.* Fraser's Hill (Apr. 15–25, P4092–4338). *NW. Borneo, Sarawak:* Kuching (Sept. 12), Batu Kitang (13), peat swamp forest at Setapok (14), Karenga sand, Mile 6 Penrissen Road (14), Semnagoh Forest Reserve (14), Bau (15), Sebanding Swamp Forest, Lundu (18), Gunung Gading, Lundu 100–1000 ft (19), Lundu (20), Sematan (21), Kp. Pueh (21), G. Pueh (22), Kp. Pueh (25), Sematan (27), Kuching (29).—*1956. NW. Borneo, Sarawak* (May 15–June 13)[1]: in Bako National Park, Sungei Tau, Sungei Miyang Bukit Mersing and Tatau. *Malay Peninsula:* Mersing, G. Pulai in Johore; Fraser's Hill.

Collections. *Herb. Sing.;* dupl. at *Kew*, *Leyden*, *Sarawak Mus. Herb.* (*Borneo* specim.), and the *Arn. Arb.* In *Sarawak* (*1955*) assisted by Moh. Shah bin Haji Mohamed Nur (see there) and from time to time by members of the Museum and Forest Department Staff, Sarawak, collecting *nos* P4351–P4856, numbered in his own series; in *1956 nos* P4877–5490 (Sarawak), *etc.*

Malaysian collections begin at P4001 (series begun in Uganda). Uganda collections in *Kawanda Herb.* and *E. Afr. Herb., Nairobi.* Dupl. of *Gesneriaceae* to *Herb. Edinb.*, of *Ficus spp.* to Mr Corner (*Cambridge*), and *Sterculia spp.* to Mr Kostermans (*Bogor*).

Literature. (1) See concise botanical report in Ann. Rep. Bot. Gard. Dept. for 1956, 1957, p. 3–4.

Pijl, L. van der

In 1948 appointed Professor of Botany in the Technical College at Bandung; retired in spring 1954, and returned to Holland, settling in The Hague.[7]

Literature. (7) Other papers relating to his collections are: L. van der Pijl: 'The re-establishment of vegetation on Mt Goentoer' (Ann. Jard. Bot. Btzg 48, 1938, p. 129–152, pl. 19–20); 'Botanische notities over een bezoek aan Anak Krakatau in Augustus 1949' (Chron. Nat. 105, 1949, p. 283–285).

***Quaife,** Dr

collected *Cassia didymobotrya* Fresen. at Renglet, Cameron Highlands, *Malay Peninsula*, in Jan. *1941*; material in *Herb. Sing.*

***Quintana,** P. O., *cf. sub* Philippine National Herbarium.

Quisumbing, E.

when assigned to the U.S. Navy in Guiuau, at the southern tip of Samar, made collections in that region.

Author of 'Medicinal plants in the Philippines' (Manila 1951).

Collecting localities. Add: *1946. Samar* (June–Aug.), and from there in *Tubaban Isl., Calicoan Isl., Manikani Isl.—1946 onwards* in *Luzon.—1949. Mindanao* (March): Mt Kabatuan, Sukailang, Luna, Surigao.

Raadt, E. A. P. de

Collecting localities. *S. Sumatra:* Palembang, at least till May *1950.*

***Rabor,** Dioscoro S.

on the zoological staff of the Philippine National Museum, was assigned to the Chicago-Philippine Expedition headed by Dr Harry Hoogstraal (see there); he contributed some plants from *Negros* (May 1953), Mt Kanloan, to the P.N.H. series (*cf. sub* Philippine National Museum).

Radde, G.

Itinerary. *1890.* Add: In the Bay of Kendari (*SE. Celebes*) making a trip to a small islet and to a rivulet at the west end of the gulf.

Literature. (2) Add: *Ditto* II (*ibid.* p. 171–174); *ditto* III (*ibid.* p. 187–191).

(3) Add: 'Aus den asiatischen Tropen' (Jahresber. Ver. Erdk. Dresden 5, 1896, p. 105–216). Dealing with the voyage from Makassar to Singapore and Ceylon.

Radermacher, J. C. M.

Collections. In *Herb.* Bergius (= *Acad. Stockholm*) I saw a sheet with 'Radermacher *per* Thunberg, *e Java*', on the back. Possibly he gave dried plants to Thunberg during the latters stay in Java.

Raffles, Sir Thomas St. B.

Collections. Add: Paintings of flowering plants from Sumatra, and sketches of Javanese scenery, caused to be made by him, are now in the collections of Mrs Drake, of Inshriach, Aviemore, Inverness-shire, Scotland, whose great great uncle was Sir Stamford.[9]

Literature. (9) *Cf.* mimeographed report written by E. J. H. Corner in Oct. 1957.

Biographical data. Add: C. E. Wurtzburg: 'Raffles of the Eastern Isles' (London 1954).

Rahmat si Boeea

Collections. In 1957 a set was presented to *Herb. Leyden.*

***Ramos,** C. A., *cf. sub* Philippine National Herbarium.

***Ramos,** J., *cf. sub* Philippine National Herbarium.

***Ranario,** B., *cf. sub* Forestry Bureau, Manila.

Rant, Anton
Line 1, for April read: May 18.

Rappard, F. W.
Early 1954 appointed Director of Forestry at Hollandia, N. New Guinea. In July 1957 he repatriated, and settled in The Hague.

COLLECTING LOCALITIES. Add: *1950. Nusa Barung*, S of E. Java (March 11 with MOCHTARNO; 13).—*1955.* W. New Guinea. End of Oct. he made a tour in the Wissel Lake region, making a small collection on heathland between Enarotali Plain and Jahwei River.

COLLECTIONS. *Nos* 173–226 from *Nusa Barung*. Occasionally he contributed in total *c.* 200 numbers to the B.W. series (*cf. sub* Boswezen Nieuw Guinea).

***Rayner,** Laurence Tibor
(1911, Budapest, Hungrary; x), architect who attended the Technical College in Budapest from 1929–34, and emigrated to Australia in 1939. Till 1950 he was employed in Sydney, from 1950–56 Senior Designing Architect for the Victorian Government in Melbourne, and at present in private practice there. He has a special interest in mountaineering, nature study, and photography. Together with his friend N. M. SEMPLE (see there) he collected plants in *New Guinea* in *1953.*

***Regondola,** Z., *cf. sub* Philippine National Herbarium.

***Reid,** John Alexander
(1915, Newcastle-on-Tyne, England; x), was educated at London University (B.Sc. 1938, D.Sc. 1956); Research Student in entomology at the Institute for Medical Research, Kuala Lumpur 1940; Entomologist at the same institute since 1947. His interest in botany was raised whilst a p.o.w. in Singapore.

Author of some papers in the Malayan Nature Journal.

COLLECTING LOCALITIES. *Malaya.* Mostly near Kuala Lumpur, Selangor.

COLLECTIONS. *Herb. Sing.*: some ten plants, new locality records, and first or early records of introduced weeds.

***Reinking,** O. H., *cf. sub* Philippine National Herbarium.

Resvoll, Th.
(† 1948, ?Oslo, Norway).

BIOGRAPHICAL DATA. Blyttia 6, 1948, p. 57–61 with portr.; Årbok Norsk. Vidensk.-Akad. Oslo for 1949, 1950, p. 29–37, incl. bibliogr. and portr.; also portr. in coll. WARMING in Copenhagen Museum.

***Richardson,** A. C.
forest officer employed by the Department of Forests at Lae, Territory of New Guinea; collected in the N.G.F. series (*cf.* New Guinea Forces) in *E. New Guinea.*

Richthofen, Freiherr Ferdinand von
died in Berlin.

Ridley, H. N.
(† 1956, Kew, England).

BIOGRAPHICAL DATA. Add: J. W. PURSEGLOVE: 'The Ridley centenary' (1955); Nature 176, 1955, p. 1092–1093; Mal. Nat. J. 10, 1955, p. 43–55, portrs; M. A. H. A. Mag. 12¹, 1955, p. 3–6, portr.; Taxon 6, 1957, p. 1–6, portr.

Riedlé, A.
(† Oct. 21, 1801 and *not* Sept. 23), wrote a letter to France, dated later than Sept. 23rd.[2]

LITERATURE. (2) 'Extrait d'une lettre du citoyen Riedlé, embarqué, en qualité de premier jardinier, sur le Géographe, l'un des vaisseaux commandés par le capitaine Baudin, datée de Timor le 6 vendimaire an X; adressée au citoyen A. Thouin' (Ann. Mus. Hist. Nat. 1, 1802, p. 165–178).

Rink, H. J.
(1819, Copenhagen, Denmark; 1893, Kristiania, Norway), geographer, educated at the Polytechnical College, Copenhagen. Because of illness he did not accompany the Galathea Expedition all the time, but returned to Denmark from P. Penang. In 1883 he settled at Kristiania.

BIOGRAPHICAL DATA. Add: Geogr. Tidsskr. 12, 1893–94, p. 162–166; Dansk Biogr. Leksikon 19, 1940, p. 560–564.

***Rivera,** C. J., *cf. sub* Philippine National Herbarium.

***Rivilla,** M., *cf. sub* Philippine National Herbarium.

Robinson, C. B.
was evidently not murdered by Ambonese, but by 'binongkos', a kind of sea gypsies who have some settlements in the Moluccas.

***Rodrigo,** Pedro A., *cf. sub* Philippine National Herbarium.

***Roenteboy,** E., *cf. sub* Boswezen Nieuw Guinea.

***Roenteboy,** R., *cf. sub* Boswezen Nieuw Guinea.

Roepke, Walter Karl Johann
retired in 1953.

Rookmaker
was probably identical with the civil officer

H. R. ROOKMAKERS, who made a small ornithological collection in Bone, *SW. Celebes*, in *1912*[1].

LITERATURE. (1) *Cf.* G. C. A. JUNGE in Ardea 41, Jub. *no*, 1954, p. 327.

***Root**, Lt (Capt) H. J.

collected plants near Port Moresby, Mt Hombron, in *1945;* in *Herb. Melbourne.*

***Rosendahl**, M., *cf. sub* Boswezen Nieuw Guinea.

Rothdauscher, Heinrich

pharmacist.

COLLECTIONS. In *Herb. Munich:* 338 *nos* from the *Philippines* (pres. 1879).

***Routledge**

N. Borneo, Sandakan, in *1897* collected an orchid (possibly more) which SCHLECHTER later described as *Oberonia borneensis* SCHLTR in Fedde, Rep. 8, 1910, p. 564. He possibly collected in behalf of RIDLEY.

Roxburgh Jr, W.

COLLECTING LOCALITIES.[7] Add: *Malay Islands* (*1803*), *Moluccas* (*1803*), Sumatra (*1803–04*).

COLLECTIONS. Evidently ROXBURGH specimens are also present in *Herb. Sing.*

LITERATURE. (6) Add: J. R. SEALY: 'The Roxburgh Flora Indica drawings at Kew' (Kew Bull. 1956 (1956/7) p. 297–399).

(7) Data derived from ROXBURGH, Hort. Beng. 1914, where he is cited as Mr W.R.

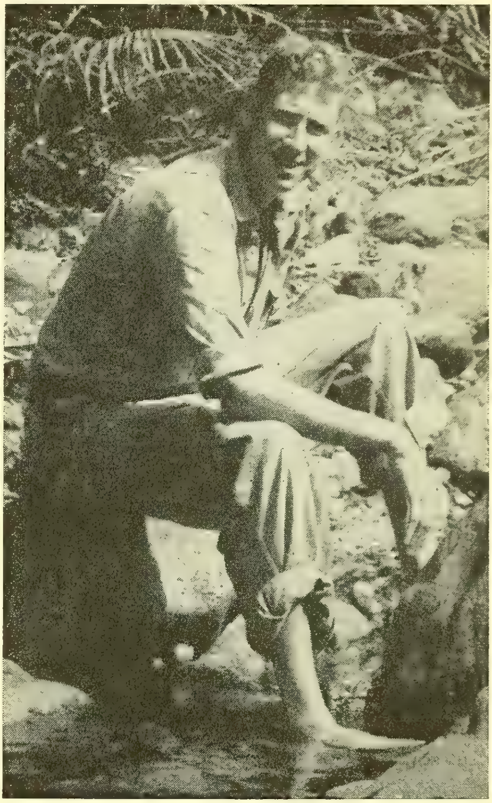
***Roy**, F. A., *cf. sub* Philippine National Herbarium.

***Royen**, Pieter van

(1923, Lahat, Bencoolen, Sumatra; x), botanist, educated at Utrecht University, where he took his Ph.D. degree in 1951. Since 1951 on the staff of the Rijksherbarium at Leyden. In 1954–55 he made a botanical exploration in New Guinea in co-operation with the forest services there.

Author of a thesis on *Podostemonaceae*, and several other taxonomical papers.[1]

ITINERARY.[2] Sailing from Holland (Feb. 6, **1954**) to *West New Guinea;* staying at Sorong (March 12–May 24), exploring the hills in the vicinity, making short trips to the region of Steenkool (Apr. 22–May 4), Moetoeri, and Temboeni, and a 3-day trip to Marchesa Bay on the E. extremity of *Batanta Island* (March 30–Apr. 3); leaving (end of May) for Hollandia on the N. coast, on the way collecting for 2 days in the vicinity of Manokwari; excursions to Lake Sentani, and foot of Cyclops Mts near Ifar, and collecting at Hollandia and Maribon (May 29–June 14); by plane (June 14) to Lae (*Mand. Territory, NE. New Guinea*), and making trips with J. S. WOMERSLEY to the foot of Saruwaged Range (Busu River area), Yalu Creek, Markham River and valley, and some tributary valleys; by plane to Port Moresby (*Papua*), where exploring the dry eucalypt savannahs (June 20) and visiting Sogeri Plateau, Kokoda Trail, Javarari Plateau, Rouna Falls (21–23), Brown River (24–27), and finally in the environs of Bulala, Wau, and Eddie Creek (June 28–July 3); returning by car to Lae (*NE. New Guinea*), from where by plane to Kainantu (NW of Lae) and continuing to Aiyura (*c.* 1700 m alt.), situated in *Nothofagus* forests which were explored for some days (July 6–9); by car to Markham and Ramu valleys (9) and returning by plane (12) to Hollandia (*N. New Guinea*); exploring the foothills of Cyclops Mts (12–30); by plane (30) to Merauke on the *S. coast*;[3] exploration of the savannahs between Merauke and Manggatrike and Taram River (Aug. 1–6); ascending Merau River by boat to Boepoel (6–15), camps S of Senajo (6–12); on foot to Wammeer (Lake Wam) near the Australian border, penetrating into *Papua* to close to Fly River (15–20), and returning by the same way to Merauke; exploration of the future Koerik ricefields, N of Koembe River (Sept. 4–9); by plane to Hollandia (18) (*N. New Guinea*); with R. D. HOOGLAND (see there) to the Cyclops Mts (Oct. 7–14); small trips to Depapre and some islets in Lake Sentani with H. J. LAM, HOOGLAND, and others (15–23); with HOOGLAND to Kebar valley (halfway between Manokwari and Sorong (Oct.



VAN ROYEN

24–Dec. 1)⁴, ascending Mt Nettoti (2000 m) in the Tamrau Mts and exploring the Tombwa hills south of, and the Toghiri hills east of, the valley (27–30); return by plane to Hollandia (Dec. 1); exploration in foothills of Cyclops Mts and ascent of Mt Baboko (16–20); by plane to Sorong (Jan. 4, **1955**); from Sorong (12) to *P. Waigeo*, sailing into Majalibit Bay and making a base camp on the east bank near Selogof; climbing the Buffelhoorn (880 m) *via* Waifoi (13–18); crossing the eastern peninsula to Kabaré (24–28); visiting the islet *Rauki* in the Bay of Kabaré (29, 31), and the E. side of the bay (Feb. 2); trip to the Kambelé hills S of Kabaré (1); return to Selogof and crossing Majalibit Bay to Loepintol, exploring the southern part of the bay as far as Mt Bomjai (8–12); from Loepintol crossing to Sessil Bay (9); finally from Selogof to Poean Bay, Poean Isthmus, Go hills, and Fofak Bay (15–18); return at Sorong (22), from where sailing for Holland.

COLLECTIONS. *Herb. Leyden:* 1st set, 2555 *nos* from *New Guinea*.⁵ Dupl. specimens of woody plants (2nd and 3rd set) would be sent to *Hollandia* or *Manokwari* later. Other dupl. will be distributed in due time. About 35 *nos* were collected together with CHR. VERSTEEGH (see there), with VAN ROYEN numbers.

LITERATURE. (1) On New Guinea: 'Orchideeën in Nieuw Guinea' I (Orchideeën 17, 1955, p. 71–76, 5 fig.).

(2) *Cf.* Verslag Rijksherbarium Leiden for 1954–55, p. 12–14; P. VAN ROYEN: 'Botanical exploration of New Guinea' (Discovery, July 1956, p. 269–273, fig. 1–5, 1 map); 'De botanische expeditie 1954–55 in Nieuw Guinea' (Tijd. K.N.A.G. 73, 1956, p. 329-347, 6 fig., 10 photogr.).

(3) P. VAN ROYEN: 'Notes on a vegetation of clay-plains in southern New Guinea. *Etc.*' (Nova Guinea n.s. 7, 1956, p. 175–195, pl. 9–11).

(4) P. VAN ROYEN: 'Kebar vallei, land van Araucaria's' (Nederlands Nieuw Guinea 3⁴, 1955, p. 12–13, 2 fig.).

(5) A new *Batis* by VAN ROYEN in Nova Guinea n.s. 7, 1956, p. 187–195, fig. 1–2, t. 11.

Rümke, Christian Ludwig
Since 1953 Professor of Genetics at Utrecht University.

Ruiz, Q., *cf. sub* Philippine National Herbarium.

Rumph, G. E. (called Rumphius)
BIOGRAPHICAL DATA. Indon. J. Nat. Sc. 108, 1952, p. 161–172; Taxon 1, 1952, p. 101–110.

Ruttner, Fr.
LITERATURE. (2) Add: *Musci* by J. FROEHLICH in Arch. Hydrobiol. Suppl. 21, 1955, p. 299–342. *Hepaticae* by V. SCHIFFNER in *ibid.* p. 382–407, 16 fig.

BIOGRAPHICAL DATA. In Schweiz. Z. Hydrobiol. 14, 1952.

Rycroft, Sir William Henry
(1861, Kempshott Park, Basingstoke, England; 1925, Perth, Scotland), educated at Eton and Sandhurst, with a military career mainly in Africa; on retired pay in 1921. Governor of British North Borneo from 1922–25.

BIOGRAPHICAL DATA. Who was who, 1916–1928.

***S.H.** *nos, cf. sub* Forest Department British North Borneo.

***Sa'at**
collected in Perak, *Malay Peninsula*, with HANIFF (see there) in *1924*.

***Sabana,** *cf. sub* Forest Research Institute, Buitenzorg (Bogor), Java.

***Safri Sjater**
(1929, Solok, Sumatra, Indonesia; x), during 1956 Student-Assistant of W. MEIJER, Faculty of Agriculture, Pajakumbuh.

COLLECTING LOCALITIES. *Cf. sub* AMIRUDDIN.

COLLECTIONS. Made with AMIRUDDIN (see there), and HUSNI KARIM, under the joint name of 'Kongsi Tiga'.

Salverda
is identical with the already mentioned A. Th. L. SALVERDA († 1955, Soest, U., Holland).

Salvoza, F. M., *cf. sub* Philippine National Herbarium.

***Samuels,** Th., *cf. sub* Boswezen Nieuw Guinea.

***San** *nos, cf. sub* Forest Department British North Borneo.

***Sanchez,** Mateo
collected at Montalban, Rizal Prov., *Luzon* (*1954*); > 80 *nos* in *Herb. Univ. Philip.*

***Santen,** Henricus van
(† Sept. 19, 1765, Batavia, Java), from Kampen, O., Holland, went to *Java* as an Assistant Surgeon for the Chamber Zealand of the East India Company, in 1746. Later Chief Physician at Batavia.

COLLECTIONS. In the years *1758–59* he collected some plants for N. L. BURMAN; in *Herb* BURMAN = DELESS. (= *Geneva*). Some are mentioned in BURMAN's Flora Indica.

Santos, José Kabigting
(1889; Aug. 6, 1949), former professor of botany and Head of the Botanical Department of the University of the Philippines.

BIOGRAPHICAL DATA. Philip. J. Sc. 78, 1949, p. 275–283, incl. bibliogr.

Santos, José Vera
(1908, Pulilan, Bulacan Prov., Luzon, P.I.; x), botanist, educated in the University of the Philippines (M.Sc. 1934), and at Michigan University

(Ph.D. 1946); from 1934–37 Assistant Instructor in Botany at the U.P., from 1938–46 in Michigan as Partial Fellow of the U.P. and Research Assistant in the Botanical Gardens, Univ. Michigan, from 1947–55 Assistant Professor of Botany in the U.P., and from Nov. 1955 onwards Associate Professor and Head of the Botany Department there.

His main interest is grasses.

COLLECTING LOCALITIES. *Philippine Islands* (arranged from N to S, recorded *to Feb. 20, 1956*). *Batanes, Batan Isl. 1955:* at Basco and Manatao; *Babuyan Islands, Dalupiri Isl.—Luzon.* Cagayan Prov.: Solana; Ilocos Norte: Laoag; Mountain Prov., Bontoc Sub-prov.:[1] Mt Polis, Besao, Sagada, Baguio-Bontoc Road; Mountain Prov., Benguet Sub-prov.:[1] Ambuklao, Baguio City, Mt Santo Tomas, Kennon Road; Ilocos Sur: Angaki, Mt Tirad, Concepcion; Isabela Prov.: Reina Mercedes, Cauayan; Quezon Prov.: Baler; Nueva Ecija: Bongabong; Zambales: Binagbag, Sta Cruz, *Hermana Mayor Isl.*, Iba; Bulacan: Pulilan; Rizal: Montalban, Quezon City, Malabon, Muntinlupa, Manila (Ermita, Pandacan); Laguna: Calamba, Los Baños.—*Mindoro Or.:* Puerto Galera, Calapan; *Panay*, Iloilo: Barotac Nuevo, Iloiloi City; *Guimaras Isl.*: Buenavista; *Negros Occ.:* La Carlota; *Bohol:* Ubay (Dec. *1955*—Jan. *1956*).—*Mindanao.* Misamis Or.: Cagayan de Oro; Bukidnon: Del Monte, Tungkulan, Malaybalay, Maramag; Zamboanga: Zamboanga City; *Basilan:* Basilan City; Cotabato: Buluan, Marbel.—*Sulu Prov.: Keenapusan Isl., Cagayan Sulu Isl., Muligi Isl., Mambahenauhan Isl., Turtle Islands* (*Boaan Isl., Langaan Isl., Great Bakkungan, Taganak Isl., Baguan*).

COLLECTIONS. Postwar collections, incl. many grasses, in *Herb. Univ. Philip.;* dupl. in *Leyden*, and eventually in *Philip. Nat. Herb.* (*Manila*), *U.S. Nat. Herb. Wash.*, *Univ. Michig.*, and *Herb. Arn. Arb.*

Philippine collections made before World War II were lost in fire, except the dupl. set in *Univ. Michig. Herb.* During his stay in the New World, he collected at Michigan and in Central America.

In Feb. 1956 his collections amounted to 6430 *nos.*

LITERATURE. (1) J. V. SANTOS: 'Post-Congress tour of Benguet and Bontoc' (Proc. 8th Pac. Sc. Congr. Manila 1, 1955, p. 348–355).

***Sario,** Inocencio H.

(1928, Bagabag, Nueva Vizcaya, Luzon, P.I.; x), a graduate of the Forest School, University of the Philippines (B.Sc.For.). Appointed as Forest Ranger in 1951, stationed at Kretam, North Borneo Timber Company logging operations; in 1954 transferred to Kudat.

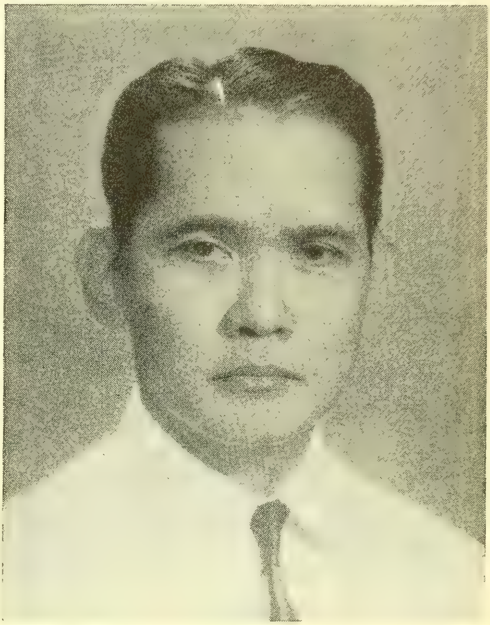
COLLECTIONS. At Kretam, Sandakan, *Br. N. Borneo. Cf. sub* Forest Department British North Borneo.

***Sasquety,** P. P., *cf. sub* Forestry Bureau Manila.

***Sato,** Masami

Japanese botanist who during his internment in *Galang Island* near Singapore at the end of World War II made a collection of plants.[1] During the war he apparently visited Buitenzorg (Bogor).[2]

COLLECTIONS. The collection from *Galang Island* comprises 72 spermatophytes, 7 pteridophytes and some cryptogams. Present location not known to me.



J. V. SANTOS

LITERATURE. (1) M. SATO: 'Florula galangensis' (J. Jap. Bot. 24, 1949, p. 46–52, 2 fig., 1 map).
(2) M. SATO: 'Notes on the luminous Fungi found in the Botanic Gardens, Buitenzorg' (J. Jap. Bot. 25, 1950, p. 137–138; in Japanese).

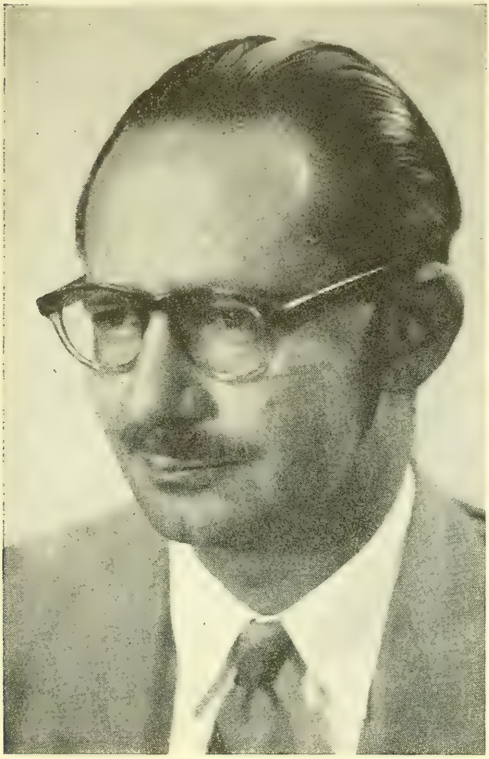
Saubert, G. G. P.

BIOGRAPHICAL DATA. Ann. Jard. Bot. Btzg 51, 1949, p. 177.

***Saunders,** John Campbell

(1930, Sydney, N.S.W., Australia; x), educated at Sydney University; from 1954 Botanist-ecologist with Commonwealth Scientific and Industrial Research Organisation, Division of Land Research and Regional Survey, Canberra, A.C.T.

ITINERARY. *New Guinea. 1954. Papua,* Northern and Milne Bay Distr.: Uiaku to Waiowa Volcano and back (July 12–16); Iuaiu to Amarida on the lower Musa River, along Musa to Guruguru, to Wanigela (19–Aug. 3); Fona to Aku (7); Aku to Mt Trafalgar and Mt Victory and back (9–13); Tufi to Mt Trafalgar to Sinapara (16–18); Uwe to Mt Vicotory to Wanigela (20–23); Baniara–Tapio–Pem–Medino–Ruaba River–Koabagira-Mopuna (31–Sept. 15); Kirikirikona, Tarakoruru (17–21); Kewansasap, Kwagira River, Baiawa (25–Oct. 1); Sinapa (3–5).—*1955. Mandated Territory*, Madang Distr.: Ramu valley, *c.* 8 km SE of Faita airstrip, detailed ecological study of rainforest on NE. slopes of Bismarck foothills.



SAUNDERS

COLLECTIONS. *Herb. Canberra* (*C.S.I.R.O.*): *nos* 1–180 (coll. *1954*), *nos* 181–565 (coll. *1955*); dupl. distributed to *Lae*, *Leyden*, *Arn. Arb.*, *Kew*, *Brit. Mus.*, *Brisb.*, *U.S. Nat. Herb. Wash.*, *Melb.*, *Sydn.*, *Bog.*, *Philip. Nat. Herb.*, *and Geneva.*

Wood samples deposited with the Div. of Forest Products, C.S.I.R.O., Melbourne; Dept. of Forests, Lae; C.S.I.R.O. Herb., Canberra.

Savinierre, Erd de la

COLLECTIONS. Add: Other labels bear the heading: 'Voyage à Célèbes et à Java, 1876–1879'.

Savornin Lohman, C. de

cited by KOORDERS as the collector LOHMAN (*cf.* Fl. Mal. vol. 1), was adviser of the Agricultural Department at Buitenzorg in 1907.

***Saw**

a Sakai from the Malay Peninsula, employed by the Forest Department.

COLLECTING LOCALITIES. Mt Kinabalu, *pr.* Kumu-Rengis (June *1952*).

COLLECTIONS. *Herb. Kepong.*

Sayer, W. A.

COLLECTIONS. *Herb. Copenhagen:* dupl. *N. G. Scitamineae.*

***Schacht,** Walter Holland

(1911, Gympie, Queensland, Australia; x), Forest Ranger, collected at Sogeri and in *Misima Island, Papua, after 1945.* Later resigned from the Administration of Papua and New Guinea.

COLLECTIONS. In the N.G.F. series (*cf.* New Guinea Forces).

Scheffer, R. H. C. C.

COLLECTING LOCALITIES. P. 467 line 10, for Bandjir read: Bandjar.

Schierbrand, W. C. von

a general who evidently collected birds round Bandjermasin in the 1850s and presented them to the Austrian Frigate 'Novara' during the latter's scientific voyage round the world, 1857–59 (*cf.* Fl. Mal. vol. 1 *sub* JELINEK).[2]

It seems probable that he is the collector of the *Java* plants (*cf.* Fl. Mal. vol. 1, p. 467) as he also collected Java birds,[3] and is the author of the published manuscript, in which case he must have been in Indonesia for over thirty years at least.

COLLECTIONS. *Herb. Vienna:* at least 6 *Java* plants collected by SCHIERBRAND (no initials).

LITERATURE. (2) *Cf.* B. E. SMYTHIES in Sarawak Mus. J. 7, 1957, p. 533–534.

(3) *Cf.* G. C. A. JUNGE in Ardea 41, 1954, p. 308.

Schiffner, V. F.

COLLECTIONS. Recently a paper on his moss collection was published.[6]

LITERATURE. (6) J. FROEHLICH: 'Die von Prof. Victor Schiffner in den Jahren 1893/94 in Ceylon, Penang, Singapore, Sumatra und Java gesammelten Laub- und Torfmoose' (Ann. Naturhist. Mus. Wien 59, 1953, p. 66–116).

Schild, J.

COLLECTIONS. Add: Some hundreds of mosses came into the hands of R. HERZOG in Jena, who described the *Hepaticae* (Ann. Naturhist. Mus. Wien 53, 1943, p. 358–373, 8 fig.).

Schlechter, F. R. R.

COLLECTIONS. *Herb. Sydney: c.* 400 dupl. *New Guinea* orchids.[11]

LITERATURE. (11) H. M. R. RUPP: 'The Schlechter collections of Orchidaceae in the National Herbarium of New South Wales' (Contr. N.S.W. Nat. Herb. 1, 1950, p. 304–311).

Schmidt

As regards alinea 2 of this entry in Fl. Mal. vol. 1, p. 473a the name SCHMIDT between brackets after the locality in DE WILDEMAN's 'Prodrome' probably means that A. SCHMIDT in his 'Atlas' mentions that locality for the species in question. As in other cases in the same book the name between brackets is certainly the collector's name, it is rather confusing.

***Schneider,** Dr Fritz
of Surabaja. The disparity in the date of collecting (*viz* before 1892, while 1936 for the Sumatra plants) makes it doubtful whether this SCHNEIDER is the same as the one mentioned in Fl. Mal. vol. 1, p. 473b.

COLLECTIONS. *Herb. Genoa Univ.:* a portfolio containing about 20 cryptogams (ferns, lycopods, *Musci*, *Algae*) collected in *Java before 1892.*[1]

LITERATURE. (1) *Cf.* Att. Congr. Bot. Int. Genua 1892 (1893) p. 234.

***Schofield,** J. L.
genetist employed at Chemara Plantation, a private research station belonging to Messrs GUTHRIE & Co. In June 1953 he was no longer in Malaya.

COLLECTIONS. He collected at least a specimen of *Cassia surattensis* BURM. *f.* at Layang Layang (Johore), *Malay Peninsula;* in *Herb. Sing.* Although the specimen was not numbered, he might incidentally have collected other plants.

Scholte, Johannes
In 1915 stationed at Makassar, SW. Celebes.

***Schophuys,** Hendrik Jurriaan
(1904, Bandung, Java; x), agriculturist, educated at Wageningen Agricultural College in Holland, taking his Dr's degree in 1936 when on leave.[1] From 1928 onwards Agricultural Advisor in D.E.I. government employ, stationed in SE. Borneo and Java; after the war making explorations in New Guinea and Borneo, and since 1950 Inspector of Agriculture in Kalimantan (= Borneo) in Indonesian government service. After his retirement he went to Sumatra, organizing the new agricultural faculty of the first university of Sumatra, at Pajakumbuh (Fakultas Pertanian, Universitas Andalas).

Together with G. KLAY he collected some plants at Parit Mas near Sintang (Sept. 30, *1949*) in *W. Borneo* for Miss Dr POLAK (see there) on a joined excursion.

LITERATURE. (1) H. J. SCHOPHUYS: 'Het stroomgebied van de Barito, Landbouwkundige Kenschets en Landbouwvoorlichting' (Wageningen 1936).

***Schram,** Ferdinand August Willem
(1928, Batavia, Java; x), from 1945–50 in D.E.I. military service; from Nov. 1950 staying in North New Guinea, since Nov. 1953 on monthly pay in the employ of the Forestry Service at Hollandia.

COLLECTING LOCALITIES. *West New Guinea. 1954.* Manokwari (Feb.); Prafi Plain, NW of Manokwari; with P. VAN ROYEN (see there) in the vicinity of Merauke (on the S. coast); sample plots near Holtekang, *pr.* Hollandia.—*1955.* Warjori Plain near Sidai, W of Manokwari.—*1956.* Hollandia (Feb. 9); Cyclops Mts (Feb. 14–21); Tami River (March 15–24, ± 75 *nos*), Nemo (Mosso River) (March 27–31, ±65 *nos*), Tami River (May 24–25); Hamadi near Hollandia (June 5, 12); Tami River (June 22); Tami River (Aug. 4–8); Jautefah (= Jotefa) Bay (Aug. 17); Holtekang, Humboldt Bay (several *Intsias*, Sept. 18–21); Kota Nica near Hollandia (Oct. 17, Nov. 1, 2, 9).—*1957.* Doeboe and Singgi, Jafi Distr. (Feb. 8–13); Kota Nica near Hollandia (March 8); Nafri, Jautefah Bay (June 20–21); Hollandia (June 8, 15); Holtekang, Humboldt Bay (July 21); Hamadi near Hollandia (Aug. 1, 6); Warsamson, E of Sorong (Aug. 19–Sept. 17, ± 200 *nos*).

COLLECTIONS. *Herb. Leyden;* numbered with private and corresponding B.W. *nos* (*cf. sub* Boswezen Nieuw Guinea); in 1957 *c.* 1000 *nos.*

***Schrijn,** H., *cf. sub* Boswezen Nieuw Guinea.

***Schut,** H. W.
Forest Officer, educated at Wageningen Agricultural College, Holland. He entered the Indonesian Forest Service after World War II, and repatriated in 1956. He made small collections when with KOSTERMANS (see there) in Borneo.

COLLECTIONS. *Herb. Bog.*, from E. Kutei (*Borneo*), *1954.* Low K numbers.

Schwartz, A.
German ex-soldier.

Schwenk, Heinrich
BIOGRAPHICAL DATA. BACKER, Verkl. Woordenb. 1936. According to TEIJSMANN he died in 1860.

***Scott,** J.
presented a plant from the 'Malay Islands' to the Botanic Garden at Calcutta in *1800* (*cf.* ROXBURGH, Hort. Beng. 1814, p. 66). Possibly he is also the collector of the *Penang* plants, and not JOHN SCOTT the Curator of the Calcutta Gardens (1850) (*cf.* the latter's entry in Fl. Mal. vol. 1, and in BRITTON & BOULGER, Biogr. Index, 2nd ed. by RENDLE 1931, p. 271).

***Scott,** Dr R. I. C.
surgeon in H. M. S. Hastings, collected ferns in Ceylon and *Malacca* in *1853;* in *Kew Herb.*

***Seal,** John Edward
(1923, Leicester, England; x), educated at Leicester, but university training interrupted by the war; Sarawak Government Civil Servant, and Honorary Curator of Botany, Sarawak Museum. Amateur botanist who in his spare time looks after the Sarawak Herbarium; his special interest is *Begoniaceae*.

COLLECTING LOCALITIES. *NW. Borneo*, all over Sarawak from April *1954 onwards.*

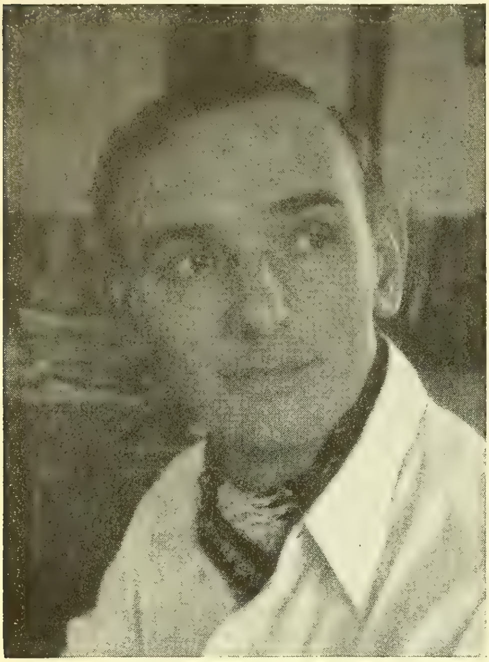
COLLECTIONS. *Herb. Sarawak:* 2 specimens of each number; remaining specimens to *Herb. Sing.* In June 1956 his collection amounted to *nos* S 1–S 680.

Seifriz, William

(† 1955, Chesapeake Bay, 80 km W of Washington, U.S.A.).

His special interest was protoplasma, but he also wrote several plant-geographical papers.

BIOGRAPHICAL DATA. Protoplasma 45, 1956, p. 513–524, portr. & bibliogr.; Verh. Zool.-Bot. Ges. Wien 96, 1956, p. 12–13.



SEAL

Seimund, E.

was evidently still in Malaya early in 1926, as he collected once more in *P. Rumbia* (= *Rembia*) on March 26, *1926*.

Seligman(n), Ch. G.

(born in London, died at Oxford, England), M.D. University of London in 1905. From 1913–34 Professor of Ethnology in the University of London. He also made ethnographic investigations in Ceylon (1907–08) and in Africa (Egypt and Sudan), with his wife BRENDA Z. SELIGMAN.

The Cambridge Expedition (see below) was supplemented by an expedition to Sarawak, by an invitation of Ch. HOSE (see there).

After 1914 he dropped the last letter of his surname.

ITINERARY. **1898.** *Cambridge Anthropological Expedition to Torres Straits*, add: leader A. C. HADDON.[1] SELIGMANN made an earlier start to gain some ethnological experience in N. Queensland, where he worked for several months in the Cape York Peninsula; he joined the expedition in *Thursday Isl.* (Apr. 22, *1898*); *via Dungeness* – *Rennell* – (*Mauar*) and *Darnley Isl.* (*Èrub*) to *Murray Isl.* (May 6–22); *Papua:* Delena on Hall Sound (26–28); *via Haidana Isl.* (Borobada) to Port Moresby (31–June 1): by boat to Kaila (Gaile) (2), and Kapa-Kapa (3); Hula (4); by canoe to the estate of R. E. GUISE and crossing the Hood Peninsula by buggy to Kalo; visit to Babaka (6), Kerepunu, and Alukune (Harukune); Bulaa; Kapa-Kapa (15) and visit to Vatorata and Ikoro; proceeding to Kaile, and trip to Gomoridobo (16); back to Port Moresby (16); excursion in the hinterland, climbing Mt Werirata (18) and back *via* Taburi; S. by boat to Kaile and Kapa-Kapa, paying a visit to Rigo (25); Port Moresby (27–July 6); Mekeo Distr. (6–17); *Yule Isl.*; Aug. 24 part of the expedition proceeded to Sarawak; the others at Daru (Sept. 12–14); *Mabuiag* (*Jervis Isl.*) (17–20); Oct. 22 left for *Saibai etc.*; *Thursday Isl.* (till Nov. 14); leaving (15) to Sarawak by way of Hongkong (28); *Singapore* (Dec. 9); *NW. Borneo:*[3] Kuching (12–Jan. 3, **1899**); the 4th proceeding to Limbang (8–15) and visit to Brunei; up the Limbang River (16), and its affluent the Madalam (19), and up the Trunan (or Trikan) (22); crossing foot of a spur of Mt Mulu (or Molu); reaching the Baram River *via* the Malinau and Tutau (journey from Limbang to Marudi or Claudetown, taking 11 days); in the Baram Distr., Marudi (Jan. 28–Apr. 19), trip up the Tinjar (starting Feb. 6) and its tributaries, the Lobong and Dapoi, including an ascent of Mt Dulit; second trip to Pata River; work brought to a close by the end of April, leaving Marudi (20), leaving Kuching (25); arrived in London on May 31.

COLLECTIONS. In *Herb. Kew* also some *Sarawak* plants (coll. *1899*).

Sapot. (coll. before Dec. 1893?) from Siak River, *Sumatra* in *Herb.* PIERRE (*Paris*).

LITERATURE. (1) Add: SELIGMANN contributed several papers to the Reports of the Cambridge Anthropological Expedition *etc.* vols 2, 3 and 5.

(3) *Cf.* Geogr. J. 14, 1899, p. 302–306; Nature 60, 1899, p. 413–416; and A. C. HADDON: 'Headhunters. Black, white, and brown' (London 1901).

BIOGRAPHICAL DATA. Dict. Nat. Biogr. 1931–40, 1949; Obit. Not. Fellows R. Soc. *no* 10, 1941, p. 627–646, incl. bibliogr. with portr.

Semmelink, J.

collected birds in Pleihari (*SE. Borneo*) in *1867* (*cf.* G. C. A. JUNGE in Ardea 41, Jub. *no*, 1954, p. 314).

***Semple,** Noel Merson

(1922, Preston, Vict., Australia; x), was educated at Melbourne University (B.S.); biochemist, Commonwealth Serum Laboratories, Melbourne. With a friend, L. T. RAYNER, he spent a 6-week holiday in NE. New Guinea (July-Sept. 1953).

COLLECTING LOCALITIES. *1953. Mand. Terr. of New Guinea:* Mt Wilhelm, 67 miles SW from Madang, in open places above timberline, 11.000–15.000 ft (Aug. 5–8); Mt Gil(l)uwe (Aug. 23).

COLLECTIONS. *Herb. Melbourne*: fragmentary specimens, no dupl.; 38 from Mt Wilhelm, 8 different ones from Mt Gil(l)uwe, coll. by SEMPLE & RAYNER. The collection was made as a personal favour to Mr J. H. WILLIS of the National Herbarium of Victoria.

***Sete**, R.

COLLECTIONS. Material from San Fernando (Union Prov.), *Luzon* (coll. May *1928*) in *Philip. Nat. Herb. Manila*. The collector's notes in Spanish.

***S.H.** *nos*, *cf. sub* Forest Department British North Borneo.

***Shah** bin Haji Mohamed Nur, Mohamed

Plant collector, Singapore Botanic Gardens. He accompanied Mr PURSEGLOVE to *Sarawak* in *1955–56*.

***Shaw Mayer,** F., *cf.* MAYER, F. W. SHAW.

***Simbut,** Gabriel

(1923, Penampang, Jesselton, Br. N. Borneo; x), was employed by the Forest Service in Br. N. Borneo from 1948 onwards; graduate of the Forest School, Kepong, in 1949; in 1955 stationed at Weston as Forest Ranger.

COLLECTIONS. *Cf.* Forest Department British North Borneo. Most of his collections made at Sandakan and Labuk.

***Simmonds,** N.W.

Senior Cytogenetist at the Imperial College of Tropical Agriculture, Trinidad, Br. W. Indies, visited *Papua* and *New Guinea*, securing seeds and botanical material of wild species of *Musa* and *Ensete*, for breeding purposes.[1] During his extensive trip to Africa, Asia, and the Pacific, he also visited *Malaya* and *New Britain* (Bismarck Archipelago).[2]

COLLECTING LOCALITIES.[3] *Banana Collecting Expedition, 1954–55. 1954. New Britain:* Gazelle Peninsula, near Keravat (Nov. 23–Dec. 1); *New Ireland*, above Laupul (Nov. 26); *NE. New Guinea* (Terr. of N.G.): Dagua (Dec. 7), Bainyik (8), Sepik Plains (9), Ambunti (10), all in the Sepik area; Madang Distr. and Gogol valley (14–16); Baiyer River valley, Western Highlands (19); middle Markham valley (22), Yalu River near Lae (24), near Lae (26), Lower Markham River valley (28); Wompit, Snake, and Bulolo River, Wau Gorge (28–30); Lae area (30).—*1955. Papua:* Omati, Gulf Div. (Jan. 14); Middletown, Kikori River (16); Mekeo Distr. (20), Sogeri Plateau (23). *Malaya*: Ulu Langat near Kuala Lumpur, Selangor (Feb. 10); Ginting Sempak, Selangor (12); Cameron Highlands (16–17); Perak, at Kenayat, Pelang, *etc.* (23–24); Bau Mpat and Durian Buring, E of Gurum, Kedah (27); Gurum area, Kedah (28); Bukit Lagi, Bt Chuping, Bt Ketri, in Perlis (March 4); in Kelantan (6–9). In Thailand (April); in India, Assam, and Burma (Apr. 26–May).

COLLECTIONS.[3] No dried specimens were made; representative floral parts were collected in spirits, lodged at *Kew*, along with sets of photographs, drawings, museum seed samples, *etc.* Each collection was assigned a B.E. (Banana Expedition) number.

LITERATURE. (1) N. W. SIMMONDS: 'Classification of the bananas (Musac.)' (Kew Bull. 1953, p. 571–574, 1954; incl. 2 *n. sp.*).

(2) See Newsletter *no* 1, July 11th, 1955, Dept of Forests, Div. of Botany, p. 4–5.

(3) N. W. SIMMONDS: 'Botanical results of the Banana Collecting Expedition, 1954–5' (Kew Bull. 1956, p. 463–489).

J. SINCLAIR

***Sinclair,** James

(1913, Bu, Hoy, Orkney, N of Scotland; x), graduated B.S. with honours in Botany at Edinburgh University in 1936. Subsequently he obtained Teachers Certificates and taught in schools in Orkney from 1939 to 1941. During the war he served in the R.A.F. in Britain and India, returning home at the end of 1945. In 1946 joined the staff of the Edinburgh Royal Botanic Garden Herbarium, and in 1948 appointed Curator of the Herbarium at Singapore.

He visited Kuching in Feb. 1949, at the request of the Sarawak Government, to examine and put into order the Herbarium of the Sarawak Museum.

Author of taxonomic papers with a special interest in *Annonaceae*.

COLLECTING LOCALITIES. From May **1948** *onwards* in *Singapore Island*[2].—**1949.** *Borneo, Sara-*

wak (Feb.–March): Santubong, Bukit Segu, Bau and Buso.[1] *Malaya:* Maxwell's Hill in Perak (Sept.) with KIAH BIN SALLEH.—**1950.** Johore: Kluang Forest Reserve, Gunong Lambak and Ma'okil Forest Reserve (Aug. 27–28); *Penang* (Oct.–Nov.). —**1951.** *Penang* (Oct.–Nov.).–**1953.** Johore: G. Pulai (March 26, Apr. 15, May 14, June 17); Trengganu: Kuala Trengganu and Dungun with KIAH BIN SALLEH (July); Selangor (Nov.): Batu Caves, Weld Hill, forest above Kepong (= Bukit Lagong), Klang Gates; Sungei Menyala Forest Reserve near Port Dickson in Negri Sembilan (one day in Nov.).—**1954.** G. Pulai in Johore (Apr. 8); *P. Tinggi* off the E. coast of Johore (May 16); Trengganu (Nov. 3–21), returning by way of Kota Bahru in Kelantan.—**1955.** To Malacca and Cape Ricardo (Apr. 1–6, 53 *nos*), *P. Pisang* and *P. Sauh* (16–18), Kuala Trengganu (Sept. 4–25; coll. 226 *nos* incl. new species and records), and some minor excursions to Johore (Kota Tinggi, Sg. Tiram, Sg. Tebrau).—**1956.** Kuantan, Temerloh, Fraser's Hilland Malacca (Oct. 19–22).—**1957.** *Br. N. Borneo:* Mt Kinabalu (June, coll. 416 *nos*).

COLLECTIONS. *Herb. Sing.:* from *Borneo* (*1949*) *c.* 120 *nos*, > 1000 from *Malaya* (numbered in the S. F. series)[3], and 74 *nos* from Pakistan (coll. *1949*). Collections made before 1948, mainly in *Herb. Edinb.* Dupl. Kinabalu to *Herb. Leyden.*

LITERATURE. (1) *Cf.* Ann. Rep. Bot. Gard. Dept. for 1949.

(2) Several from Singapore recorded in J. SINCLAIR: 'Addition to the Flora of Singapore for some Plants thought to be Extinct' (Gard. Bull. Sing. 14, 1953, p. 30–39).

(3) M. JACOBS: 'A new Malaysian record in Lindernia (Ilysanthes) (Scrophulariaceae)' (Gard. Bull. Sing. 15, 1956, p. 266).

***Skinner,** F. E.
contributed some plants from *Mindanao* (Nov.–Dec. *1949*) to the P.N.H. series (*cf. sub* Philippine National Herbarium).

Skottsberg, C. J. F.
COLLECTIONS. Add: Also dupl. in *Herb. State Mus.* Stockholm.

Slooten, D. F. van
(† 1953, Amsterdam, Holland). He retired in 1951, settling in Amsterdam.

BIOGRAPHICAL DATA. Taxon 2, 1953, p. 85–86; Vakbl. Biol. 33, 1953, p. 57–58; Trop. Natuur 33, 1953, p. 75; Blumea 7, 1953, p. 473–474; Reinwardtia 2, 1954, p. 367–372.

***Smit,** J. B., *cf. sub* Boswezen Nieuw Guinea.

Smith, Christopher
COLLECTING LOCALITIES. Add: *P. Penang* (*1796*), *Ambon* (*1798*).[8]

LITERATURE. (8) Data derived from ROXBURGH, Hort. Beng. 1814.

Smith, Eryl G.
(for Bangkok, Siam read: London, England). Her husband is working now on reptiles at the British Museum.

COLLECTIONS. Some dupl. in *Herb. Brit. Mus.*

***Smith,**? Hm. (or Hon.) C.
COLLECTIONS. *Herb. Kew:* some plants from Perak, *Malay Peninsula*, collected in *1881.*

Smith, J. J.
COLLECTING LOCALITIES. *1906. P. Doea* (Fl. Mal. 1, p. 490a) is probably not the islet in the Bay of Bantam of that name, but one of the northernmost islets of the Duizendeilanden.

BIOGRAPHICAL DATA. Add: Bull. Bot. Gard. Btzg III, 17, 1948, p. 381–382.

***Smythies,** Bertram Evelyn
(1912, Naini Tal, India; x), was educated in forestry at Oxford University (B.A.); a member of the Burma Forest Service from 1934–48, of the Sarawak Forest Service from 1949 onwards; in the years 1952–56 stationed in Brunei.[1]

Author of 'The Birds of Burma' and of a checklist of Borneo birds.

COLLECTIONS. Mainly *Dipterocarpaceae* from *Brunei*, in *Herb. Brunei* (Forest Office); dupl. in *Kepong* from where specimens will be distributed to *Kuching*, *Sandakan*, *Kew*, *Bogor*, *Leyden*, *Arn. Arb.*

LITERATURE. (1) Author of 'Forests and Forestry in Brunei' (Mal. For. 19, 1956, p. 19–24, 4 photogr.).

Soh
is SOW (BIN TANDANG), *cf.* Fl. Mal. vol. 1.

Solander, D. C.
COLLECTIONS. Dupl. indeed also in *Herb. Copenhagen*, with *Herb.* VAHL. His early (Swedish) collections also with *Herb.* ALSTRÖMER in *State Mus. Stockholm.*

BIOGRAPHICAL DATA. Science. Bot. Disc. in New Zeal. Post-prim. School Bull. 5, *no* 2, 1951, p. 19–32.

***Solheim** II, W. G., *cf. sub* Philippine National Herbarium.

***Somerville,** G. W.
(1902, U.K.; x), was educated in forestry at Edinburgh University (B.S.); from 1924 onwards a member of the Malayan Forest Department, collecting in the C.F. series (*cf.* Conservator of Forests series in Fl. Mal. vol. 1); from 1950 Civil Defence Commissioner, Federation of Malaya.

***Soriano,** J. D.
collected a few plants in *Luzon*, and about 230 in *Panay Isl.* (*1952–1953*) in Iloilo and Capiz; numbered in the P.N.H. series (*cf. sub* Philippine National Herbarium).

***Soriano,** M., *cf. sub* Philippine National Herbarium.

Spare, H. Gordon
collected together with C. F. Symington on G. Sibajak, *Sumatra East Coast* (Nov. 22, *1931*); in *Herb. Sing.*, F. *nos.*

Sparrman, A.
Itinerary. Voyage to China, *1765–67*, in the 'Stockholms Slott' (Capt. C. G. Ekeberg).

Collections. In *Herb.* Retzius (= *Lund*) many sheets, also from the Pacific (Cook's 2nd Voyage); with *Herb.* Alströmer in *State Mus. Stockholm;* in *Herb.* Bergius (= *Acad. Stockholm*)[4]; in *Herb.* Thunberg (= *Uppsala*), several from Cook's 2nd Voyage, but possibly also from elsewhere.[5]

Literature. (4) In a MS letter to Bergius, dated Nov. 1771 (in R. Swed. Ac. Sc., Stockholm), C. G. Ekeberg recommended Sparrman on condition that specimens of the latter's collections would be sent to Bergius. From another letter it is evident that at least in Aug. 1773 a small collection of Cape plants was sent to Bergius.

(5) In 1779 A. Alnoor (see there) wrote a letter to Thunberg on material collected by Sparrman at the Cape, Batavia (*Java*), Ceylon, *etc.* (MS letter in Library Univ. Uppsala).

Biographical data. Bretschneider, Hist. Bot. Disc. China 1898, p. 61–62; portr. in 'Naturhistoriska Riksmuseets Historia' 1916, p. 17; J. S. Afr. Bot. 23, 1957, p. 43–63 with portr. (pl. 17), 127–137.

Speldewinde, Clair Alexander
(† Dec. 5, 1949, Penang, Malaya).

Biographical data. Mal. For. 12, 1949, p. 2, with portr.; *ibid.* 13, 1950, p. 2.

Spurway, B. J. C.
retired as Conservator of Forests, Sarawak.

Biographical data. Mal. For. 14, 1951, p. 104.

***Star,** G. H. van der, *cf. sub* Boswezen Nieuw Guinea.

***Stearns,** E. A.
Collections. *U.S. Nat. Herb. Wash.: Cyperus javanicus* Houtt. from Malabang, *Mindanao, P.I.*

Steemann Nielsen, E.
Itinerary. *1929.* Add: *West New Guinea:* Manokwari (July 15–26, correction!); *P. Talisse* (near Manado) (before July 3, and in Aug.); *Mentawai Islands:* Sipora (Sept.–Oct.); Nov., when at Belawan Deli, visiting Medan and Brastagi.

Collections. On the original labels of the expedition the collector's name is printed: Einer Nielsen!

Steenis, C. G. G. J. van
From Dec. 1949–Nov. 1950 he stayed at Bogor once more. Since 1950 Director of Flora Malesiana Foundation. In 1951 he was appointed Professor of Tropical Botany and Plant Geography on behalf of the Tropical Institute in Amsterdam; in 1953 also at Leyden.

The genus *Steenisia* Bakh. *f.* was named after him.

Collecting localities. **1950.** *W. Java:* Tjisarua Zuid (Feb. 26); Tjengkareng between Tangerang and Djakarta (= Batavia) (March 19); G. Pangrango-Gedeh (28–29); *P. Amsterdam* in the Bay of Djakarta (Apr. 5); Tjisarua Zuid (9); G. Gedeh to Kandangbadak and back *via* Geger Proet, Tjibeureum, Tjibodas (May 28–29); S. coast, Wijnkoopsbay (June 11); and occasionally in Hort. Bog.—**1953.** *W. Java:* Tjibodas (Nov. 7), Bogor (12–14); *Labuan:* aerodrome (15); *Luzon:* Manila (20); Paranaque, Manila Bay (20); Manila and Quezon City (22), Los Baños and Mt Maquiling (*c.* 200 m), Laguna de Bay; along Kennon Road from Manila to Baguio (29); road Baguio-Bontoc (30); to Mt Polis (*c.* 2100–2300 m) (Dec. 1); Bontoc-Baguio (2); Mt Santo Tomas, near Baguio (*c.* 2000 m) (3). *W. Timor:* Kupang, vicinity of aerodrome (12); *Port. Timor:* Dili and vicinity (12), at Caicoli, Tibar Bay; near Monotuto, W of Dili (14); *Port. E. Timor:* limestone plateau of Baucau (*c.* 350 m) (15–16); escarpment between Baucau and Vemassi (*c.* 350–100 m) (17); plateau of Fuiloro (Lautem), site of Mehara (400 m) (18), and Muapitine (350 m) (19); S. coast near Lorè (20); Los Palos–Fuiloro (21); Uato–Carabao, riverbed Irabèrê (22); *Centr. Port. Timor:* Mt Perdido (ascent from Ossu, 700–1750 m) (23); from Ossu-Monotutu, N. coast (26); Dili (29) near the shore; Bessilau, S of Dili (Jan. 3, **1954**); Ainaru, S of Tatamailau, 1000 m alt., and Huato-Builico, NW of Mt Tatamailau (1800–2150 m) (4); Mt Tatamailau, eucalypt forest up to 2950 m (5); S of Dili, Aileu, Maubisse, Bessilau, Nova Dili (6); *Malay Peninsula:* Johore, Aer Hitam, Negri Sembilan, Port Dickson (13); Forest Reserve Sg. Menyala, Sg. Lukut, and Telok (14); Kanching Forest Reserve (16); Fraser Hill (17).

Collections. From *Labuan* (*1953*) *nos* 17855–17868, from *Luzon* (*1953*) *nos* 17869–17973, 18546–18576, from *Timor* (*1953*) *nos* 17974–18488, 18577–18686 (in *Herb. Bog.*, *Leyden*, *Brit. Mus.*, *Lisbon*), from *the Malay Peninsula* (*1953*) *nos* 18489–18545. He collected besides in Australia (1950), in several localities in Europe, in Marocco (1954), and in Siam (1957).

Steere, J. B.
Biographical data. Add: Bretschneider, Hist. Bot. Disc. China 1898, p. 702.

***Stefels,** Casper Jacobus
(1928, Amsterdam, Holland; x), since 1954 forest officer in West New Guinea, educated at Wageningen Agricultural College; stationed respectively at Manokwari and Fak-Fak.

Collecting localities. *West New Guinea. 1955.* Anggi Lakes (Jan. 7–13, ± 50 *nos*).—*1956.* Fak-fak (July 7); Esania (subdiv. Kaimana) (July 14–16); Kooy (subdiv. Kaimana) (Sept. 28); Argoeni Bay (Sept. 29–30), at Mendiwa and Goesimawa; Rijklof-van-Goens Bay, at Kembala, Tiporro, and Tongerai (Nov. 7–11, ± 25 *nos*).—*1957.* Gesawe River (subdiv. Kaimana) (Jan. 31, Feb. 1); Fak-fak (June 3, 22).

***Steiner-Lindenberg,** Mona Lisa

(1915, Vienna, Austria; x), botanist, graduated in the University of the Philippines (B.S.), and the University of Vienna (Ph. D. 1954); from 1938–40 teaching at the Botany Department U.P. After the war her activities were mostly in the horticultural field, starting an Orchid Society, a Garden Club, *etc.*

MRS STEINER

Author of some books[1] and numerous articles in weeklies, newspapers, and in the Philip. Orchid Review.

COLLECTING LOCALITIES. *Philippine Islands. Luzon:* mainly around Manila, Baguio, and in the vicinity of Manila.

COLLECTIONS. Mainly cultivated plants, in *Herb. Manila* (P.N.H. series); since 1953 in private herbarium, but for the greater part duplicated in the *Philippine National Herbarium.* Dupl. will be deposited in *U.S. Nat. Herb. Wash.* and *Leyden.* At the end of 1955 about 1000 field *nos* in total.

LITERATURE. (1) M. L. STEINER: 'Philippine ornamental plants' (Manila 1952); 'Philippine Orchids' in collaboration with REG. S. DAVIS (New York 1952).

Steup, F. K. M.

From 1946–48 Inspector of the Forest Service, Batavia; 1948–55 Director Akademi Kehutanan (Forestry School), Bogor; from 1952 onwards respectively Lecturer, Extraordinary Professor, and Professor at the Gadjah Mada University, Jogja. In 1958 living in the Hague.

Stevens, H.

The STEVENS mentioned in the Cyclopaedia (Fl. Mal. vol. 1) as a collector in Mowless District, *E. New Guinea,* collected in Morobe Distr. on Mt Mis(s)im in *1932–33.* On the typed labels of the Gray Herb. it wrongly reads Mowlee Distr.!

Stoliczka, F.

BIOGRAPHICAL DATA. Add: BRETSCHNEIDER, Hist. Bot. Disc. China 1898, p. 798–800.

***Stonor,** C. R.

collected *Rhododendrons* in Hagen and Bismarck Ranges, *NE. New Guinea* during World War II.[1] > 13 *nos;* in *Herb. Edinb.*

LITERATURE. (1) *Cf.* The Rhododendron Year Book 1951–52 (*no* 6, ed. by the R. Hort. Soc. Lond.), p. 48–51, fig. 48–54.

Strong, Thomas Arthur

(1899, Glencorse, Scotland; x), obtained the B.S. degree in Forestry of the University of Edinburgh in 1921.

In 1950 he retired on medical grounds.

BIOGRAPHICAL DATA. Mal. For. 13, 1950, p. 117–118, with portr.

Strugnell, E. J.

In May 1953 appointed Deputy Director; in 1954 he retired and migrated to Australia.

BIOGRAPHICAL DATA. Mal. For. 18, 1955, p. 2–3, with portr.

***Sudiora**

collected at least at Air Koa in *Billiton* (Aug. 26, *1953*); material in *Herb. Bog.*, dupl. at *Leyden.*

***Suganda**

'mantri' of Herbarium Bogoriense, Bogor, Java, accompanied a tour to Bantam in Feb. *1954.* He assisted A. G. L. ADELBERT with collecting. His name may appear on some labels.

Sulit, M. D.

COLLECTING LOCALITIES. Add: *1926–27, 1945–46. Luzon.—1948. Samar,* partly with CONESE (Apr.–May).—*1949. Mindanao* (Feb.).—*1950. Guimaras Isl.* (Feb.–March), *Palawan* (May-June). —*1951. Mindoro* (Jan.), *Samar* (March-May).—*1952–53. Mindoro* with H. C. CONKLIN (see there).

***Sun Hong Fan**

(1908, Kaifeng, Honan Prov., China; x), took his B.S. degree in biology in the National Honan University, China; teacher in Chinese high schools in the Malay Peninsula and the Dutch East Indies (later Indonesia).

From July 1949–1951 he studied in the Buitenzorg Herbarium.

COLLECTING LOCALITIES. *1940. Malay Peninsula: Singapore* and Johore (Jan.–March), Selangor (March–July); *Sumatra East Coast:* Medan and Brastagi (Aug.–Dec.).—*1941. Sumatra East Coast:* Medan and Brastagi (Jan.–May). —*1947. W. Lombok* (Sept.–Nov.).–*1948. E.*

Lombok (Feb.–May).—*1949. W. Java:* Bogor and Sindanglaja (Aug.–Nov.).

COLLECTIONS. Partly deposited in *Herb. Nat. Honan Univ.*, partly in *Fukien Prov. Mus.* at Foochow, and partly in *private herbarium. Nos* 1–604 from the *Malay Peninsula*, 605–1109 from *Sumatra*, 1110–1404 from *W. Lombok*, 1405–1729 from *E. Lombok*, 1730–2210 from *W. Java*.

Surbeck, H.

According to his daughter, Mrs L. OTTO–SURBECK, Pematang Siantar, he came to Sumatra in 1902. During the Japanese occupation he started making water-colour drawings of insects and plants, in total they consist of 400 sheets.

BIOGRAPHICAL DATA. Du (Swiss periodical), Juni 1953 (*n.v.*).

Sybrandi, J.

(† *c.* 1940, Aerdenhout, Holland), manager of the sugar plantation Soemberhardjo, discovered *Amorphophallus oncophyllus* at Lebak Barang, *Centr. Java* (coll. Jan. 12, *1918*).[1]

LITERATURE. (1) J. SYBRANDI: 'Op zoek naar een Amorphophallus' (Trop. Natuur 8, 1919, p. 33–41, 5 fig.).

BIOGRAPHICAL DATA. Portr. in Trop. Natuur *l.c.* p. 40.

***Sijde,** Hendrik Adolf van der

(1926, Assen, Dr., Holland; x) was educated in the Agricultural College, Wageningen; since 1955 forest officer in the employ of the Forestry Service of West New Guinea, stationed respectively at Merauke, and Hollandia.

COLLECTING LOCALITIES. *West New Guinea. 1956.* Merauke (Feb. 22, 24); in the vicinity of Hollandia, *e.g.* at Hamadi, Kota Nica, Lake Sentani, Jautefah (Jotefa) Bay, *etc.* (onwards of June 19); Waisiniwai (Demta Distr.) (July 24, Sept. 6, Dec. 8); *Sorong* (Oct. 16–17).—*1957.* In the environs of Hollandia.

Symington, Colin Fraser

collected together with H. GORDON SPARE on G. Sibajak, *Sumatra East Coast* (Nov. 22, *1931*); in *Herb. Sing.*, F. *nos.*

Tabat, E., *cf. sub* Philippine National Herbarium.

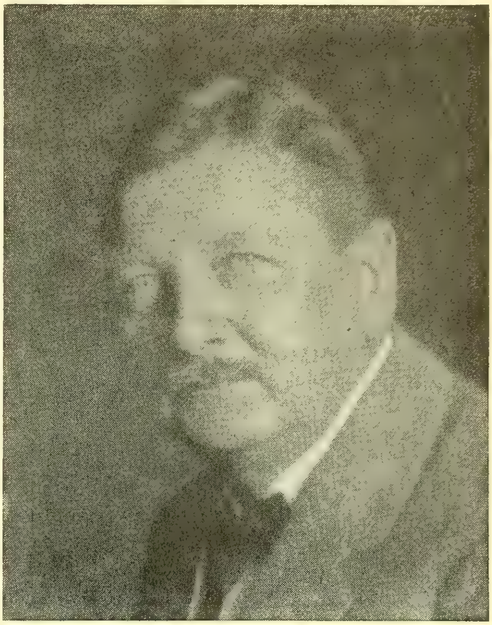
***Tadena,** E. R., *cf. sub* Philippine National Herbarium.

***Tadeo,** C., *cf. sub* Philippine National Herbarium.

***Tärnström,** Christopher

(1703, Halmbyboda i Uppland, Sweden; Dec. 4 or 5, 1746, Pulo Condor, island off the coast of Cambodia, Indo-China), was educated at Uppsala University (from 1724); minister and pedagogue at Östhammar 1739; pedagogue at Vaxholm 1741; studied botany with LINNAEUS from 1738–44; fil. kand. 1745 and fil. dr. in 1746 (non-attendant). In 1745 he was appointed chaplain on a ship of the Swedish East India Company to China, but died on the voyage out, without possibility to collect China plants for LINNAEUS. The latter called him an excellent collector, but nothing more.

He was LINNÉ's first apostle to foreign countries.



SURBECK

The genus *Ternstroemia* MUTIS was named after him.

ITINERARY.[1] Arrived at Göteborg Dec. 10, 1745, but the 'Callmar' and 'Cronprins Adolph Friederic' did not sail before Feb. 13, *1746*; touching Cadiz, passing the Canary Islands; rounding the Cape (July 20); Sept. 3 *Java* was sighted; taking in water, T. going ashore, collecting at least *Algae*, corals, shells, *etc.;* Sept. 6 and following days trading with the natives, T. taking care of his collections; Ban(g)ka Straits (13), heading for the north, and Oct. 13 anchoring in the harbour of Poli (= Pulo) Condor off the coast of Indo-China, staying there till Apr. 15, *1747* when the ships proceeded to Canton. Nov. 10, 1746 T. fell seriously ill. The ships back at Göteborg in May and June *1748*.

COLLECTIONS. He made collections during the voyage, and as the ship passed Sunda Straits, these might contain some Malaysian (*Java*) plants. If so they will be with *Herb.* LINNAEUS in *Linn. Soc. Lond.* From a letter from LAGERSTRÖM to LINNAEUS it is evident that at least a fruit was collected on the coast of *Java*,[2]

LITERATURE. (1) *Cf.* 'Om Christopher Tärnströms resejournaler under en resa till Ostindien (1746)' (Svensk. Linné-Sällskap. Årsskr. 1, 1918, p. 126–144; summary by the 1st librarian Dr

A. W. GRAPE after the MS in Uppsala University Library).

(2) *Cf.* 'Bref och Skrifvelser af och till Carl von Linné *etc.*' I, 8, 1922, p. 16 note 4.

BIOGRAPHICAL DATA. KROK, Bibl. Bot. Suec. 1925, p. 727; BACKER, Verkl. Woordenb. 1936 (Chr. Ternström).

Tamesis, F.

contributed a plant from *Palawan* (May *1949*) to the P.N.H. series (*cf. sub* Philippine National Herbarium).

Tangkilisan

probably W. TANGKILISAN, formerly in the employ of the D.E. Indian Forest Service (*cf. sub* Forest Research Institute), accompanied KOSTERMANS on the expedition to *Morotai* (Moluccas) in *1949.* Material preserved in *Herb. For. Res. Inst. Bogor* and in *Herb. Bog.* His name occurs on labels.

***Taylor,** Bruce William

(1927, Melbourne, Vict., Australia; x), botanist, educated at Sydney University; Soil Conservationist, N.S.W. Dept of Conservation, 1949; Biologist, Australian National Antarctic Research Expedition, 1950–52, stationed on Macquarie Island, 1950–51; since 1952 Ecologist with Commonwealth Scientific and Industrial Research Organisation, Division of Land Research and Regional Survey, Canberra, A.C.T.; in 1956 he resigned and went to Canada to study the ecology of the Arctic. Author of several publications on Macquarie Island.[1]

ITINERARY. *New Guinea.*[2] *1954. Papua:* Northern and Milne Bay Districts.

COLLECTIONS. *Herb. Canberra (C.S.I.R.O.): nos* 2001–2025 from *Papua*; some dupl. in *Herb. Lae.*

LITERATURE. (1) Including 'The Flora, Vegetation and Soils of Macquarie Island' (A.N.A.R.E. Reports Series B, Vol. II Botany, 1955).

(2) Several papers on New Guinea to be published in CSIRO Australia Land Research Series, others submitted to J. Ecol., and Ecology.

B. W. TAYLOR & G. A. STEWART: 'Vegetation Mapping in the Territories of Papua and New Guinea conducted by the CSIRO' (Study of Trop. Veget. Proc. Kandy Symp. Unesco 1956, 1958, p. 127–136).

BIOGRAPHICAL DATA. Kandy Symp. *l.c.* p. 127.

Tenison-Woods, Julian Edmund

ITINERARY. Last line add: and *Talise* (N of Celebes).

***Ternström,** Kristoffer, see TÄRNSTRÖM, CHRISTOPHER.

***Tesoro,** B. T., *cf. sub* Philippine National Herbarium.

Teijsmann, J. E.

He himself always spelt his name with 'ij' and not with 'y' (see A. J. G. H. KOSTERMANS, New and critical Malaysian Plants III, Djawatan Kehutanan Indonesia. Bagian Planologi Feb. 1955, p. 29–31).

***Thomas,** Edward

friend of Mr PURSEGLOVE, after whom will be named *Fissistigma thomasii* SINCL.

COLLECTIONS. *Herb. Sing.:* above-mentioned plant from Fraser's Hill, *Malay Peninsula* (coll. *1955*), included under one of PURSEGLOVE's numbers.

Thomsen, A. Chr. T.

(† 1945, Batavia, Java).

Thomson, G.

might be GIDEON THOMSON (died before 1855), a younger brother of THOMAS THOMSON (Supt. Calcutta Bot. Gard. 1854–61, co-author of HOOKER's Flora Indica). According to I. H. BURKILL (J. Bomb. Nat. Hist. Soc. 54, 1956, p. 83) he made large collections through collectors in Madras, which passed into his brother's possession and later were distributed through Kew. He well might have paid a visit to Singapore, collecting there.

BIOGRAPHICAL DATA. Biogr. Index BRITTEN & BOULGER, 2nd ed. by RENDLE, 1931 (Gideon Thomson).

Thunberg, C. P.

had a large correspondence with LINNÉ in the years 1771–74.[5] L.'s letters often contained special requests to look for certain plants in S. Africa. His correspondence with Prof. BERGIUS dated from 1772[6].

Not a successor to LINNÉ as Professor at Uppsala, but to LINNÉ *f.*

ITINERARY & COLLECTING LOCALITIES. In July 1777 he met the Swedish East-Indiaman 'Stockholms Slott' with ALNOOR, BLADH (see those), *etc.* in Sunda Straits.[7]

From sheets in his herbarium it appears that he collected in *Java* also at Noka Nanta (place unknown to author), and '*prope* blauwe berg *in montibus*'. The *Strobilanthes hirta* (inserted under *Ruellia*), collected in the latter locality, proves without doubt that he also collected in the mountains.

COLLECTIONS. Also specimens in *Florence* (with *Herb.* WEBB), in *Copenhagen* (probably with *Herb.* VAHL), with *Herb.* RETZIUS in *Lund* (several), and with *Herb.* BÄCK in *Uppsala.* He sent plants to BURMAN in Amsterdam before 1775, but complained that with the latter the material (partly in alcohol) lay '*in obscuro*'.[8]

Probably his early collections (S. Africa) were sent to LINNÉ in the first place, but a Cape collection was also bought by the Swedish Academy[9].

LITERATURE. (5) Letters from LINNÉ to THUNBERG in Brefsamling vol. 19 in R. Swed. Ac. Sc., Stockholm.

(6) Letters from THUNBERG to BERGIUS in R. Swed. Ac. Sc., Stockholm.

(7) See letter to BERGIUS, dated Ceylon, Oct. 7, 1777.

(8) See letter to BERGIUS dated Batavia, June 15, 1775, in which he mentions also the rumour of LINNÉ's death.

(9) It is evident from letters from EKEBERG to BERGIUS (in R. Swed. Ac. Sc.) that 100 'rixdollars' were paid for it.

BIOGRAPHICAL DATA. Add: Svensk. Linné-Sällskap. Årsskr. 27, 1944, p. 29–64, fig. 1–7; 'Forskningsmaterial rörande C. P. Thunberg' (and with Japanese title) Tokyo 1953.

***Tirto**, O. T.

Indonesian who evidently collected some plants in behalf of the Sugar Experiment Station at Pasuruan, at Djokjakarta, *Centr. Java*, in *1906*; *Herb. Pasuruan* (*e.g. no* 793 C).

Torén, Olof

was matriculated in Uppsala University in 1737, and entered the service of the Swedish East India Company as a chaplain in 1747, making two voyages to China. He was one of LINNÉ's apostles, but died of consumption when still young.

ITINERARY.[2] In the 'Hoppet', *1748–49*. Sailing from Göteborg in Jan. *1748; via* Cadiz, the Cape; passing Sunda Straits, anchoring at Angri (= Anjer) in *W. Java* (July 24), T. was ashore for some hours; Canton (Aug. 21–Jan. 28, *1749*); on the home voyage anchoring in New Bay (= Meeuwenbaai) between Prinsen Isl. and the SW. point of *Java* (Feb. 16–17), touching *Mew Island;* Keeling Islands, the Cape, St Helena; July *1749* back at Göteborg.—In the 'Götha Leyon', *1750–52*. Sailing from Göteborg, April 1, *1750; via* Dunkirk, Cadiz, Madeira (T. ashore), the Cape, between S. Africa and Madagascar, Johanna, to Surat (India, staying for more than 5 months), Mangalore and Mahié (Mahé) (also coast of Malabar); passing Malacca Straits, touching at Queda (May 13–26, *1751*), on the way to Canton (staying 6 months); Jan. 4, *1752* sailing from Canton on the home voyage, this time passing Sunda Straits, taking in water in New (Mew) Bay (Jan. 19–20) in the meanwhile T. visiting a little coral islet *Cantaye;* rounding the Cape, anchoring at Ascension, and from there in company with the 'Prins Carl' (see OSBECK) to Göteborg (arrival July 26).

COLLECTIONS. Evidently material (also zoological) from both voyages was sent to LINNAEUS by M. LAGERSTRÖM, Director of the Swedish E.I.C.

LITERATURE. (2) CARL-AXEL TORÉN: 'Om Olof Torén. Hans färder till Kina och Indien som skeppspredikant samt om växtsläktet Torenia L.' (Svensk. Linné-Sällskap. Årsskr. 36, 1953, p. 17–56, fig. 1–25, Bil. 1–9 incl. map). Author consulted MS diaries and reports of the ship's assistant and clerk CHRIST. HINDR. BRAAD, who accompanied both voyages.

BIOGRAPHICAL DATA. Add: Svensk. Linné-Sällskap. Årsskr. 36, 1953, p. 17–56.

Toxopeus, L. J.

(† April 21, 1951, after an accident, Bandung, Java).

BIOGRAPHICAL DATA. Vakbl. Biol. 31, 1951, p. 121–122; O.S.R. News 3, 1951, p. 118–119, with portr.; Entom. Ber. 13, 1951, p. 289; Tijdschr. Entom. 95, 1952, p. 9–22, incl. portr. + bibliogr.

TUYAMA

***Trono** Jr, Gavino

collected at Pineda, Pasig (Rizal Prov.), *Luzon*, in Dec. *1952*; > 50 *nos* in *Herb. Univ. Philip.*

***Turqueza,** A., *cf. sub* Philippine National Herbarium.

***Tuxen,** C. F. A., *cf.* S. C. A. TUXEN.

***Tuxen,** S. C. A.

collected in *Banka* in *1921*, when visiting a son.

COLLECTIONS. In *Herb. Copenhagen;* on the labels erroneously written C. F. A. TUXEN.

***Tuyama,** Takasi

(1910, Hiroshima-City, Hiroshima, Japan; x), was educated in botany at Tokyo University, making a special study of the flora of the Bonin and Micronesian Islands. In 1939 he was appointed Assistant at the Botanical Institute of Tokyo University; in 1941 Member of the Research Institute for Natural Resources; 1943 D.Sc.; in 1950 Ass. Professor of Ochanomiza University and since 1952 Professor.

ITINERARY. *1943.* Expedition in the 'Vogelkop', *West New Guinea* (Feb.–June). Collecting mainly in the lowland, at Manokwari (March and June), in the Prafi River District, also at Hattam, and in the Island of *Japen* (June).

COLLECTIONS.[1] Provisionally deposited in *Herb. Res. Inst. Nat. Resources, Tokyo*, numbered 566–1967; some dupl. in *Herb. Nat. Sc. Mus. Tokyo.* According to the collector himself the material is rather poor and incomplete; the material in alcohol was practically lost by the bombardment of Tokyo. Specialists are working on special groups, and the results will eventually be published as Contribution 2 seq.[1]

LITERATURE. (1) S. HATTORI: 'On a small collection of Hepaticae from Dutch New Guinea'. Contrib. to the Tuyama 1943 Collection of Dutch New Guinea Plants No 1 (Bot. Mag. Tokyo 64, 1951, p. 112–119).

***Twiss**
is mentioned by H. J. LAM (Bull. Jard. Bot. Btzg III, 12, 1932, p. 439) as a collector of *Canarium pseudo-decumanum* in *Sumatra*, Palembang, at Muaradua.

***Uichanco,** L. B., *cf. sub* Philippine National Herbarium.

***Umali,** A. F., *cf. sub* Philippine National Herbarium.

***Valderrama,** C. (or O.) M., *cf. sub* Philippine National Herbarium.

***Valdez,** E., *cf. sub* Forestry Bureau, Manila.

***Valentin,** Aron Oscar
(1885, Stockholm, Sweden; x), merchant; Director of EKSTRÖM & BORGSTRÖM.

He developed a keen interest in botany and made study tours in several countries (see *sub* Collections). From 1930–31 in the employ of the Natural History Museum in Stockholm, taking his Ph. D. in 1939.

COLLECTIONS. He collected plants in Brazil and Magellansland in 1921–22, in East Asia in *1925–26*, in S. Africa and Australia in 1927–28[1], and in N. America (1929). A specimen collected at Pasay, Manila (*Luzon*) on Sept. 9, *1925* in *Herb. State Mus. Stockholm.* In 1930, 430 phanerogams from the Indies and Australia were presented to *Herb. State Mus. Stockholm;* in 1931 mainly plants from Australia.

LITERATURE. (1) R. FLORIN *in litt.* March 17, 1953.

BIOGRAPHICAL DATA. Vem är det 1951.

***Valera,** José
(† 1948, Manila, Luzon, P.I.) was appointed Forest Ranger in Br. N. Borneo in 1933, stationed at Sandakan and Lahad Datu. During the Japanese occupation he ran away to the Philippines and joined the Allied Forces, later being one of the volunteers who attacked Japan. After the war he returned to Manila where he died in hospital.

COLLECTIONS. *Cf.* Forest Department British North Borneo; his plants were at least partly numbered in the S. H. series.

Valera, R., *cf. sub* Philippine National Herbarium.

Valeton, Theodoric
Line 8, *for* 1915 *read:* 1916.

Vanoverbergh, M. van
COLLECTIONS. 220 dupl. from *N. Luzon* in *Herb. Copenh.;* in *State Mus. Stockholm:* 100 plants from the *Philippines.*

Velasco, J., *cf. sub* Philippine National Herbarium.

***Veloira,** Miss Nieya
collected on Mt Maquiling, and at Montalban (Rizal Prov.), *Luzon*, early *1954;* > 80 *nos* in *Herb. Univ. Philip.*

Verdoorn, Fr.
COLLECTIONS. Correction: His *Musci* in *Herb. Brit. Mus.*, the ferns (few) in *Gray Herb.*, the *Hepaticae* in *Farlow.*

***Vergara,** Benito S.
collected at Quezon City (*1953*), and at Antipolo (Rizal Prov.), *Luzon;* > 82 *nos* in *Herb. Univ. Philip.*

***Vermeulen,** Pieter
(1899, Limmen, N.H., Holland; x), teacher who studied biology at Amsterdam University (1930–35); secondary school teacher at Doetichem and in Amsterdam; Ph.D. Amsterdam (1947), and subsequently Conservator at the Hugo de Vries Laboratory there. He was awarded the Buitenzorg Fund for 1955.

His main interest is in *Apostasiaceae* and *Orchidaceae.*

ITINERARY.[1] *1956* (June 25–Dec. 31). Travelling by plane, visiting India: from Calcutta to Darjeeling and Sikkim to Changu on the Tibethan border; *W. Java:* Bogor (July 25–Oct. 3), Kebun Raya Indonesia, making excursions in the environs, *e.g.* to Muara Angké (N. coast) and Tjibodas; Oct. 4 leaving for Sydney, N.S.W., Australia; back at Bogor (Oct. 28); at Bandung and Lembang with Dr KOSTERMANS; Nov. 8 to Jogjakarta (*Centr. Java*) as a guest of the Gadja Mada University; excursions to G. Lawu (11–18) from Tawangmangu; *Bali; W. Java:* Bogor (Nov. 25–Dec. 10), making a tour to the Wijnkoopsbaai; Dec. 11 leaving for *W. Sumatra:* Pajakumbuh as a guest of Dr W. MEIJER, making excursions to Haraukloof, G. Sago, Manindjau Lake, and Aneikloof, in company of the latter; leaving Dec. 21 for Padang and by bus from Bukittinggi by way of Sibolga, Toba Lake, Prapat, to Medan (arriving 23); returning to Amsterdam by way of Djakarta.

COLLECTIONS. About 200 *nos* from the Himalaya, 400 from Australia, *c.* 25 from Muara Angké;

a collection from G. Lawu (will be sent from Jogja), and from *W. Sumatra.* The material will probably be presented to *Herb. Amsterdam.*

LITERATURE. (1) P. VERMEULEN: 'Bezoek aan Plantentuinen' (in Folia Civitatis 10, *no* 21, March 2, 1957).

Vermoesen, Frans Marie Camille

(1882, Malderen, Belgium; 1922, Leuven, Belgium), was educated at the University of Leuven (Ph.D. 1909). After a term of probation in the Herbarium at Brussels, he was appointed mycologist for plant diseases in the Congo, and made a study tour to India and the Dutch East Indies, *1911–12.* From 1913–15 he worked in the Congo, but was forced to resign due to ill health. After World War I appointed Inspector in the Department of Colonies, and since 1919 Conservator of the Rijksplantentuin at Brussels to work up his own Congo collection of about 2000 numbers.

ITINERARY. Leaving Marseille (Feb. 11, *1911*), visiting Colombo, Peradenya, *Singapore, Penang,* and Buitenzorg (*Java*).

BIOGRAPHICAL DATA. Belg. Kolon. Biogr. 2, 1951, incl. bibliogr.

Versteegh, Chr.

Add: Stationed at Hollandia, North New Guinea, since 1952; making numerous informative tours.

COLLECTING LOCALITIES. Add: From *1952 onwards. West New Guinea: Waigeo;* Prafi Plain near Manokwari; Cyclops Mts, near Pioneer Bivouac on the Mamberamo River; Holtekang, Humboldt Bay, savannahs near Merauke (S. coast); Anggi Lakes (Arfak Mts); near Hollandia; Sidai, W of Manokwari; *Meos Noem, Japen;* Kebar Plain (W of Manokwari); Wissel Lakes; on the Tami River near the Australian border; Manokwari, Oransbari and on the island *Meos Waar.* In *1954* he collected with P. VAN ROYEN (see there) in *Papua* and the *Mand. Terr. of New Guinea* (June 15–July 12).

COLLECTIONS. Collections from *1952* onwards in *Herb. Leyden,* and *Manokwari,* numbered in the B.W. series (in 1957 ± 800) and some tens of numbers in the series of VAN ROYEN (see there). Mostly only few numbers were collected, but more near Anggi Lakes (56), Kebar Plain (41), Cyclops Mts (47), Wissel Lakes (127), Oransbari and *Meos Waar* (80).

***Verzosa,** E. A., *cf. sub* Philippine National Herbarium.

Vesterdal, Axel Peter Nielsen

(† 1954, Copenhagen, Denmark), resigned in 1944.

COLLECTING LOCALITIES. Add: *W. Java:* Garoet (*1917*).

***Viado,** A. B., *cf. sub* Philippine National Herbarium.

Vidal y Soler, S.

COLLECTING LOCALITIES.[6] *Luzon:* Angat, Prov. of Bulacan; Bagag, Prov. Bataan; Tayabas; Calauan, San Antonio, Laguna; San Mateo, Manila; Angat, Prov. Bulacan; *Mindanao:* Surigao; *Panay:* Ilo(-)ilo; *Luzon:* La Paz, Prov. Tarlac; Arayat, Prov. Pampanga; Antipolo, Boso boso, San Isidro, Prov. Morong; Monte Banahao, Prov. Tayabas; Castillejos, Prov. Zambales; Caraballo, Prov. Nueva Ecija; San Juan del Monte, Prov. Manila; Centro de Luzon; *Isla Alabat,* Prov. Tayabas; Lupi, Iriga, Prov. Camarines Sur; Bucay, Prov. Bataan; Mt Maquiling, Prov. Batangas; Benguet, Prov. Benguet; Tarlac, Prov. Tarlac; Ilocos Norte, Ligmanan, Prov. Camarines Norte; Dumaran, Prov. Paragua; *Isla de Marinduque; Isla Guimaras,* Prov. Ilo-Ilo; *Isla Panay:* Concepcion; *Luzon:* Prov. Albay; Bontoc, Prov. N. Luzon; Prov. Union; Abra and Lepanto in N. Luzon; Goa, Mt Isarog in Camarines Sur; Infanta, Prov. Zambales; Mt Mayon, Prov. Albay; Iriga, Prov. Camarines Sur; ? Tuban (or ? Libon) and Bulusan, Prov. Albay; *Isla Paragua* (= *Palawan*)*; Luzon:* Taal Volcano, Prov. Batangas; *Panay:* Miagao, Prov. Ilo-Ilo; Mayon Volcano, Prov. Albay; Mt Banahao and Lucban, Prov. Tayabas; Union Province.—Besides in *Guimar* (= *Samar*), *Isl. Balabac,* and in *Cebu.*

COLLECTIONS. When incorporated, the *Herb. Bot. Gard. Madrid* (= Inst. Bot. Ant. J. Cavanilles) will include VIDAL's collection of ± 14.000 specimens, not all woody plants, collected by him and his assistants (*cf.* also *sub* QUADRAS and JOSÉ BARANDA). According to Mr ALSTON (*in litt.*) some labels of the collection are printed: 'Inspeccion General de Montes'; these must be old labels dating from the original Forest Inspection (see under J. G. VALDEZ). On some labels was written 'El Jefe (Chief) de la Com^n', the specimens in question might have been collected by VIDAL himself. The specimens are unmounted, most not named, but appear to have been sorted into families once. Duplicates (± 4000) have been promised to *Manila.* Dr E. QUISUMBING took 319 dupl. from Madrid with him to *Manila* in 1954.[7]

LITERATURE. Add: (6) Copied from lists preserved at Kew Herbarium; and from bundles in Herb. Bot. Gard. Madrid by Mr A. H. G. ALSTON (June 1955).

(7) *Cf.* E. Quisumbing: 'A report of my Trip' (mimeogr. 1954) p. 60.

***Villarta,** M., *cf. sub* Philippine National Herbarium.

***Viola,** V.

collected at Antipolo (Rizal Prov.), *Luzon,* in Dec. *1952;* plants in *Herb. Univ. Philip.*

Visser Smits, D. de

correction: (1881, Zetten (Valburg), G., Holland; x), in Java from 1912 onwards. He returned to Holland in 1948.

***Vogel,** Alfred Anton
(1899, Stockholm, Sweden; x), officer in the Royal Horse Guards, who served in the Hungarian (1933) and Polish army (1937); retired after the war. In 1950–51 member of the Australian HALLSTROM Expedition to Jimmi and Ganz Rivers in New Guinea, to find rare animals and birds of paradise and to contact unknown tribes of pygmies in the Bismarck and Schrader Ranges.[1]

COLLECTING LOCALITIES. *1950.* Central Highlands *E. New Guinea,* Nondugl (Nov.); Jimmi River Valley, Lae (Dec.); Bismarck Mts.

COLLECTIONS. 15 specimina in *Herb. State Mus. Stockholm.*

LITERATURE. (1) A. A. VOGEL: 'Papuans and pygmies' (London 1953; transl. from the Swedish ed.; Germ. ed. Zürich 1954).

Voigt, J. O.
COLLECTIONS. In his herbarium are included plants from the *Moluccas,* either or not collected by himself.

Voogd, C. N. A. de
LITERATURE. (5) 2nd line, after Trop. Nat. add: Jubil. *no*

Vries, A. M. de
typist to C. A. BACKER at Buitenzorg; about 1924 she married Mr BARKMEYER; *cf.* also *sub* A. M. BARKMEYER-DE VRIES.

Vriese, W. H. de
ITINERARY. *1860.* Add: In the 2nd half visiting *Centr. Java* (principalities Djokjakarta and Soerakarta); *Sumatra West Coast:* Padang Highlands.

LITERATURE. (1) Add: W. F. R. SURINGAR: 'Voyage de M. le Prof. W. H. de Vriese dans l'Archipel des Indes Orientales Néerlandaises, fait par ordre de S.M. Le Roi des Pays Bas, dans l'intérêt des Grandes Cultures, 1857–1861' (Alg. Konst- en Letterb. 1861, *no* 10; repr. in Ann. Hort. Bot. 5, 1862, p. 45–48).

BIOGRAPHICAL DATA. Ann. Hort. Bot. 5, 1862, p. 163–164.

Vuuren, L. van
(† 1951, Utrecht, Holland).
BIOGRAPHICAL DATA. Tijd. K.N.A.G. 68, 1951, p. 365–367.

Vuuren, O. van
(† 1951, Amsterdam, Holland).

Wade, A.
His New Guinea plants were mostly ferns collected in the forests of Vailala River, *Papua.*

Wänman, Carl Henric (or Hindrikson)
(1733, Uppsala, Sweden; 1797, Åbo, Finland), entered the University of Uppsala in 1758; pupil of C. LINNAEUS, graduating in 1759 (Flora Capensis), and taking his doctorate in medicine in Oct. 1768. At first medical practitioner in Stockholm; appointed medical officer to the Nyland county council (Finland) in 1779, physician at Helsingfors (Finland) in 1780; at the outbreak of war in 1788 army surgeon at Helsingfors, and in 1794 medical officer in the council of Åbo (Finland). He was a ship's surgeon on two journeys to the East Indies and brought home some scientific material.

ITINERARY. His 1st voyage to China must have taken place between Sept. *1766* and Sept. *1768*[1], visiting at least the Cape. The 2nd voyage possibly between end *1768* and *Aug. 1770*[2]*;* during this voyage Manila (*Luzon, Philippine Islands*) was visited. Possibly respectively in the 'Lovisa Ulrica' and the 'Adolph Friederic' (*cf.* P. J. BLADH).

As he brought home material from *Java* and *Sumatra,* this must have been collected when going to, or coming from, China.

COLLECTIONS. In *Herb.* BERGIUS (= *Acad. Stockh.*): plants from China, the Cape, *Java,* Ind. Or., Manila (*Luzon*), *Sumatra.*[3] It seems almost certain that he also collected for LINNÉ; then in *Herb. Linn. Soc. Lond.* Specimens in *Herb.* THUNBERG (= *Uppsala*).

LITERATURE. (1) *Vide* MS letter to P. J. BERGIUS dated Sept. 14, 1766, in which he tells that he will make a voyage to China in a new ship of the Swedish East India Company. LINNÉ had given him a private lecture on what he must look for and how to keep the bulbs, seeds, *etc.* (in R. Swed. Ac. Sc., Stockholm); and *ditto* dated Sept. 24, 1768 in which he writes that LINNÉ had bade him welcome from the antipodes, and states that all medical men are good Linneans!

(2) *Vide* MS letter from LINNÉ to WÄNMAN dated Aug. 19, 1770 (in Brefsamling in R. Swed. Ac. Sc. vol. 14, p. 779) in which he congratulates him on his happy return home.

(3) *Vide* MS letter to BERGIUS *l.c. sub* 1, dated Sept. 24, 1768, in which he asks him to select duplicate specimens.

BIOGRAPHICAL DATA. SACKLÉN, Sveriges Läkare Historia 2, 1823, p. 69–71 (Dr R. FLORIN kindly supplied me with the data in English).

Wahr-Perera, E. W.
recorded as Mrs WAHR in the Cyclopaedia (vol. 1), collected at Koeningan near Cheribon (*W. Java*) on July 17, *1932.*

***Wakefield,** Norman Arthur
(1918, Romsay, Vict., Australia; x), was educated at Scotch College, Melbourne and the University of Melbourne; primary schoolteacher in Victorian Education Department. He collected in New Guinea and the Solomon Islands during his period of service with the Australian army.

He worked on the flora of Victoria.

COLLECTING LOCALITIES. Aug. *1943*–July *1945. Papua:* Laloki River valley, E of Port Moresby, from sea-level to *c.* 1000 m alt.; *Mand. Terr. New Guinea:* at low elevations in the Lae-Nadzab area of the Markham Valley; Solomon Islands: low SW. part of Bougainville; Treasury Group: Stirling Island.

COLLECTIONS. 1st Set in *Herb. Brit. Mus.,* about 800 specimens, covering *c.* 300 species of *Pteridophyta.* In due time a complete set will be placed in *Herb. Melbourne,* and some dupl. at *Brisbane* and *Florence.*

Walker, George Warren
was in fact stationed in Ceylon as Adjutant-General from 1830–37; he made large journeys of inspection through all parts of the island.[2]

COLLECTING LOCALITIES. About *1837* in *Penang* and *Singapore.*

LITERATURE. (2) *Cf.* I. H. BURKILL in J. Bomb. Nat. Hist. Soc. 54, 1956, p. 50.

Wallich, N.
COLLECTIONS. His oldest collections and dupl. of the E.I.C. herbarium in *Herb. Copenhagen;* also dupl. E.I.C. in *Herb. State Mus. Stockholm.*

***Walton,** Arthur Bernard
(1904, U.K.; x), was educated in forestry at Edinburgh University (B.S.); from 1926–1955 a member of the Malayan Forest Service, collecting occasionally in the C.F. series (*cf.* Conservator of Forests series in Fl. Mal. vol. 1).

BIOGRAPHICAL DATA. Mal. For. 1955, p. 3–4 with portr.

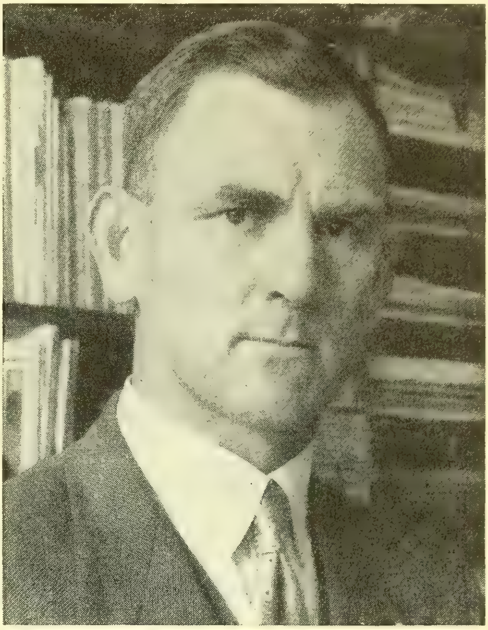
Waterhouse, J. H. L.
of Cairnleith, Chatswood, N.S.W., Australia, worked in the South and Northwest Pacific from 1907 onwards, starting in Fiji. From about 1930–end 1932 he stayed in the Solomon Islands, mainly in Bougainville, but paying visits to Buka Isl. and adjacent islets, commissioned on behalf of the Ministry of Agriculture and Fisheries, and the Empire Marketing Board, London; in Jan. 1933 appointed teacher at the native Nodup Administration School and the Police School at Rabaul, New Britain. He was evidently also engaged in linguistic work.[2]

COLLECTING LOCALITIES. *1931–32.* Solomon Islands.—*1933–± 1935. Bismarck Archipelago: New Britain.*

COLLECTIONS. Mr FORMAN from Kew informed me that the numbers up to 850 are practically all from Bougainville; those above 850 are all from *New Britain.* This may hold for the material at Kew (? material from 1932 and later possibly having been renumbered following on the numbering of earlier collections), but the collection sold to *Yale University* (coll. 1932–35) was numbered 1–423, of which the numbers 208 onwards were collected in *New Britain.* In literature a *no* 345 is cited to have been collected in October 1930, so it is evident that several numbers will have been used twice, and for citation it will be wise to give both the Kew and Yale numbers. The plants were partly identified at Kew (special groups were sent to Berlin and are possibly lost), partly in the U.S.A. by Dr MERRILL.

LITERATURE. (2) Most data derived from the correspondence present at the Yale Herbarium, kindly put at my disposal by the Curator Mr WILLIAM L. STERN.

Waterstradt, Johannes
(† 1944, Copenhagen, Denmark), a gardener of Dutch descent; in 1888, when on his way to emigrate to Australia, he made the acquaintance of a German insect collector, who worked for STAUDINGER, on board the ship. The latter was willing to learn him the trade, and both left the ship in Ceylon, and for the next 25 years WATERSTRADT worked as a professional zoological collector. In 1913 he returned to Denmark and started horticulture once more, especially breeding orchids.


WAKEFIELD

ZOOLOGICAL COLLECTING LOCALITIES. Add: 1888–89. Ceylon.–2nd half of *1889, Penang.*

BIOGRAPHICAL DATA. Entom. Meddel. 15, 1936, p. 362–363, fig. 105 portr.

Waterstredt, Johannes, *cf. sub* WATERSTRADT, JOHANNES.

Watson, James Gilbert
(† Jan. 6, 1950). Author of 'Some materials for a forest history of Malaya' (Mal. For. 13, 1950, p. 63–72).

BIOGRAPHICAL DATA. Mal. For. 13, 1950, p. 60–62, with portr.

Wawra von Fernsee, H. Ritter
p. 562b, 2nd and 3rd line, delete: with Kaiser Maximilian von Mexico.

***Wegmann**
collected some plants on Pangalian Estate,

Indragiri, *Centr. Sumatra,* in Jan. *1923;* in *Herb. Bog.*

Weirich, H., *cf. sub* H. WEYRICH.

Weiss, Emanuel

COLLECTIONS.[4]

LITERATURE. (4) E. GOMBOCZ: 'Weiss Emánuelnek a Nemzeti Múzeum birtokában lévo gyűjtése' (The collection of E. Weiss in the Hungarian National Museum) (Botanikai Közlemények 30, 1933, p. 110–111, 117) (*n.v.*).

Wendover, R. F., *cf. sub* Philippine National Herbarium.

Wennerberg, Hans Petter

(1750, Torekov, Sweden; 1821, Förslöv, Sweden), had since his youth a special liking for water and boats. A student at Lund from 1764–69; in 1770 accepting a place at Stralsund, graduating at Lund in 1771, and the next year passing his Ph. magister examination. In 1773 he visits Greifswald and other places, and accompanied some voyages by boat, visiting Copenhagen and Danzig. He earned a living by teaching, but the thought of the sea and foreign countries still haunted him, and in 1774 he paid a visit to a representative of the Swedish East India Company. In 1776 he was appointed chaplain in the Company's service, and from 1777–82 accompanied several voyages to the East. Returning an ill man from the last voyage, he passed a pastoral examination at Lund in 1782, and was from 1784 until his death a minister at Förslöv.

ITINERARY. Leaving Göteborg (Jan. 20, *1777*) in the 'Stockholms Slott' (with A. ALNOOR & P. J. BLADH), *via* the Cape, China Sea (July 25), to China (Aug. 8), setting out on the home voyage in Jan. *1778:* back at Göteborg in June.—Sailing (March *1778*) in the 'Lovisa Ulrica', *via* Cadiz, Canton (Sept. 29), from where leaving Dec. 24, back at Göteborg June 21, *1780.*—Sailing in the 'Gustaf III' (Feb. 2, *1781*), reaching Canton on Sept. 1, setting out on the home voyage on Jan. 10, *1782*, reaching Göteborg on July 12.

COLLECTIONS. Last line in the entry in the Cyclopaedia, Fl. Mal. vol. 1, *read:* p. 19, 28; and fasc. 6, 1791, p. 35, 38.

BIOGRAPHICAL DATA. Autobiography in old register of deceased persons, Lands arkiv, Lund (microfilm in Arch. Flora Malesiana).

Went, F. A. F. C.

BIOGRAPHICAL DATA. Add: Ned. Kruidk. Arch. 45, 1935, p. 161–162 with portr.

Wenzel, C. A.

COLLECTIONS. Dupl. from Surigao (*Mindanao,* coll. *1927*) in *Herb. Copenh.*

***Werner**

is the collector of *Cyperus* specimens in *Java* in *1846;* material in *Herb. Melbourne.*

***Westerhuis,** V. E., *cf. sub* Boswezen Nieuw Guinea.

***Westermann,** Bernt Wilhelm

(1781, Ringkøbingegnen, Denmark; 1868, ? Copenhagen), an amateur insect collector who was sent out to India (Calcutta) and later to Java (Batavia) in the employ of an English business firm. At the Cape, in Bengal, and Java, he collected insects for English and Dutch friends, amongst others for TH. HORSFIELD. In 1817 he returned to Copenhagen as shipowner and owner of a sugar-refinery at Slotholmsgade.

COLLECTIONS. *Herb. Copenhagen:* at least some *Java* plants.

BIOGRAPHICAL DATA. Entom. Meddel. 15, 1936, p. 161–164, fig. 39–40 portr., p. 197–198.

Weyrich (or Weirich), H.

(† 1863, Petersburg, Russia), studied medicine at Dorpat, 1846–51 (M.D.). The transfer to the 'Vostok' took place at Plymouth.

ITINERARY.[3] Naval Expedition *1852–54,* in the 'Pallas' and 'Vostok'. The 'Pallas' left the roads of Kronstadt Oct. 7, 1852; the 'Fearless' (= Vostok) was bought in England, and joined the 'Pallas' at Plymouth; sailing from Plymouth (Jan. 6, *1853*), by way of the Cape of Good Hope; the 'Vostok' ordered to visit the Cocos (Keeling) Islands and then to repair to Hongkong; the 'Pallas' anchored off Anjer, *W. Java* (May 17), reached Singapore (24), June 1 sailing for Hongkong; Canton, Bonin Islands, Japan, mouth of the Amur River, W. coast of Sachalin, Nagasaki, Shanghai; Manila (*Luzon,* Feb. 16, *1854,* the 'Vostok' a week later); Feb. 27 the squadron left Manila; the flagship had a delay of 10 days in one of the islands of the *Babuyan Group;* Liu Kiu Islands, Nagasaki, E. coast of Korea; in May *1854* returning to De Castries Bay because of the war with England and France. Admiral PUTIATIN returned to St Petersburg in Nov. 1855 by the Amur and Siberia.

LITERATURE. (3) *Cf.* BRETSCHNEIDER, Hist. Bot. Disc. China 1898, p. 573–576.

BIOGRAPHICAL DATA. BRETSCHNEIDER, Hist. Bot. Disc. China 1898, p. 618; in S. LIPSCHITZ, Botanicorum Rossicorum Lexicon Biographobibliographicum II, 1947, p. 79.

White, C. T.

(† 1950, Brisbane, Queensland, Australia).

BIOGRAPHICAL DATA. Proc. R. Soc. Queensl. 62, 1952, p. 35–48, incl. bibliogr. and portr.; the cited volume includes a C.T. WHITE Memorial Supplement.

Whitford, H. N.

COLLECTING LOCALITIES. Add: *Mindoro* (March 1, *1906*).

***Whitmore,** Timothy Charles

(1935, Ruislip, Middlesex, England; x), botanist educated at Cambridge University (1953–56), arrived in Singapore in Dec. 1956 with a Colonial Development and Welfare Grant for 1957. He will study the anatomy of the bark of *Dipterocarpacae* and other families in relation to taxonomy, and in due time submit this subject as dissertation for Ph.D. at Cambridge. During his stay in Malaya his work consisted mainly of collecting, while the subsequent analysis will be made at Cambridge.

COLLECTING LOCALITIES. *1957. Malaya:* in every state except Kelantan. Also in *Sarawak*, *Brunei*, and the E. coast of *Br. N. Borneo*.

COLLECTIONS. Consecutively numbered 1–680, most collections in duplicate only of sterile material and accompanied by a bark sample (temporarily sent to Cambridge, ultimate destination as yet undecided). About 50 general collections, usually of 6 sets for more general distribution, usually of fertile material.

***Whitty,** R. H.

(1891, Ireland; x), was a member of the Malayan Forest Service from 1921–33. He occasionally collected in the C.F. series (*cf.* Conservator of Forests series in Fl. Mal. vol. 1).

Wichura, M. E.

BIOGRAPHICAL DATA. Add: BRETSCHNEIDER, Hist. Bot. Disc. China 1898, p. 941–942.

***Wight**

It seems *improbable* that this collector is identical with the brother of R. WIGHT (*cf.* Cyclopaedia Fl. Mal. vol. 1), as the Singapore Herbarium was *not* existent at that time.

COLLECTIONS. *Herb. Sing.: Payena leerii* (T. & B.) KURZ, coll. *s.n.* at Sambas, *W. Borneo.*

Wigman Jr, Hendrik Jan

read: Herman Jan († 1957, Voorschoten, Holland).

***Winder,** G. E.

collected some plants together with M. E. BRITTON (*cf.* Fl. Mal. vol. 1) in *Biak* in *1945.*

Winkler, Hans

COLLECTIONS. *Borneo* ferns *1924/25* in *Herb.* C. CHRISTENSEN = *Brit. Mus.*[5]

LITERATURE. (5) *Cf.* C. CHRISTENSEN in Mitt. Inst. Allg. Bot. Hamb. 7, 1928, p. 141–165.

BIOGRAPHICAL DATA. In Almanach Oest. Ak. Wiss. 1948 (*n.v.*); Ber. Deut. Bot. Ges. 68a, 1955, p. 27–32, portr. and bibliogr.

Winkler, Hub.

COLLECTIONS. Add: Dupl. *Mal. Penins.* and *Borneo* in *Herb. Kew.*

Winterbottom, James Edward

(1803, Reading, England; 1854, Rhodes) was educated at Oxford (M.A. 1828); M.B. 1833. He spent most of his life in travel. According to BURKILL[1] he went to *Java* in *1846* and returned westwards to India, travelling there in different parts. He returned to Britain, but set out once more, dying on the home voyage. He must be identical with the *Java* collector (*cf.* Fl. Mal. vol. 1).

COLLECTIONS. Until 1900 in the possession of the family, but then given to *Herb. Kew.*

LITERATURE. (1) In J. Bomb. Nat. Hist. Soc. 54, 1956, p. 77–78.

BIOGRAPHICAL DATA. Biogr. Index BRITTEN & BOULGER, 2nd ed. by RENDIE, 1931.

WOMERSLEY

***Wintermitz,** Mrs, *cf. sub* Philippine National Herbarium.

Wirz, Paul

(† Jan. 30, 1955, in the mountains of the Maprik region, near the Sepik mouth, Mand. Terr. New Guinea), was educated in the technical sciences, but was irresistibly drawn to ethnology and anthropology. From 1915 onwards he travelled extensively in the Old World, including many times in New Guinea. He took his Dr's degree in 1920 at Basel, and lectured in that university from 1928, but only for a very short time.

BIOGRAPHICAL DATA. Verh. Naturf. Ges. Basel 66, 1955, p. 185–194, with portr. and bibliogr.

Witkamp, H.

In late *1939* and early *1940* he visited *W. Borneo*, G. Pandung and G. Sekeh, forming the watershed between the Sambas and Kapuas rivers.[4]

LITERATURE. (4) H. WITKAMP: 'Ons bivak op de Gunung Pandung (W.-Borneo)' (Trop. Natuur 33, 1953, p. 10–20, fig. 1–3).

BIOGRAPHICAL DATA. Partial bibliogr. in Trop. Natuur 33, 1953, p. 39.

Wolfe, E. D. B.

in 1956 Deputy Director, Medical Services, Federation of Malaya.

Petraeovitex wolfei J. SINCLAIR, which he brought home as a living plant from Kedah, was named after him.[1]

Literature. (1) *Cf.* Gard. Bull. Sing. 15, 1956, p. 18–20, fig. 2.

*__Womersley,__ John Spencer

(1920, Bristol, England; x) went to Australia in 1930 and was educated in Adelaide, graduating B.S. and Teaching Certificate in 1944 at the university. In June 1946 appointed Forest Botanist, Papua and New Guinea Administration, at Lae, New Guinea.

G. H. S. WOOD

Author of some papers on collecting methods, *etc.*[2]

Hibiscus womersleyanus Borss. was named after him.

Collecting localities. From *1946 onwards. NE. New Guinea.* In the vicinity of Lae; at Morobe (Dec. *1947*–Jan. *1948*); at Aiyura and in other highland areas including Goroka and Nondugl on a number of occasions; the Upper Sepik River Distr. (July–Oct. *1949*) up to the confluence of the October River and the Sepik River[1]; Bulolo Valley area, *c.* 3500 ft; Sogeri region (*Papua*, June-Aug. *1951*); Finschhafen-Sattelberg area (Apr. *1953*); Keravat, *New Britain* (May *1953*); Aiyura, Eastern Highlands (July *1954*); collecting trip with N. W. Simmonds (Dec. *1954*–Jan. *1955*), along the N. coast from Sepik to Rabaul (*New Britain*), through the Central Highlands, and in *Papua* from the Oriomi River to Port Moresby and Sogeri; Baiyer River Valley in the Western Highlands (? first half of *1955*).

Collections. Numbered in the N.G.F. (*cf.* New Guinea Forces) series, > 2000 *nos*; in *Herb. Lae, Brisbane, Canberra* and where available dupl. to *Arn. Arb., Kew, Leyden, Bogor, Sing.*, and *Imp. For. Inst. Oxford.*

Literature. (1) *Cf.* Australas. Herb. News *no* 6.

(2) *E.g.* 'A brief history of botanical exploration of Papua and New Guinea' (The Papua and N.G. Gazette 8, *no* 2, Oct. 1953, p. 32–39).

***Wong Yun Siew**

collected *Cyperus distans* L.*f.* near Sandakan (Jan. 21, *1952*), *Br. N. Borneo,* numbered E 43 A; specimen in *Herb. Brit. Mus.*

*__Wood,__ Geoffrey Howorth Spencer

(1927, Vowchurch, Herefordshire, England; May 6, 1957, Kuala Belait, N. Borneo), was educated in botany and forestry at Oxford University (M.A.) with 1st class honours in forestry (1952). After some years in Africa he was appointed Forest Botanist at Sandakan, Br. N. Borneo, in 1953, arriving there in 1954. His tragic untimely death was the result of burns received in an accident at a camp.

His main professional interest was in *Dipterocarpaceae*, his personal interest was also in mosses.

Collecting localities. *Br. N. Borneo. 1954.* Kinabatangan Distr. (June); with J. Wyatt-Smith on the W. coast, including Kinabalu, Trus Madi and Beaufort areas (Aug.–Sept.).—*1955.* W. coast, Beaufort and Sipitang areas (May–June).—*1957.* Two-month collecting tour in Brunei (March-Apr.).

Collections. *Herb. Sandakan*, numbered in the postwar A series, and in the new series San *nos.*

Biographical data. Mal. For. 20, 1957, p. 121.

Wray Jr, L.

Collections. In 1955 the Agric. Dept Kuala Lumpur donated a number of sheets of Wray's specimens collected in the 1880s to *Herb. Sing.*

Wurth, Th.

Collecting localities. Add: *C. Java:* G. Merbabu (Sept. 6–8, *1907;* Nov. 16, *1908*); *E. Java:* G. Ardjoeno (Sept. 11–12, *1909*; *1913*).

Wyatt-Smith, John

From 1955–Oct. 1956 Ass. Conservator of Forests, Sg. Patani, Kedah; subsequently returning to Kepong as Forest Botanist.

He made a botanical exploration of Jarak Island.[1] Author of several papers[2] and manuals of Malayan timber trees.

Myristica wyatt-smithii Shaw is named after him.

Literature. (1) J. R. Audy, J. L. Harrison & J. Wyatt-Smith: 'A survey of Jarak Island, Straits of Malacca' (Bull. Raffl. Mus. Sing. *no* 23, 1950, p. 230-261, maps, photogr.).

J. Wyatt-Smith: 'The vegetation of Jarak Island, Straits of Malacca' (J. Ecol. 41, 1953, p. 207–225, 2 fig., 5 photogr.).

(2) *E.g.*: 'A note on tropical lowland evergreen rainforest in Malaya' (Mal. For. 12, 1949, p. 58–64); on *Dipterocarpaceae, Durio, Calophyllum, etc.*

***Wycherley**, P.R.
of the Rubber Research Institute of Malaya, collected *Croton hirtus* from Bukit Rajah Estate, Selangor (Apr. 22, *1956*); specimen preserved in *Herb. Sing.* (Gard. Bull. Sing. 15, 1956, p. 1). He made extensive studies on the undergrowth of rubber plantations and contributed a paper on that subject to the 9th Pac. Sc. Congress, Bangkok 1957.

Wijk, C. L. van
Literature. (1) Add: C. L. van Wijk: 'Soil survey of the tidal swamps of South Borneo in connection with the agricultural possibilities' (Tectona 41, 1951, p. 75–110, maps and photogr.).

***Xantus**, János (Johann)
(1825, Csokonya, Hungary; 1894, ? Budapest, Hungary), naturalist, ethnographer, and zoologist who originally studied for the bar, sat up as a lawyer, but joined the rebels in 1848. He was imprisoned more than once, and finally fled to Germany, travelling by way of Hamburg to London, and in 1851 from there to the U.S.A. After having had several odd jobs, he met Herzog Paul von Württemberg and joined the latter on a journey to Texas and the borders of Mexico. Later he accompanied the Director of the Copenhagen Museum, Kröger, on another trip to Mexico. At that time he started to collect on behalf of the Hungarian National Museum and to apply himself to the study of natural sciences. Other North American expeditions followed, and he made immense collections on behalf of the Smithsonian Institution in Washington, but did not forget the Budapest Museum. In 1861 he was granted an amnesty and returned to Hungary, where he was asked to arrange his collections. From 1862–64 Hungarian Consul in W. Mexico, but from 1864 onwards definitely settling in Budapest, organizing the Botanic Garden, and subsequently appointed Director of the Zoological Garden. In 1868 he joined an expedition to E. Asia in the 'Donau' and 'Friedrich' (*cf.* Wawra and E. Weiss), but left it at Yokohama and travelled on his own in the Malaysian region, returning home with rich zoological, botanical, and ethnographical collections in 1871.

Finally curator of the Ethnographical Museum in Budapest. Author of many papers, mainly dealing with birds.

Clarkia xantiana A. Gray was named after him.

Itinerary.[1] East Asia, *1868–71*, up to Yokohama with the expedition in the 'Donau' and 'Friedrich (*cf.* Wawra and Weiss), later alone, visiting: Ceylon, *Singapore*[2], Siam, Cochinchina, Hongkong, China, Japan, *Borneo* (*1870*, Sarawak and Brunei)[3], *N. Sumatra*, *Malaya* (and *Singapore*, *cf. sub* E. Weiss in Fl. Mal. 1), *Java*, *Luzon*.

Collections. From the Asia voyage he brought back seeds of 6223 species and 65000 herbarium sheets; in *Herb. Budapest*.

Literature. (1) *Cf.* Act. Bot. Ac. Sc. Hung. 1, 1955, p. 269 (map), 277.

(2) J. Xantus: 'Úti emlékeim Singapore és Ceylon vidékéről' (Travel reminiscences from the environs of Singapore and Ceylon) (Győri Közlöny, Győr 1879, Sep. 1–113) (*n.v.*).

(3) J. Xantus: 'Borneo szigetén 1870–ben tett utazäsomról' (On my visit to Borneo in 1870) Földrajzi Közlemények 1880, Sep. 1–67) (*n.v.*); *cf.* also Sarawak Mus. J. 7, 1957, p. 536.

Biographical data. C. von Wurzbach, Biogr. Lexicon Kaiserth. Oesterr. 59, 1890, p. 50–52; S. Mocsáry: 'Xántus János l.t. emlékezete (Memorial address on the member of the Academy J. Xantus) (Emlékbeszédek a M.T. Akad. tagjairól 9, *no* 9, 1899, p. 231–258, incl. bibliogr.) (*n.v.*); Act. Bot. Ac. Sc. Hung. 1, 1955, p. 299.

WYATT-SMITH

Yapp, Richard Henry
Biographical data. Add: J. Ecol. 17, 1929, p. 405–408 with portr.; Kew Bull. 1929, p. 140.

Yates, H. S.
Collecting Localities. *Sumatra East Coast:* G. Sibajak (early May *1922*).[8]

Literature. (8) A. W. Yates: 'Two botanists on Sibajak Volcano' (Madroño 1, 1923, p. 96–97).

***Yench**, J.
occasionally contributed some plants from *Luzon*, and in Sept. *1952* some plants from *Samar* to the P.N.H. series (*cf. sub* Philippine National Herbarium).

***Zee**, E. E. van der, *cf. sub* Boswezen Nieuw Guinea.

***Zeeuw,** C. de

or DE LEEUW?, Captain, later Major who in Sept. *1943* collected in the environs of Port Moresby and at Dobodura in *Papua;* > 45 *nos* in *Herb. Melbourne.*

***Zieck,** J. F. H.

COLLECTING LOCALITIES. *Borneo* and *West New Guinea.* Reconnaissance of the Prafi Plain, W. of Manokwari about *1952; cf. sub* Boswezen Nieuw Guinea.

Zollinger, H.

COLLECTIONS. In L'Institut de France, Paris, a MS list: 'Liste des plantes, recueillies à Java par M. ZOLLINGER, envoyées par M. MORITZI, juin 1846' is filed.

LITERATURE. (19) Add: C. E. B. BREMEKAMP: 'On two new Malesian Acanthaceae found among plants collected by Zollinger' (Svensk Bot. Tidskr. 43, 1949, p. 61–64).

Zschokke, T. C.

collected in *Luzon* as early as Sept. *1907.*

Zwaardemaker

plantation assistant, tea estate Kiara Pajoeng near Tjiandjoer.

SELECT INDEX

As in the Cyclopaedia, *a selection has been made of geographical names* (mostly islands, lakes, mountains, rivers).

Names of ships, expeditions, companies, etc., are included.

Names of persons have only been entered when mentioned outside their place in the alphabetically arranged list. As the additional data for the collectors of the Forest Research Institute at Bogor arrived only when the MS was already in the press, most of these collectors could not be entered separately in the alphabetical list, and consequently have been inserted in this index.

The abbreviations placed in italics behind the names are the following:

d = district (residency, province, or other administrative territory)
i = island(s)
l = lake
m = mountain
p = place
pen. = peninsula
r = river
s = ship

Reference. Reference to the Roman numerals indicating the official page numbers seemed impracticable. For this reason the Supplement has been provided with an additional parenthesized Arabian pagination at the bottom of the pages to which is referred in the index. The letters *a* and *b* following the page numbers indicate the left and right column respectively of the page.

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FLACOURTIACEAE (H. Sleumer, Leyden)

Trees or shrubs. *Leaves* spirally arranged or often distichous, sometimes crowded towards the top of the branchlets, simple, entire or crenate or serrate, crenations mostly glandular; petioles often thickened at the base and (or) the apex. Stipules small, rarely large and foliaceous, often early caducous, or wanting. *Inflorescences* subterminal or mostly axillary, sometimes on the old wood, in often spike-like racemes or in panicles or in short cymes, but sometimes condensed to glomerules or reduced to few-flowered fascicles or even to a solitary flower, apparently essentially cymose. *Flowers* bisexual or unisexual, in the latter case mostly dioecious, sometimes polygamous, actinomorphic, 3- to polymerous, cyclic (with sepals and petals) or rarely spiral (with perianth segments, in *trib. Oncobeae*). Pedicels often articulated near the base. *Sepals* 3–6, rarely more, mostly persistent, sometimes accrescent, imbricate or valvate, free or connate at the base into a calyx-tube, or calyx closed in bud and disrupting in different ways. *Petals* 3–8, rarely more, free, imbricate or valvate, mostly alternating with the sepals and caducous, sometimes persistent and accrescent, often inserted on the margin of a hypogynous or nearly perigynous disk, or absent. *Receptacle* often deepened in the centre, mostly with appendages such as an extrastaminal disk or disk-lobes, free glands between the stamens, or a corona of 5 phalanges, each of which is consisting of fine barbate threads, or staminode-like scales inserted on the inner side of the base of the petals, or with true, mostly barbate, staminodes. *Stamens* 5 to ∞, hypogynous, mostly free, rarely the filaments connate into a column; anthers with 2, longitudinally dehiscent cells; connective sometimes with a short appendage. *Ovary* mostly free, rarely semi-inferior, unilocular with (2–)3–5(–8) parietal placentas, sometimes incompletely 2–8-celled by the deeply protruding placentas; ovules 2 to numerous, anatropous. Styles 1–10, free or connate; stigma sessile. *Fruit* a fleshy or dry berry or a capsule, rarely a drupe, 1- to many-seeded. *Seeds* sometimes arillate, with abundant endosperm; embryo straight; cotyledons mostly broad, foliaceous.

Distr. About 84 genera with *c.* 1300 *spp.*, nearly all woody, predominantly in the tropics, rapidly decreasing in number towards the subtropics, 2 genera with a total of 9 (mostly Chilean) *spp.* in the temperate zones of S. America.

In *Malaysia* 19 genera, of which 4 are strictly endemic, *viz Eleutherandra*, *Pangium*, *Pseudosmelia*, and *Scaphocalyx*.

Eight others find their main area of distribution and generally their greatest number of species in Malaysia, but occur also in parts of SE. Asia, *viz Ahernia* (also reported from Hainan), *Bennettiodendron* (also in Assam, Indo-China, and S. China), *Hemiscolopia* (also in Annam and Cochinchina), *Hydnocarpus* (also in SE. Asia), *Itoa* (also in Indo-China and S. China), *Osmelia* (also in Ceylon), *Ryparosa* (also in Siam and the Andamans), *Trichadenia* (also in Ceylon).

Two genera, *viz Paropsia* and *Scolopia*, extend throughout the Old World tropics.

Flacourtia and *Erythrospermum* have a similar area, but extend further to the Pacific.

Xylosma is known from the American, the Australian-Pacific, and the Asiatic-Malaysian tropics, but is absent from Africa, while *Casearia* and *Homalium* are pantropical.

Flacourtiaceae of Malaysia thus show a very distinct alliance with SE. Asia. It is again remarkable that also in this family there are several genera or sets of allied species which occur both in W. Malaysia and in Ceylon, and have not yet been found in the proper continental Asiatic flora (*Hydnocarpus subsect. Pleianthera*, *Erythrospermum*, *Osmelia*, *Trichadenia*), a noteworthy phytogeographical peculiarity shared by genera of other families (*Acrotrema*, *Trichopus*, *etc.*).

Less distinct is the alliance with Australia. Australia is poor in *Flacourtiaceae*, having only representatives of the widely distributed genera *Xylosma*, *Homalium* and *Casearia*, and one endemic genus *Baileyoxylon* in Queensland, which is most closely allied to *Eleutherandra* from Sumatra and Borneo.

Ecol. Most Malaysian species occur in primary and secondary rain-forests. Their size is mostly small to moderate and the majority of the species belong to the substage of the forest. However, some species may grow to big dimensions, *e.g. Homalium foetidum.* Among the rain-forest species none is reported to be dominant in any vegetation type, though occasionally single species may be abundant, *e.g. Hydnocarpus ilicifolia.*

As to altitude most representatives are restricted to the tropical lowland, but some species of the genera *Casearia*, *Homalium*, and *Xylosma* seem to be confined to the montane zone and are even reported from the mossy forest.

As to climate, the bulk of the *Flacourtiaceae* occurs in the everwet area. Few species occur both in the everwet and seasonal (monsoon-) forest, *e.g. Flacourtia indica*, *Scolopia spinosa*, and *Casearia grewiaefolia*. Only one species, *viz Homalium tomentosum* is confined to the monsoon-forest and adapted to the alternatingly wet and dry climate; it sheds its leaves in the dry season.

A single species is found in the very coastal forest and even takes part in the *Barringtonia*-formation on the W. coast of the Malay Peninsula (*Hydnocarpus ilicifolia*). Some others prefer coastal swamp-forest, as *Flacourtia spp.* and *Scolopia macrophylla.*

Dispersal. Little is known about the dispersal of fruits or seeds of Malaysian *Flacourtiaceae.* Dispersal by air may be granted to the winged seeds of *Itoa.* In many species of *Homalium* the sepals and petals are accrescent and form a parachute after anthesis, in others the sepals and petals are densely beset with spreading hairs. This so-called feather-cock type, also found in African, Australian and specially in the Pacific species of *Homalium*, was interpreted by ASCHERSON (Sitzungsber. Ges. Naturfreunde Berlin Oct. 1880, p. 126–133, f. 1–3) as a medium of dispersal by wind of the whole capsule, which splits tardily and not completely from the apex. Fleshy fruits or fruits with (edible ?) pulp or arils are found in *Flacourtia*, *Hydnocarpus* and *Casearia*; such species may be dispersed by animals. Dispersal by water may be assumed for the buoyant seeds of *Pangium edule* which are frequently found in the beach-drift.

Galls. No galls specific for a distinct genus or species are hitherto known from Malaysian *Flacourtiaceae* [*cf.* DOCTERS VAN LEEUWEN, The Zoocecidia of the Netherlands East Indies (1926) 392; Ned. Kruidk. Arch. 51 (1941) 195].

Floral morphology. Numerous representatives of the family are dioecious or polygamous. The solitary flowers and the inflorescences are always axillary, although sometimes seemingly terminal. They are mostly cymose, rarely racemose (*Erythrospermum*). In the structure of the flowers a great variation is found in the number and form of the various floral organs and in their aestivation. Of special importance are the form, position and structure of the disk, respectively effigurations of the receptacle. The distinction of the tribes of the *Flacourtiaceae* is mainly based on these differences.

Wood anat. DEN BERGER, Determinatietabel van Malesië, Veenman, Wageningen (1949) on several pages; DEN BERGER, Bull. Jard. Bot. Btzg III, 9 (1927) 223 (hand lens); DESCH, Man. Malayan Timb., Mal. For. Rec. 15 (1941) 202; METCALFE & CHALK, Anat. Dic. 1 (1950) 121; MOLL & JANSSONIUS, Mikr. Holzes 1 (1906) 197 (*Bixineae*), idem 3 (1918) 604 (*Samydaceae*); PEARSON & BROWN, Comm. Timb. India 1 (1932) 36; REYES, Commonwealth Philip. Dept Agric. Techn. Bull. 7 (1938) 338: *Homalium foetidum* (ROXB.) BENTH. (*H. luzoniense* F.–VILL.) & 339: *Trichadenia philippinensis* MERR.

JANSSONIUS (Blumea 6, 1950, 415 & 432) points out that the wood structure indicates close relation to *Bridelia* and other *Euphorbiaceae* (*cf.* Mikr. Holzes 5, 1934, 464; JANSSONIUS, Key to Javanese woods, Brill, Leiden, 1952, 47; DEN BERGER, Bull. Jard. Bot. Btzg *l.c.* 231).

Wood anatomy and general anatomical characters suggest a single family: MOLL & JANSSONIUS, 3 (1918) 611; JANSSONIUS, Blumea 6 (1950) 416; METCALFE & CHALK, 1 (1950) 125. *Paropsia* is treated by METCALFE & CHALK as a *Passifloracea.*—C.A.R.–G.

Uses. Among Malaysian *Flacourtiaceae* various useful plants are found. As to important timbers, only *Homalium foetidum* (Ternataans ijzerhout, Ternate ironwood) is of some commercial value. *Flacourtia* and *Pangium* are wellknown for their edible fruits or seeds although the fruits of some species in other genera (*Scolopia*, *Ryparosa*, *etc.*) may also be edible or are used locally. The seeds of *Pangium* must be specially prepared to get rid of hydrocyanic acid. Most important is or has been the use of the chaulmoogra oil contained in the seeds of various species of *Hydnocarpus*, which has acquired medicinal fame for treating leprosy.

Taxonomy. The family as a whole is characterized by a combination of several more or less constant or predominant characters, *viz* receptacle (and/or base of the petals) with appendages, ovary 1-celled and superior, placentas parietal, ovules anatropous, endosperm copious, but no single character exists wherewith to distinguish *Flacourtiaceae* from other families or to recognize them in the field.

The separate tribes are more uniform and have often been treated as families in their own right, such as *Samydaceae* or *Homaliaceae* (*Homalium*, *Osmelia*, and *Casearia*), or, as in the case of the *Paropsieae*, as part of another family (*Passifloraceae*), an arrangement still maintained by HUTCHINSON (Fam. Fl. Pl. 1926) following BENTHAM & HOOKER (Genera Plantarum 1862). Part of the family has further been assigned to the *Bixaceae* in the wider sense.

The delimitation and subdivision of the family accepted here is based on that by EICHLER (Fl. Bras. 1871), followed by WARBURG in the first (1893) and GILG in the 2nd edition of the Pflanzenfamilien (1921).

Notes. *Flacourtiaceae* are often confounded with *Euphorbiaceae*, especially in the ♂ specimens and when stipules are present; ♀ specimens are then needed for proper identification. However, *Euphorbiaceae* have mostly an entire leaf-margin, have always a distinctly celled ovary and fruit, and have often latex. *Violaceae* (*Rinorea*) have also sometimes been confused with *Flacourtiaceae* in the herbarium, by the often striking similarity in leaf-characters; *Gestroa* Becc. (= *Erythrospermum*) was even originally assigned to *Violaceae*.

The most important precursory papers on Malaysian *Flacourtiaceae* were written by the late Dr D. F. van Slooten in his thesis entitled 'Bijdrage tot de kennis der Combretaceeën en Flacourtiaceeën van Nederlandsch-Indië' (Utrecht, 1919), henceforth cited as '*Bijdr. Flac.*', and in a later revision (Bull. Jard. Bot. Btzg III, 7, 1925, 291–421). Both papers are strictly confined to the material from territory occupied by the former Netherlands Indies. For *Hydnocarpus* (*incl. Taraktogenos*) a precursory monograph was written by myself in 1938 (Bot. Jahrb. 69: 1–94).

I am deeply indebted to Dr van Slooten for putting his additional manuscript notes at my disposal. Appreciation is due to Dr R. C. Bakhuizen van den Brink *Jr* for help in identifying some sheets wrongly assigned to the *Flacourtiaceae*. The beautiful set of photographs of living material I owe to Mr F. Huysmans and collaborators of Kebun Raya Indonesia, Bogor.

In connection with what is said about the floral variation in this family, it is essential for proper naming that collectors procure flowering material of both sexes and in addition ripe fruits.

KEY TO THE GENERA
(*based on sterile material*)

1. Leaves manifestly tripli- to quintuplinerved from the base.
  2. Upper lateral nerves numerous, trabecular, at right angles with the midrib . . . **7. Scaphocalyx**
  2. Upper lateral nerves mostly few, ± curved-ascending towards the margin, at ± acute angles with the midrib.
    3. Leaves with 2 manifest, ± prominent glands at the base or at the apex of the petiole.
      4. Unarmed . . . . **1. Ahernia**
      4. Spines usually present both on the trunk and the branchlets . . . . . . **3. Scolopia** (partly)
    3. Leaves without basal or petiolar glands.
      5. Leaves manifestly distichous . . . . **17. Osmelia** (partly)
      5. Leaves spirally arranged and crowded towards the apex of the branchlets.
        6. Leaves broadly ovate (3-lobed on saplings and suckers). Petiole 7–30(–50) cm. . . **8. Pangium**
        6. Leaves elliptic to elliptic-oblong. Petiole 3–8 cm . . . . **9. Trichadenia**
1. Leaves penninerved or nearly so.
  7. Leaves distinctly crowded towards the top of the branchlets.
    8. Shoots without perular terminal buds. Leaves ovate to oblong-ovate, broadly truncate to subcordate at the base. Petiole not corky at the apex . . . . **4. Itoa**
    8. Shoots with perular terminal buds. Leaves obovate-oblong or oblong-elliptic, attenuate at the base. Petiole at the swollen apex very soon covered with greyish cork . . . . **13. Bennettiodendron**
  7. Leaves ± distichous or scattered along the branchlets.
    9. Leaves with 2 distinct basal or petiolar glands . . . . **3. Scolopia** (partly)
    9. Leaves without distinct basal glands.
      10. Leaves characteristically dull greyish-greenish beneath, finely papillose or nearly punctulate under a lens, hairs, if present, (sometimes minute!) bifurcate, normally with two unequal branches. **10. Ryparosa**
      10. Leaves not so typically dull greyish beneath, hairs, if present, simple or stellate.
        11. Leaves with pellucid dots and/or lines . . . . **19. Casearia** (partly)
        11. Leaves not with pellucid dots or lines.
          12. Armed . . . . **3. Scolopia** (partly)
          14. Hemiscolopia (partly)
          15. Xylosma (partly)
          16. Flacourtia (partly)
          12. Unarmed.
            13. Stipules within the leaf-axils or not visible (not present or very early caducous).
            2. Erythrospermum
            3. Scolopia (partly)
            5. Paropsia (partly)
            6. Hydnocarpus (partly)
            11. Eleutherandra
            12. Homalium (partly)
            14. Hemiscolopia (partly)
            15. Xylosma (partly)
            16. Flacourtia (partly)
            17. Osmelia (partly)
            18. Pseudosmelia (partly)
            19. Casearia (partly)
            13. Stipules extra-axillary, subulate to foliaceous, at least present at the ultimate nodes.
            5. Paropsia (partly)
            6. Hydnocarpus (partly)

12. **Homalium** (partly)
17. **Osmelia** (partly)
18. **Pseudosmelia** (partly)
19. **Casearia** (partly)

ARTIFICIAL KEY TO THE GENERA
(based on leaves, flowers, and fruits)

1. Flowers bisexual or seemingly so (*Osmelia*), never polygamous.
2. Leaves with 2 distinct glands at the very base of the blade or on the apex of the petiole.
3. Sepals (4–5) and petals (10–15) distinct in size, sepals 10 by 6 mm, petals gradually decreasing in size to the centre. Capsule with crustaceous pericarp . . . . **1. Ahernia**
3. Sepals and petals (3–)4–6, similar in size and shape, hardly or not exceeding 4 mm in length. Berry succulent . . . . **3. Scolopia** (partly)
2. Leaves without 2 distinct basal glands.
4. Ovary or capsule free only in the upper part, connate with the calyx at least in the lower half. Capsule small, dry and few-seeded . . . . **12. Homalium**
4. Ovary or fruit entirely free.
5. Receptacle without disk-glands, petals without basal appendage (scale-like to petaloid) inside.
6. Flowers in elongate spike-like racemes. Stamens 5. Capsule covered with numerous small tubercles, splitting tardily into 2–4 valves . . . . **2. Erythrospermum**
6. Flowers in short few-flowered racemes or in clusters. Stamens ∞. Berry smooth. **3. Scolopia** (partly)
5. Receptacle or petals with appendages or excrescences.
7. Appendages represented by 5 phalanges, each consisting of fine densely barbate threads. Stamens 5 . . . . **5. Paropsia**
7. Appendages otherwise. Stamens 6 or more.
8. Stamens ∞. Appendages represented by a sometimes minute disk, mostly divided into ± free, short, fleshy, glabrous glands, rarely entire.
9. Style simple . . . . **3. Scolopia** (partly)
9. Styles 4–5, free or united in the lower part . . . . **16. Flacourtia** (partly)
8. Stamens (6–)8–10(–12). Appendages represented by sometimes very short, flat or thick, mostly densely hairy staminodes.
10. Flowers in spike-like racemes, sometimes composed to panicles. Leaves not pellucid-punctate.
11. Staminodes rather flat. Capsule 1–3-seeded . . . . **17. Osmelia**
11. Staminodes thick, truncate. Capsule 25–30-seeded . . . . **18. Pseudosmelia**
10. Flowers in clusters. Leaves mostly with pellucid dots and/or lines . . . . **19. Casearia**
1. Flowers unisexual and/or polygamous. Plants usually dioecious (or functionally so: *Osmelia*), occasionally monoecious (*Hydnocarpus castanea*, *Erythrospermum candidum*).
12. Flowers numerous, in elongate spike-like racemes or panicles.
13. Panicles divaricate . . . . **13. Bennettiodendron**
13. Racemes spike-like.
14. Receptacle without appendages . . . . **2. Erythrospermum**
14. Receptacle with appendages.
15. Appendages represented by a petaloid or thick and mostly hairy scale attached to the inner base of each petal.
16. Filaments united into a column . . . . **10. Ryparosa** (partly)
16. Filaments free.
17. Stamens 4 . . . . **10. Ryparosa** (partly)
17. Stamens 5 or more.
18. Calyx considerable, covering the petals in bud.
19. Calyx-lobes imbricate . . . . **6. Hydnocarpus**
19. Calyx closed in bud, disrupting irregularly, or calyx-lobes valvate . . . **9. Trichadenia**
18. Calyx very small, covering the petals in bud only at their very base . . **11. Eleutherandra**
15. Appendages represented by thick, deeply bifid, hairy scales alternating with the stamens. Petals 0 . . . . **17. Osmelia**
12. Flowers rather few, in short racemes or in clusters, or solitary.
20. Leaves manifestly triplinerved, main nerves ascending from the base to the apex, connected with the midrib by numerous transverse, ladder-like nerves . . . . **7. Scaphocalyx**
20. Leaves 3- to 5-nerved at the base, but basal nerves never reaching the leaf-apex, or penninerved.
21. Appendages of the receptacle absent. Capsule lignescent, splitting tardily from the apex in (5–)6–8 valves . . . . **4. Itoa**
21. Appendages present. Fruit with a hard shell, indehiscent, or a berry.
22. Appendages represented by petaloid or thick, mostly hairy scales attached to each petal inside at its base. Fruit a capsule.
23. Calyx-lobes imbricate . . . . **6. Hydnocarpus**

23. Calyx closed in bud, disrupting into 2–4 unequal, reflexed segments . . . . . . 8. **Pangium**
22. Appendages glabrous, represented by an entire disk or short disk-lobes.
24. Style simple, sometimes very short or wanting.
25. Style rather long, stigma very shortly trilobed. Berry *c.* 2 cm long . . 14. **Hemiscolopia**
25. Stigmas 2, rarely 3 or 4, rather large and reflexed, sessile or on a short columnar style. Berry relatively small . . . . 15. **Xylosma**
24. Styles 3–8, free or partly united into a column, each with 2 minute stigmas. 16. **Flacourtia** (partly)

SCIENTIFIC KEY TO THE GENERA

1. Perianth segments spirally arranged, variable in number (7–20); no sharp distinction between sepals and petals, the inner ones gradually smaller. Flowers bisexual (in *Erythrospermum* sometimes polygamous). Receptacle without appendages (ONCOBEAE).
2. Stamens indefinite, inserted before the petals and inner sepals . . . . 1. **Ahernia**
2. Stamens 5 (Mal. *spp.*) . . . . 2. **Erythrospermum**
1. Sepals and petals distinct, cyclic, number of sepals in a fixed relation to the number of petals, or, if petals absent, sepals (respectively calyx segments) ± equal in size and shape, not exceeding 6.
3. Receptacle without appendages.
4. Flowers bisexual. Sepals and petals relatively small and much alike. Fruit a small, 1–6-seeded berry (SCOLOPIEAE-SCOLOPIINAE) . . . . 3. **Scolopia** (partly)
4. Flowers unisexual. Sepals relatively large. Petals 0. Fruit a large, woody capsule with ∞ flat, membranously winged seeds (FLACOURTIEAE-IDESIINAE) . . . . 4. **Itoa**
3. Receptacle with various appendages or excrescences (corona, scales, a sometimes very small disk or disk-lobes, pseudo-staminodes).
5. Receptacle with a corona, consisting of 5 phalanges, each of which consists of fine, densely barbate threads. Flowers bisexual (PAROPSIEAE) . . . . 5. **Paropsia**
5. Receptacle with appendages of another kind.
6. Petals provided inside at the base with a thin to fleshy, mostly densely haired scale. Plants unisexual or polygamo-dioecious (PANGIEAE-HYDNOCARPINAE).
7. Sepals conspicuous, entirely including the petals in bud.
8. Sepals free, imbricate. ♂ Flowers in small cymes or cyme-like inflorescences, very rarely in few-flowered fascicles or solitary . . . . 6. **Hydnocarpus**
8. Sepals closed in bud, disrupting irregularly from the apex or throwing off an irregular calyptra leaving an irregularly toothed, cup-shaped calyx-tube.
9. ♂ Flowers solitary or in few-flowered fascicles, with long, very slender pedicels. Calyx spathaceous, reflexed in anthesis . . . . 7. **Scaphocalyx**
9. ♂ Flowers in, sometimes spike-like, racemes, with rather short pedicels.
10. ♂ Flowers with numerous stamens; filaments flattened. Calyx-lobes 2–3, reflexed, deciduous. 8. **Pangium**
10. ♂ Flowers with (4–)5 stamens; filaments filiform. Calyx-lobes ± persistent, reflexed in anthesis.
11. Filaments free. Leaves tufted at the twig-ends. Hairs simple or stellate . . 9. **Trichadenia**
11. Filaments normally connate into a column. Leaves not tufted at the twig-ends. Hairs if present 2-armed, arms unequal . . . . 10. **Ryparosa**
7. Sepals very small, united at the base only, not including the petals in bud. Racemes spike-like. Stamens 5; filaments free, filiform . . . . 11. **Eleutherandra**
6. Petals without inner basal scale or absent.
12. Receptacle with a disk which may be entire, lobed or divided into free, sometimes rather small, glands arranged either extra-staminal or inserted between the irregularly arranged stamens, hence not forming one whorl with these, or disk absent. Petals present or absent.
13. Petals present, petals and sepals usually resembling each other. Flowers bisexual.
14. Flowers in ± elongate, spike-like racemes or panicles. Stamens single or in groups of 2–12 opposite each petal. Capsule small, few-seeded (HOMALIEAE) . . . . . 12. **Homalium**
14. Flowers in short racemes, these rarely reduced to few-flowered fascicles or a solitary flower. Stamens numerous, irregularly arranged on the receptacle. Berry 1–6-seeded (SCOLOPIEAE-SCOLOPIINAE) . . . . 3. **Scolopia** (partly)
13. Petals absent. Flowers mostly unisexual, bisexual only in some *spp.* of *Flacourtia* (FLACOURTIEAE-FLACOURTIINAE).
15. Flowers in large panicles, the ♂ with rudimentary ovary. Disk-lobes between the lanate filaments. Berry dry, 1(–2–4)-seeded . . . . 13. **Bennettiodendron**
15. Flowers in short racemes or fascicles. Disk or disk-lobes outside the glabrous or slightly pilose filaments.
16. ♂ Flowers with a trigonous glabrous rudimentary ovary. ♀ Flowers with a single row of antherless staminodes between the ovary and the disk-lobes. Ovary 1-celled. Style simple, very shortly 3-lobed. Berry ovoid, *c.* 2 cm long, many-seeded . . . 14. **Hemiscolopia**

16. ♂ Flowers without a rudimentary ovary. ♀ Flowers not with stamens or staminodes, *Flacourtia inermis* and *F. zippelii* excepted.

17. Ovary 1-celled. Style short or very short, with 2, rarely 3 or 4, sessile stigmas. Berry relatively small, globose to elliptic both in the fresh and dry states, mostly few-seeded.[1] **15. Xylosma**

17. Ovary (2–)4–8-celled by ± imperfect, false septa. Styles 3–8, free, inserted in the centre or distinctly in an apical ring, or ± united into a column. Fruit drupe-like, mostly considerable in size, edible, globose when fresh, but characteristically cubiform when dry, (2–)4–6(–8)-celled by hard endocarps, each normally with 2 pyrenes disposed one above the other.[1] **16. Flacourtia**

12. Receptacle with staminode-like, usually densely hairy, erect, mostly clavate appendages, strictly alternating with the stamens in one whorl (in Mal. *spp.*). Petals always absent (CASEARIEAE).

18. Flowers in axillary or subterminal spike-like racemes or panicles, unisexual or functionally so. Styles 3, shortly bilobed.

19. Staminodes rather flat. Capsule 1–3-seeded . . . . **17. Osmelia**

19. Staminodes thick, truncate. Capsule 25–30-seeded . . . . **18. Pseudosmelia**

18. Flowers in axillary clusters, bisexual. Style (in Mal. *spp.*) simple. Leaves mostly with pellucid dots or lines . . . . **19. Casearia**

1. AHERNIA

MERR. Philip. J. Sc. 4 (1909) Bot. 295.

Tree. *Leaves* alternate, 5-plinerved, with 2 basal glands. Stipules 0. *Flowers* bisexual, in solitary, axillary racemes. *Outer perianth segments* 4(–5), imbricate, the outer 2 or 3 free, the inner 2 or 3 ± united at the base with the inner perianth segments. *Inner perianth segments* 10–15, very similar to the outer ones, gradually narrowing, all spirally arranged. *Stamens* ∞, inserted on the base of the inner and some outer perianth segments; filaments filiform, elongate; anthers minute. *Ovary* unilocular; placentas 5, each with many ovules. Style simple; stigma minute, obscurely 3-lobed or nearly disciform. *Fruit* capsular, indehiscent, ∞-seeded, with crustaceous pericarp.

Distr. Monotypic, Hainan and the Philippines (Luzon).

1. **Ahernia glandulosa** MERR. Philip. J. Sc. 4 (1909) Bot. 295; En. Philip. 3 (1923) 107; Lingn. Sc. J. 6 (1930) 283.

Tree 8–15 m, glabrous except the inflorescence and fruits; branches terete, brownish-gray, obscurely lenticellate. *Leaves* ovate or oblong-ovate, chartaceous, 9–15 by 4–8 cm, shining on both sides, entire or shallowly crenate towards the top, the apex rather abruptly acuminate, the base ± rounded and with 2 glands either on the margins at the junction with the petiole or on the petiole itself; basal nerves 5, ascending, prominent; petiole 2½–4½ cm. *Racemes* few-flowered, 2½–3½ cm, in fruit somewhat longer, densely grey-pubescent. Pedicels 5–8 mm, longer in fruit. *Outer perianth segments* ovate, acute, 10 by 6 mm, densely pubescent outside. *Inner perianth segments* on both sides densely grey-pubescent, with brown dots, the innermost only 1–1½ mm wide. Filaments 10 mm; anthers less than ½ mm. *Ovary* densely grey-pubescent, slightly stipitate, ovoid. Style glabrous or slightly pubescent at the base, 2–4 mm. *Fruit* obovoid to elliptic, 1½–2¼ by 1–1¾ cm, apiculate, pale green when fresh, densely grey-pubescent, grooved longitudinally specially towards the apex; pericarp 1½–3 mm, green; endocarp white. *Seeds* pale green; black when dry, obovoid, drop-shaped, shining, 8 by 4 mm; testa crustaceous; albumen fleshy.

Distr. Hainan, in *Malaysia:* Philippines (Luzon).

Ecol. In primary forests up to 600 m. *Fl. fr.* Jan.–Dec.

Vern. *Butun, sanglai*, Tag..

2. ERYTHROSPERMUM

LAMK, Tabl. Encycl. 2 (1791) 407, t. 274.—*Gestroa* BECC. Malesia 1 (1877) 184.

Small trees or subscandent shrubs. *Leaves* alternate (in Mal. *spp.*). Stipules absent. *Racemes* simple or panicled, axillary and subterminal. Pedicels articulated at the base, subtended by a scale-like bract and provided with 2 minute bracteoles.

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(1) There are no reliable differences between *Xylosma* and *Flacourtia* vegetatively and in the ♂ sex.

Flowerss, mall fragrant, bisexual, sometimes polygamous *i.e.* the lower ones ♂ only with rudimentary ovary. *Perianth segments* 7–13, imbricate, concave, glabrous, spirally arranged, the inner ones gradually decrescent and petal-like, all reflexed and caducous. *Stamens* 5 (in Mal. *spp.*); filaments glabrous; anthers broadly or lanceolate-sagittate, nearly as long as the filaments, connective broadened at the base. *Ovary* unilocular, with 3(–4), mostly many-ovulate placentas. Style thick, very short; stigma entire or 2–4-lobed. *Capsule* coriaceous, nearly globose, apiculate, rather small, rough, 3(–4)-valved or semidehiscent, splitting tardily. *Seeds* 1–6, provided with a scarlet, fleshy aril, flattened from mutual pressure; testa firm.

Distr. About 5 *spp.*, 2 from Madagascar and the Mascarenes, one of them polymorphous, 1 in Ceylon, 1 in Polynesia (Samoa & Fiji), and 1 in *Malaysia*. Fig. 1.

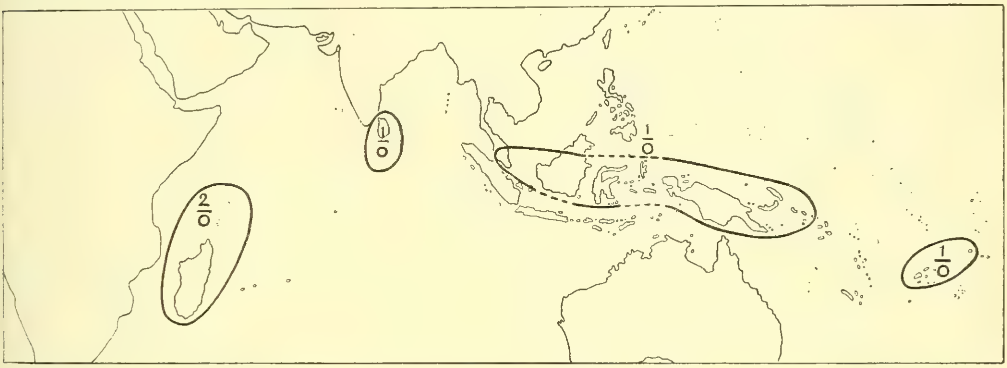

Fig. 1. Distribution of *Erythrospermum*. The figure above the hyphen indicates the number of endemic species, the figure below it the number of non-endemic species.

1. Erythrospermum candidum (BECC.) BECC. in GIBBS, Arfak (1917) 215; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 397, f. 168.—*Gestroa candida* BECC. Malesia 1 (1877) 184.—*E. scortechinii* KING, J. As. Soc. Beng. 59, ii (1890) 116; RIDL. Fl. Mal. Pen. 1 (1922) 157; *ibid.* 5 (1925) 290.—*E. wichmannii* VAL. Bull. Dép. Agr. Ind. Néerl. *no* 10 (1907) 34; Ic. Bog. 3 (1908) t. 264; PULLE, Nova Guinea 8 (1912) 671; GILG, Bot. Jahrb. 55 (1918) 274, f. 1; SLOOT. Bijdr. Flac. (1919) 61; Nova Guinea 14 (1924) 190; Bull. Jard. Bot. Btzg III, 7 (1925) 295; WHITE, J. Arn. Arb. 10 (1929) 243.

Shrub or (slender) tree, 4–25(–35) m; bark grey to brownish, with oblong, pustular, transverse lenticels; branchlets glabrous. *Leaves* obovate-oblong or oblong-elliptic, shortly acuminate, cuneate at the base, glabrous, shining and dark bluish-green above, chartaceous to subcoriaceous, 12–20(–26) by (3–)5–8(–11) cm, entire or slightly crenate, especially towards the apex; lateral nerves arcuate-ascending, 5–8(–10) pairs, little prominent; petiole stout, sulcate, (1–)$1\frac{1}{2}$–2 cm. *Racemes* axillary or subterminal, interrupted, 5–8 cm. *Flowers* solitary or 2–3 in fascicles along the rhachis, white, scented like jasmin; pedicels 2–4 mm during anthesis, afterwards accrescent up to 8 mm. Outer perianth segments 5, suborbicular, ciliate, (2–)3 mm. Inner perianth lobes 5, elliptic, as long as but somewhat narrower than the sepals, fimbriate at the apex. *Stamens* 5; filaments very short, white; anthers sagittate, yellow; connective white. *Ovary* constricted at the base, yellow, attenuate into a 1 mm long style; stigmas 3, slightly divergent. *Fruit* with style-rudiment, stalked, subglobose or subangular, with a woody (± 2 mm thick), finely verrucose pericarp, glabrous, pale green or whitish when ripe, $1\frac{1}{4}$–$1\frac{3}{4}$ by *c.* $1\frac{1}{2}$ cm, dehiscing from the top into 2–3 valves, red or violet-coloured inside. *Seeds* (1–)2–3, trigonous, roundish at the margins, dorsally convex, flat on the other 2 sides.

Distr. Solomons (San Cristobal & Florida Isl.), in *Malaysia:* Malay Peninsula (Perak, Negri Sembilan, apparently very rare), E. Borneo (N of Balikpapan), SW. Celebes (Pangkadjene), Moluccas (Misool), New Guinea.

Ecol. Apparently rather frequent but scattered in N. New Guinea, in primary forest on flat or hilly, never inundated, alluvial land with a clayey or sandy soil, 10–75 m, rarely up to 500 m (in San Cristobal up to 800 m). *Fl. fr.* Jan.–Dec.

Uses. Wood pale, sapwood not defined.

Vern. Borneo: *Mĕdang bĕrunai*; New Guinea: *mbren*, *sagobuatemeru*, *wobrijka*, *bembrok*, *m'béb*, *bokom*, *mana*, *efetra*, *sabao*, *kosy*; *auduma*, Aitape.

Note. The specimens from the Malay Peninsula differ slightly from the others by outer perianth segments only 2 mm, fruit stalks more slender, and less coriaceous leaves in which the nerves are emitted at about right angles from the midrib.

3. SCOLOPIA

SCHREB. Gen. 1 (1789) 335, *nom. cons.*—*Aembilla* ADANS. Fam. 2 (1763) 448, *nom. rej.*—*Phoberos* LOUR. Fl. Cochinch. (1790) 317.—*Rhinanthera* BL. Bijdr. (1826) 1121.—*Dasianthera* PRESL, Rel. Haenk. 2 (1835) 90, t. 66.—*Rhamnicastrum* [LINNÉ, Fl. Zeyl. (1747) 193] O. KTZE, Rev. Gen. 1 (1891) 45.—**Fig. 2–3.**

Small trees or shrubs, often with spines on the trunk, and (or) the branches. *Leaves* alternate, entire to shallowly serrate or crenate, ± coriaceous, glabrous, pinnately nerved, sometimes with 2 distinct glands (hydathodes) at the very base of the blade or at the apex of the petiole. Stipules in the leaf-axils minute, early caducous. *Flowers* rather small, bisexual, in axillary, mostly simple racemes sometimes reduced to few-flowered fascicles or to a solitary flower. *Sepals* (3–)4–6, imbricate, expanded a long time before anthesis, ± connate at the base. Petals as many as sepals, similar in shape. *Stamens* indefinite, whether or not surrounded by a row of free, short, orange glands; these mostly 2 opposite each petal, rarely forming a continuous disk, inserted on the tomentose receptacle, downwards-incurved in bud, longer than petals; anthers elliptic-ovoid, dorsifixed, the connective produced into an apiculate appendage beyond the thecae in all Mal. *spp.*. *Ovary* sessile, unilocular, with 2–4, few-ovuled, deeply penetrating placentas. Style rather long, ± persistent; stigma entire or slightly 2-lobed. *Berry* (1–)2–3(–6), very rarely up to 20-seeded, somewhat fleshy, with the sepals, petals and the withered stamens at the base.

Distr. About 40 *spp.* from tropical and subtropical Africa, India, and SE. Asia, through *Malaysia* (7 *spp.*) to Queensland and N.S. Wales.

Ecol. In primary and secondary forests at low and medium altitudes, mostly scattered.

KEY TO THE SPECIES

1. Leaves (all or at least most of them on the same twig) with 2 distinct orange (when dry blackish), secretory glands at the very base of the blade or at the apex of the petiole. Spines on trunk and branches usually present.
  2. Nerves 6–8 pairs, not or little prominent beneath. Rhachis and pedicels coarsely ferrugineous-tomentose. Sepals and petals 4(–5–6), equal to each other, only the former connate at their bases. Connective glabrous. Disk-glands 8(–12). Spines simple . . . . **1. S. macrophylla**
  2. Nerves 4–6 pairs, slightly though distinctly prominent beneath. Rhachis and pedicels ± densely finely greyish-yellowish pubescent. Sepals and petals 5–6, differing somewhat from each other in shape and size, all connate. Connectives ± hairy.
    3. Disk-glands 10 or more. Leaves elliptic to orbicular- or oblong-elliptic, obtuse (nearly rounded) or slightly acuminate at apex, densely reticulate on both sides. Fruit broadly ovoid, ± rounded at the top . . . . **2. S. chinensis**
    3. Disk-glands absent. Leaves ovate to oblong- (rarely lanceolate-)ovate, ± long acuminate but obtuse at the tip, veins ± obscure. Fruit elliptic, slightly attenuate . . . . **3. S. spinosa**
1. Leaves without distinct glands at the base of the blade or at the apex of the petiole, at most sometimes with one or two small glands on descending dentations on the leaf-margin near the insertion of the petiole. Plants usually unarmed.
  4. Disk-glands absent. Racemes conspicuous, 2–4½(–8) cm long. Leaves variable in size and shape, mostly shortly acuminate but blunt at the tip, distinctly crenate-serrate . . . **4. S. luzonensis**
  4. Disk-glands 6(–8), short, truncate, sometimes rather minute, but always distinct. Racemes very short, 2–5 mm long, 2–6-flowered, or reduced to a solitary flower.
    5. Leaves elliptic, 1½–2¼(–2¾) by 0.9–1.4(–1.6) cm . . . . **5. S. novo-guineensis**
    5. Leaves oblong to ovate-oblong, rarely obovate-oblong, 3–5 by 1½–2½(–3) cm . . **6. S. nitida**

1. Scolopia macrophylla (W. & A.) CLOS, Ann. Sc. Nat. IV, 8 (1857) 253.—*Phoberos macrophylla* W. & A. Prod. (1834) 30.—*Ph. rhinanthera* BENN. & BR. Pl. Jav. Rar. (1840) 187, t. 39.—*Rhinanthera blumei* STEUD. Nom. ed. 2 (1840) 448.—*Ph. maritima* MIQ. Fl. Ind. Bat. Suppl. (1860) 388.

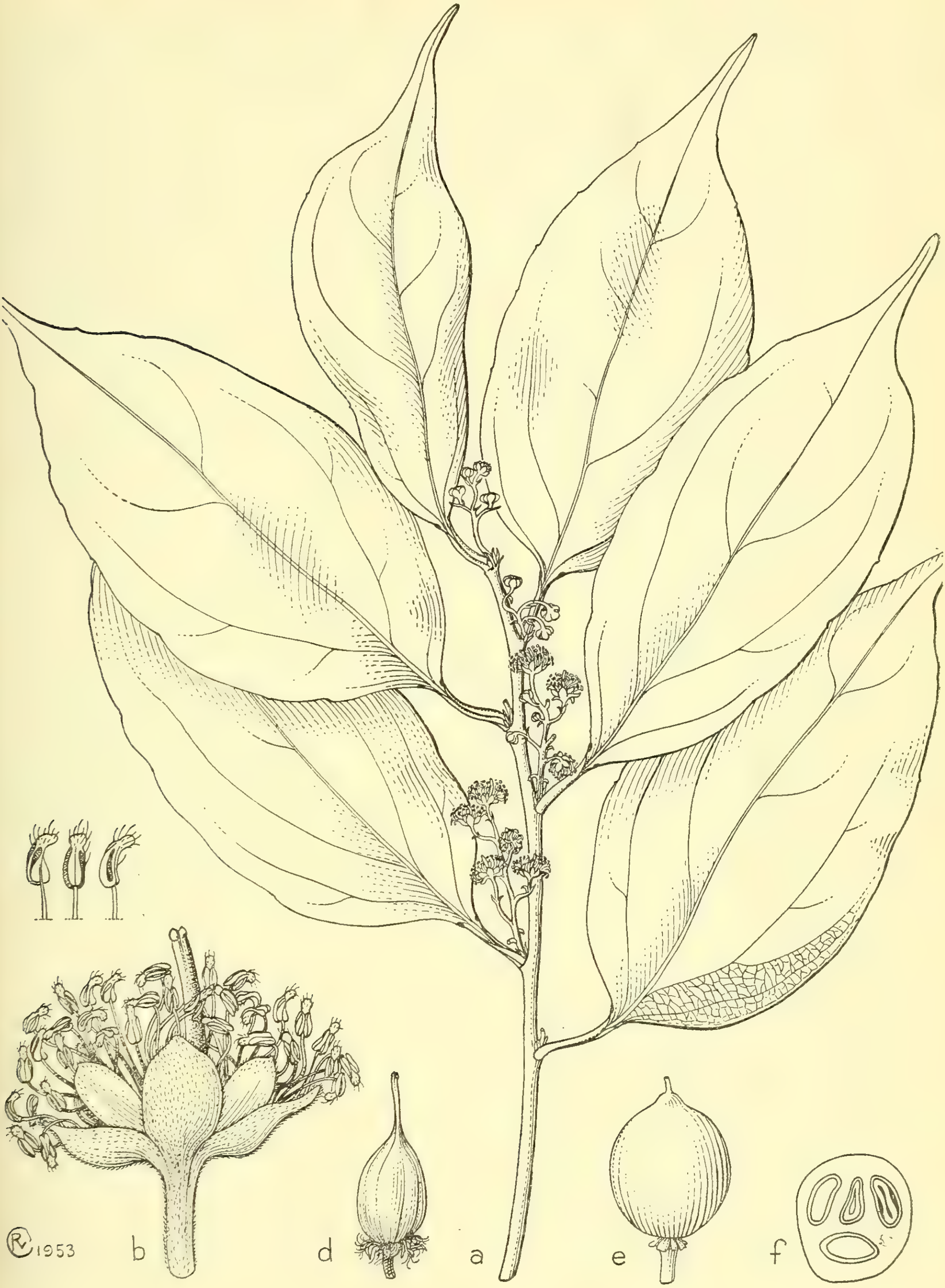

Fig. 2. *Scolopia spinosa* (ROXB.) WARB. *a*. Flowering twig, × 2/3, *b*. flower, × 6, *c*. stamens, × 7, *d*. developed ovary, subtended by the rests of the stamens and perianth, × 1 1/2, *e*. fruit, × 2 3, *f*. fruit cross-section, × 2/3 (*b* after WINCKEL 262).

—*S. rhinanthera* CLOS, Ann. Sc. Nat. IV, 8 (1857) 252; MIQ. Fl. Ind. Bat. 1 (1859) 107; HOOK. *f.* & TH. Fl. Br. Ind. 1 (1872) 190; KING, J. As. Soc. Beng. 59, ii (1890) 114; BRIQ. Ann. Cons. Jard. Bot. Genève 2 (1898) 46; K. & V. Bijdr. Booms. 5 (1900) 17; BACK. Fl. Bat. 1 (1907) 64; Voorl. Schoolfl. Java (1908) 15; Schoolfl. Java (1911) 70; KOORD. Exkfl. Java 2 (1912) 632; SLOOT. Bijdr. Flac. (1919) 94; MERR. En. Born. (1921) 411; RIDL. Fl. Mal. Pen. 1 (1922) 155, f. 17; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 336; BURK. Dict. (1935) 1983; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 84, p. 6; CORNER, Wayside Trees (1951) 309.—*S. rhinanthera var. siamensis* CRAIB, Kew Bull. (1922) 235.—*S. crenata* [*non* (WALL.) CLOS] KING, J. As. Soc. Beng. 59, ii (1890) 115.—*Rhamnicastrum rhinanthera* O. KTZE, Rev. Gen. 1 (1891) 45.—*S. maritima* WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 29.

Shrub or small tree 2–6(–10) m; trunk with unbranched, spirally arranged thorns $2^1/_2$–$7^1/_2$ cm; young branches not rarely with axillary, simple spines 1–3 cm. *Leaves* ovate or ovate-elliptic to ovate-lanceolate, tapering to the acute apex, mostly rounded at the base, thinly coriaceous, hard, purplish or brownish when young, glabrous, shining above, ± crenate round the edge, 6–12 (–16) by ($2^1/_2$–)4–6(–8) cm; lateral nerves ascending, rather yellowish-green, reticulations distinct; petiole (0.6–)1–1.8 cm, reddish-pink with 2 black glands at the top on the upper side. *Racemes* axillary and terminal, 3–10 cm, *c.* 20-flowered. *Flowers* greenish-white, slightly fragrant. Pedicels 4–10 mm. *Sepals* (greenish) and *petals* (greenish- or yellowish-white) ovate-lanceolate, the former ferrugineous-tomentose, the latter ciliate but glabrous outside, 3–4 mm. Stamens white. *Ovary* and style commonly flushed dull crimson. *Berry* ovoid, pointed by the persistent rest of style, orange, blackish when dry, *c.* 2 by 0.8 cm, sometimes smaller, with (1–)2–6 seeds.

Distr. Cambodia, Cochinchina, S. Siam, in *Malaysia:* Sumatra (also Mentawei Isl.), Malay Peninsula, Java (Djakarta, Semarang, Madiun), Borneo.

Ecol. In humid or marshy soil at the back of mangrove forests or more inland on riversides, by swampy creeks, at margins of pools, along marsh in teak-forest, mostly on temporarily inundated soils, usually between 0–15 m, rarely up to 90–150 m, near Toba Lake (Sumatra) at 900 m. The localities are wide apart, but the species is sometimes locally comparatively common *e.g.* in the Malay Peninsula. *Fl.* Oct.–Aug.

Uses. Wood heavy (sinks in water), reddish-brown, used for house-building in Malacca.

Vern. Mal. Pen.: *Pokok rukam gajah, p.r. puteh, p.r. hutan*; *rukam* (Penang); *damak-damak tahun* (Malacca); Java: *marong*; Sumatra: *rukĕm, r. laut, r. bĕtina*; *api* (Bencoolen); Borneo: *rukam laka* (N. Born.), *bĕlangan* (SE. Born.).

2. Scolopia chinensis (LOUR.) CLOS, Ann. Sc. Nat. IV, 8 (1857) 249; BACK. Fl. Bat. 1 (1907) 65; Voorl. Schoolfl. Java (1908) 15; Schoolfl. Java (1911) 70; SLOOT. Bijdr. Flac. (1919) 99; Bull. Jard. Bot. Btzg III, 7 (1925) 340; MERR. Comm. Lour. (1935) 272; GAGNEP. Fl. Gén. I.C. Suppl. 1 (1939) 209; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 84, p. 6.—*Phoberos chinensis* LOUR. Fl. Cochinch. (1790) 318.—*S. siamensis* WARB. in FEDDE, Rep. 16 (1919) 255.

Small tree 4–5 m, or mostly shrub 1–2 m; branches and branchlets usually with strong, simple spines 1–5 cm. *Leaves* widely cuneate or nearly rounded at the base, coriaceous, glabrous, shining above, dull beneath, 3–7(–10) by 2–$4^1/_2$ cm, entire or nearly so, rarely serrate; petiole 3–5(–8) mm. *Racemes* 2–3(–6) cm, few-flowered, often ± panicled at the tops of the branches. Pedicels 4–5(–10) mm. *Sepals* ovate, yellowish-white, ± 2 mm, dorsally somewhat tomentose. *Petals* nearly glabrous, yellowish-white, $2^1/_2$–3 mm. *Berry* 8–10 mm.

Distr. Native in Indo-China, S. China, Hainan, Siam, cultivated in India, Ceylon and in *Malaysia:* Java (vicinity of Djakarta, introduced there by the Chinese long ago; once found in W. Java in cemetery-grove between Merak and Bantam), possibly elsewhere cultivated through Malaysia. *Fl.* Dec.–Jan.; *fr.* Oct.

3. Scolopia spinosa (ROXB.) WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 29; MERR. En. Philip. 3 (1923) 110; Pl. Elm. Born. (1929) 209; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 338; HEYNE, Nutt. Pl. (1927) 1139; BURK. Dict. (1935) 1983; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 84, p. 6.—*Ludia spinosa* ROXB. [Hort. Beng. (1814) 38, *nomen*] Fl. Ind. ed. CAREY 2 (1832) 507.—*Phoberos roxburghii* BENN. Pl. Jav. Rar. (1840) 192; MIQ. Fl. Ind. Bat. Suppl. (1860) 388.—*S. roxburghii* CLOS, Ann. Sc. Nat. IV, 8 (1857) 250; MIQ. Fl. Ind. Bat. I, 2 (1858) 107; KING, J. As. Soc. Beng. 59, ii (1890) 115; BOERL. Cat. Hort. Bot. Bog. 1 (1899) 53, *incl. var. ovata* and *var. lamponga* BOERL.; K. & V. Bijdr. Booms. 5 (1900) 14; RIDL. J. Str. Br. R. As. Soc. 59 (1911) 72; BACK. Schoolfl. Java (1911) 70; KOORD. Exkfl. Java 2 (1912) 632; KOORD. Atlas Baumart. 2 (1914) t. 339; SLOOT. Bijdr. Flac. (1919) 97; RIDL. Fl. Mal. Pen. 1 (1922) 156; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 338.—*Rhamnicastrum spinosum* O. KTZE, Rev. Gen. 1 (1891) 45.—*S. fragrans* ELM. Leafl. Philip. Bot. 5 (1913) 1780.—**Fig. 2–3.**

Tree (6–)10–15(–27) m, rarely a shrub; old trunks grey, smooth, unarmed, but both young ones and suckers heavily armed with branched spines, young twigs not rarely with axillary, simple thorns. *Leaves* broadly cuneate, rarely subrotundate at the base, beautifully rose-coloured when young, ± coriaceous, glabrous, 8–18 by $3^1/_2$–8 cm, nearly entire to remotely crenate; petiole 6–12 mm. *Racemes* 2–$4^1/_2$(–6–8) cm. Pedicels 7–11 mm. *Flowers* sordid-white. *Sepals* ovate, white-greyish to yellowish-tomentose outside, $2^1/_2$–4 mm. *Petals* ovate-lanceolate, glabrous, ciliate, somewhat larger than the sepals. *Berry* apiculate to mamillate, $1^3/_4$–$2^1/_2$ cm diam., green or brown-green to greenish-purplish, black when

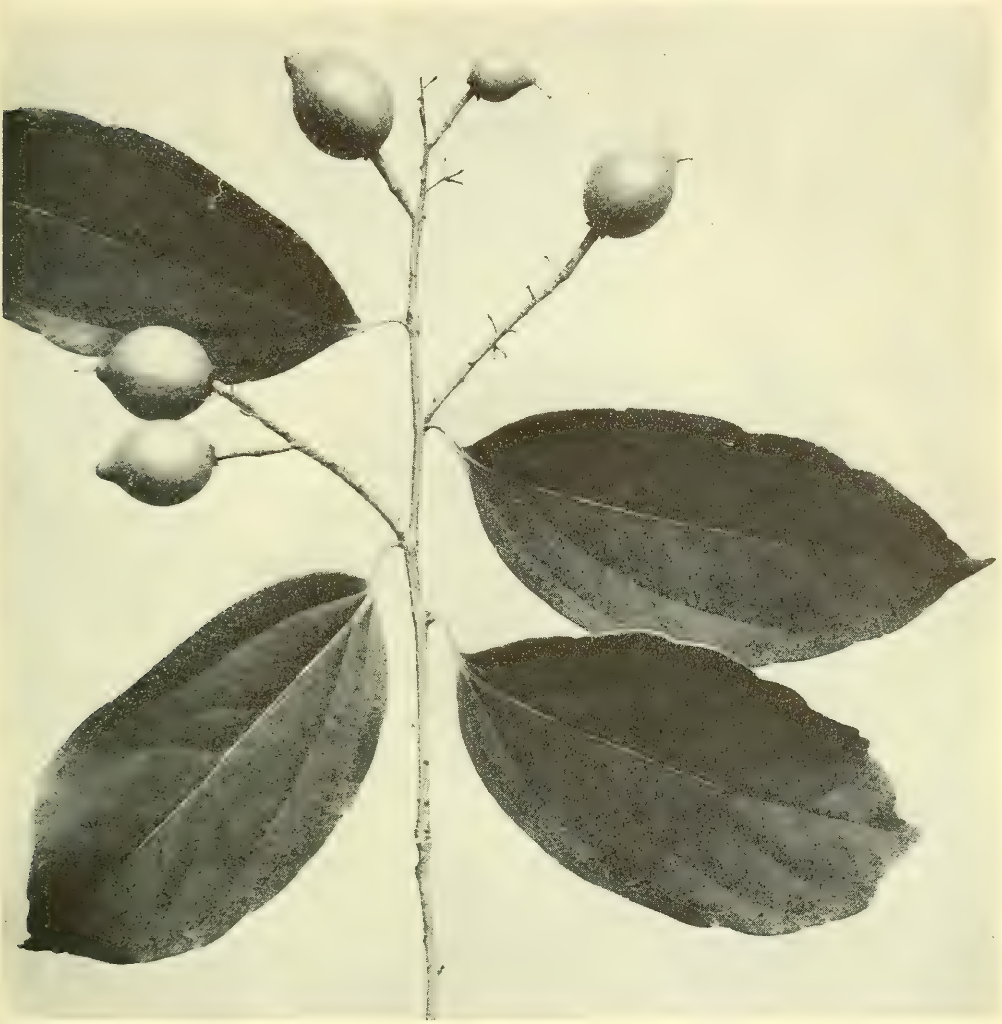

Fig. 3. *Scolopia spinosa* (ROXB.) WARB. Fruiting twig, upper surface of leaves, × 1/2 (C.H.B. IV–F–105).

dry, with 6 or more, rarely up to 20 red and bitter seeds.

Distr. Burma, Siam, Indochina, in *Malaysia:* Sumatra (also Simalur Isl.), Banka, Malay Peninsula, Java, Borneo, Palawan, Talaud Isl. (N. of Celebes).

Ecol. Both in mixed primary and secondary rain-forest and in teak- and other deciduous forest, often on calcareous soil, whether or not on riversides, up to 1100 m. *Fl.* Jan.–Dec.

Uses. Sapwood dirty-white, heart-wood orange-red, fairly hard and moderately durable; used by the Bajans (Sandakan) for fencing purposes, and for house-building in Sumatra. Fruit said to be edible.

Vern. *Rukĕm*, *rukam*, standard J, M, S, *rukĕm putih*, *sulung*, *s. ĕtèm*, *s. batu*, *tutun tangkulung silai*, M, *ki kĕmandèn*, *ki heas*, S, *bagan*, *kaju-tudjuh*, *kĕmanden*, *landakan*, *rĕmang*, *rilam*, *rukĕm karang*, *sintok*, *songowodjo*, J; Br. N. Borneo: *kaju boko*, *piring*, *rukam hutan bini*, *rotiom andu*, *rukam otan* Kedayan, *buah munyit*, *kapuk-kapuk*, Bajan, *toung kakang*, Dusun Putatan, *rukam* Baj. W.C.; *bunároh*, Talaud.

4. Scolopia luzonensis (PRESL) WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 30; BRIQ. Ann. Cons. Jard. Bot. Genève 2 (1898) 45; MERR. Philip. J. Sc. 1 (1906) Suppl. 98; *ibid.* 10 (1915) 327; Sp. Blanc. (1918) 274; En. Philip. 3 (1923) 109.—*Dasianthera* *luzonensis* Presl, Rel. Haenk. 2 (1835) 90, t. 66, *incl.* α *ovatifolia*, β *intermedia* et γ *lancifolia* Presl.—*Banara racemosa* Blanco, Fl. Filip. (1837) 425.—*Banara brevifolia* Blanco, *l.c.* 426.—*Phoberos dasyanthera* Benn. Pl. Jav. Rar. (1840) 192.—*Flacourtia corollata* Blanco, Fl. Filip. ed. 2 (1845) 559, ed. 3 (1879) 220, t. 367.—*Flacourtia parvifolia* Blanco, *ll.cc.* 560, 220.—*S. lanceolata* Clos, Ann. Sc. Nat. IV, 8 (1857) 252, *quoad specim. philip.*; Miq. Fl. Ind. Bat. I, 2 (1858) 107, *quoad specim. philip.*; Vidal, Phan. Cuming. Philip. (1885) 94; Rev. Pl. Vasc. Filip. (1886) 49. —*S. crenata* Clos, Ann. Sc. Nat. IV, 8 (1857) 250, *quoad specim. philip., excl. bason. Flacourtia crenata* Wall.; F.-Vill. Nov. App. (1880) 12; Vidal, Sin. Atl. (1883) 13, t. 7, f. B; Phan. Cuming. Philip. (1895) 94; Rev. Pl. Vasc. Filip. (1886) 48; Miq. Fl. Ind. Bat. I, 2 (1858) 107, *quoad specim. philip.*; Koord. Minah. (1898) 478; Sloot. Bijdr. Flac. (1919) 100; Bull. Jard. Bot. Btzg III, 7 (1925) 341.—*S. rhinanthera* [*non* (Benn.) Clos] F.-Vill. Nov. App. (1880) 12.—*Flacourtia lanceolata* Vidal, Rev. Pl. Vasc. Filip. (1886) 49, *nomen* (*sphalm. S. lanceolata*).—*S. saeva* (*non* Hance) Briq. Ann. Jard. Bot. Genève 2 (1898) 46, *quoad specim. philip.*; Merr. J. Philip. Sc. 10 (1915) 328; En. Philip. 3 (1923) 109.—*S. dasyanthera* F.-Vill. *l.c.*; Gagnep. in Morot, J. Bot. 21 (1908) 167.

Shrub or small tree, 5 m, occasionally with fine axillary thorns on young twigs; bark smooth, grey. *Leaves* ovate to ovate-oblong or elliptic-lanceolate, cuneate to nearly rounded at the base, ± coriaceous, glabrous, shining above, 6–12$^1/_2$ by 2$^1/_2$–4(–5) cm; nerves little prominent, veins ± reticulate; petiole 0.6–1.2 cm. *Racemes* axillary and terminal, ± as long as the leaves, simple or panicled, 10–14-flowered; rhachis minutely pubescent or glabrous. Pedicels 4–6 mm. *Flowers* whitish, sweet-scented. *Sepals* 4, oblong, 2$^1/_2$ mm, ciliate. Connective ± laxly pilose. *Petals* 4, ± equal to the sepals. *Berry* ovate to nearly globose, red, *c.* 6 mm. *Seeds* 3–8, semilunar.

Distr. *Malaysia:* Br. N. Borneo, Philippines (widely distributed in Luzon, also in Mindoro, Mindanao, Masbate, Panay, Catanduanes, Guimaras Isl.), NE., SW. and SE. Celebes (*incl.* P. Kabaena).

Ecol. In dry thickets and secondary forests, up to 680 m, often common on clayey soil or along the sandy beach, also on limestone rocks. *Fl.* Sept.–March; *fr.* Apr.–June.

Uses. Wood very hard, apparently not in use.

Vern. Philippines: *Aniñguai, kandong*, Sbl., *anonot, annot*, Pang., *babaliuain, bitoñgól, malakaráyom, pilapil, suliakdagá, amayit*, Tag., *bagnayau*, C. Bis., *balingsuá, dóging hálas*, Bik., *palutan*, Ilk., *balit*, Bis. Ilongs, *ugatan-tayabas, gamut panguli, gamot uway, granada*, Mindoro.

Note. Originally I assumed the form described as *S. lanceolata* Clos to represent a distinct variety characterized by elliptic-lanceolate leaves and a sometimes less hairy connective, but I have discarded it on account of intermediates. *S. luzonensis* comes very near *S. crenata* (Wight) Clos from the Concan to the Nilgherries (India) which has entirely glabrous connectives.

5. Scolopia novo-guineensis Warb. Bot. Jahrb. 13 (1891) 384; Gilg, *op. cit.* 55 (1918) 276, f. 2; Sloot. Bijdr. Flac. (1919) 101; Nova Guinea 14 (1924) 191; Bull. Jard. Bot. Btzg III, 7 (1925) 341.

Shrub. *Leaves* rounded or emarginate at the apex, sometimes apiculate, obtuse at the base, subcoriaceous, glabrous, shining above, entire or nearly so, obscurely triplinerved from the base, lateral nerves 3–4 slightly prominent above, not raised beneath, veins very tenderly reticulate above; petiole 2(–3) mm. *Racemes* reduced to a solitary, axillary flower; pedicel (incl. peduncle) 3–4 mm, pubescent. *Sepals* 5, oblong. *Petals* 2 mm, similar to and ciliate as the sepals. Fruit unknown.

Distr. W. New Guinea (McCluer Gulf; once found near Sekar).

Ecol. On dry slope of sandstone hill, low alt., *fl.* Dec.

6. Scolopia nitida C. T. White, J. Arn. Arb. 10 (1929) 243.

Much-branched treelet or shrub, up to 1$^1/_2$ m; young branchlets velutinous-pubescent. *Leaves* obtuse at the apex, broadly attenuate at the base, glabrous except for the puberulous upper side of the midrib, subcoriaceous, very shining above, dull beneath, remotely paucidentate or shallowly crenate to subentire; obscurely triplinerved from the base, higher lateral nerves 3–5, all somewhat prominent on both sides, veins laxly reticulate; petiole puberulous 3–4 mm. *Racemes* puberulous. Pedicels 3–5 mm. *Sepals* 4–6, ovate 1$^1/_2$ mm, ciliolate. *Petals* 4–6, *c.* 2 mm. *Fruit* oblong, 6 by 4 mm, few-seeded.

Distr. Melanesia (New Ireland), in *Malaysia:* SE. New Guinea (Wassi Kussa River, Port Moresby) and N. New Guinea (Humboldt Bay), from sea-level to low altitudes.

Ecol. Undergrowth of dry, bushy rain-forests along rivers.

4. ITOA

Hemsl. in Hook. Ic. Pl. 27 (1901) t. 2688; Bot. Mag. Tokyo 15 (1901) 1.—*Mesaulosperma* Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 384.

Dioecious trees. *Leaves* spirally arranged, large, long-petioled, crenate, pinnatinerved. Stipules 0, but intra-axillary buds attached to nearly all leaves. *Panicles* of ♂ flowers erect, ample, terminal, shortly peduncled. ♀ *Flowers* solitary, axillary (or terminal ?); peduncle in fruit elongate, distinctly articulate above the middle. *Calyx* in both sexes coriaceous, lobes 3(–4), valvate, nearly free, ovate-deltoid. *Petals* 0. ♂ *Flowers:* stamens numerous, up to half the length of the calyx-lobes; filaments filiform; anthers minute, basifixed. Ovary rudimentary. ♀ *Flowers:* unknown, probably with numerous staminodes. *Fruit* capsular, large, ± attenuate-ovoid or -oblong, with short, broad style and sessile, shortly 6–8-lobed stigma, many-seeded, tardily dehiscent from the apex in (5–)6–8 valves, these coherent at the base, but the coriaceous exocarp separating both at base and apex from the hard, woody endocarp; placentas (5–)6–8, woody, filiform, persistent in the centre of the valves, but detaching at base and apex. *Seeds* very compressed, winged, vertical, the inner ones in radial groups, the outer ones arranged in tangential groups, the proper seed lenticular and small, the wing ample, membranous, very variable in size (± triangular to quadrate), with funicle running transversely through the wing.

Distr. Two closely allied *spp.*, one in S. China and Indo-China (*I. orientalis* HEMSL.), the other in E. Malaysia: Celebes, Halmaheira and N. New Guinea (Japen Isl.). Fig. 4.

1. Itoa stapfii (KOORD.) SLEUM. Notizbl. Berl.-Dahlem 11 (1934) 1026.—*Polyothyrsis stapfii* KOORD. Minah. (1898) 474.—*Polyothyrsis celebicus* KOORD. *l.c.* 476–477, *errore*.—*Mesaulosperma stapfii* SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 386; HEYNE, Nutt. Pl. (1927) 1141.

Buttressed tree, 25–40 by 0.7–1 m; bark grey, peeling; branchlets glabrous; innovations subferrugineous- or greyish-tomentose. *Leaves* ovate to oblong-ovate, shortly obtusely acuminate, base truncate or mostly subcordate, subcoriaceous and glabrous when fully developed, membranous and ± densely and finely pubescent when young, intensively green above, pale beneath (brownish when dried), 10–15 by 5–8(–9) cm, ± coarsely glandulose-crenulate; nerves 10–13 pairs (the basal 2 pairs proceeding nearly from the petiole) and prominent on both sides, veins ± transversely subparallel and little reticulate; petiole $4^{1}/_{2}$–$6^{1}/_{2}$ (–$7^{1}/_{2}$) cm. ♂ & ♀ *Inflorescences* unknown. *Fruit* ovoid-elliptic, attenuate at both ends, grey or dilute ferrugineous-tomentose, $7^{1}/_{2}$–10 by ± $3^{1}/_{2}$ cm, somewhat 6–7-sulcate longitudinally; peduncle axillary, very stout (2 mm), *c.* 4–5 cm long. *Seeds* flat, *c.* 6 mm diam., surrounded by a $3^{1}/_{2}$–4 cm broad, membranous wing.

Distr. NE. & Central Celebes (Minahassa, Masamba Distr.), Moluccas (Halmaheira), N. New Guinea (Japen Isl.).

Ecol. In old, mixed primary and in secondary rain-forest, in level, sometimes inundated or hilly localities, rather rare, growing scattered, 60–1000 m. *Fl.* July, *fr.* Febr., July, Sept.

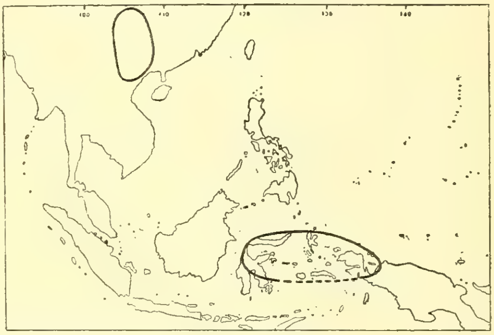

Fig. 4. Distribution of *Itoa*. In E. Malaysia *I. stapfii* (KOORD.) SLEUM., in China *I. orientalis* HEMSL.

Uses. Heart-wood yellowish, hard, used in Halmaheira for house-construction.

Vern. *Hulo aju*, Manado, *danoan*, *daägon*, Minah., *wurio*, Masamba, *usu tamau*, Halmaheira, *ramboni*, Japen.

Note. The differences between this species and *I. orientalis* HEMSL. are rather vague, the latter having terminal flowers and (12–)14–18 pairs of nerves.

5. PAROPSIA

NORONHA *ex* PETIT-THOUARS, Hist. Vég. Isl. Austr. Afr. (1805) 59, t. 19.—*Trichodia* GRIFF. Not. 4 (1854) 570.

Trees or shrubs. *Leaves* alternate, shortly petioled, with 2 distinct glands on the decurrent leaf-bases. Stipules very early caducous. *Flowers* bisexual, fascicled or glomerate in dense axillary cymes, rather small, fragrant, shortly pedicelled. *Calyx*-tube short, 5-lobed. *Petals* 5, inserted on the base of the calyx-tube as is the corona consisting of 5 filiform, fimbriate, epipetalous phalanges. *Stamens* 5; filaments flat, linear; anthers ovate-oblong. *Ovary* subglobose, on a sometimes very short gynophore. Styles 3–5; stigmas thick, reniform-capitate. *Fruit* capsular, inflated, dehiscent from the apex into 3 valves. *Seeds* ∞, obovate-compressed, with crustaceous testa.

Distr. About 13 *spp.* in tropical Africa and Madagascar, one in W. *Malaysia* (Sumatra and Malay Peninsula).

1. Paropsia vareciformis (GRIFF.) MAST. Trans. Linn. Soc. 27 (1871) 639; in HOOK. *f.* Fl. Br. Ind. 2 (1879) 600; KING, J. As. Soc. Beng. 71, ii (1902) 49; RIDL. Fl. Mal. Pen. 1 (1922) 842; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 333; BURK. Dict. (1935) 1672.—*Trichodia vareciformis* GRIFF. Not. 4 (1854) 571.—*P. malayana* PLANCH. *ex* MAST. Trans. Linn. Soc. 27 (1871) 639; in HOOK. *f.* Fl. Br. Ind. 2 (1879) 600.—*P. bakhuisii* BOERL. & KOORD. in KOORD.-SCHUM. Syst. Verz. 2 (1914) 41; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 333, f. 8.

Shrub or small to medium-sized tree; young branches rusty pubescent. *Leaves* oblong to elliptic-oblong or lanceolate-oblong, rarely ovate to ovate-oblong, ± abruptly bluntly acuminate (1–$1^{1}/_{2}$ cm), broadly cuneate to subrotundate at base, chartaceous to subcoriaceous, midrib excepted glabrous above when old, but tomentose along midrib and nerves beneath, finely serrate to entire, $6^{1}/_{2}$–10(–12) by 2–4(–$3^{1}/_{2}$–6) cm; nerves 7–8(–9) pairs; petiole 4–5(–8) mm. *Flowers* in 3–5-flowered fascicles, rusty-tomentose, with a fragrance of roses. Pedicels ($2^{1}/_{2}$–)4–5 mm. *Calyx* lobes oblong, somewhat inequal, subacute, 6–7 by 2–3 mm. *Petals* oblanceolate, similar to the calyx-lobes, somewhat longer, but narrower, white-tomentose. Stamens 5–6 mm; filaments glabrous. Corona consisting of a single row of flat ferrugineous woolly threads, half the length of the petals. *Ovary* ovoid, covered with a white-villous pubescence, very shortly stipitate or nearly sessile. Styles and stigmas white to greenish-white. *Fruit* ovoid to subglobose, 2–$2^{1}/_{2}$(–3) cm diam., 1 mm stipitate; pericarp dry, leathery, yellowish-green and nearly glabrous when ripe. *Seeds* 2–3, ovoid, flat, scrobiculate, light-brown with a white aril.

Distr. Sumatra (Palembang), Malay Peninsula (Perak, Selangor, Negri Sembilan, Malacca).

Ecol. In Sumatra in primary forest on hilly ground and sandy clay, apparently rare, 10–75 m.

Vern. *Tuba ulat*, *tadji*, Sum., *bĕlimbing hutan*, *bĕras-bĕras*, Mal. Pen.

Note. The material from the single specimen collected in Sumatra by KOORDERS in Indragiri (Padangtarab), described as *P. bakhuisii* BOERL. & KOORD., is slightly different from those collected in the Malay Peninsula by ovate-oblong leaves, broadly attenuate or rounded at both ends, 8–9 pairs of lateral nerves, 9–12 by $3^{1}/_{2}$–6 cm; petiole *c.* 8 mm; pedicels $2^{1}/_{2}$–4 mm. KOORDERS stated the bark of the tree to be copper-red and peeling, flowers yellowish-green, stamens 8 mm, pubescent near the base.

6. HYDNOCARPUS

GAERTN. Fruct. 1 (1788) 288, t. 60, f. 3; SLEUMER, Bot. Jahrb. 69 (1938) 1–94.—**Fig. 6–10.**

Trees, sometimes shrubs, usually dioecious, occasionally monoecious (*H. castanea*, *H. curtisii*). *Leaves* alternate, entire or serrate, penninerved; petioles thickened at the apex. Stipules mostly early caducous. ♂ *Flowers* in axillary (rarely supra-axillary) peduncled and ± branched cymes (these sometimes very short or reduced to ± sessile fascicles, very rarely to a solitary flower) from younger branches, or rarely in elongate raceme-like panicles from the trunk or the old branches. ♀ *Flowers* similarly arranged, but mostly solitary or in (very shortly peduncled) fascicles of 2–3 from the axils of young branches. *Bracts* small or minute, sometimes subpersistent. *Sepals* (3–)4–5, rarely 7–11, free or rarely slightly connate at the base, concave, ± equal, imbricate, ± reflexed at anthesis, caducous. *Petals* 4–5, rarely up to 14, free or rarely slightly connate at the base, mostly membranous, with a somewhat fleshy and mostly densely pilose scale at their inner base, caducous. ♂ *Flowers:* stamens 5–∞(–115); filaments free, sometimes very short; anthers oblong to ovate-cordate or didymous; cells divergent by the dilated connective. Rudimentary ovary sometimes present. ♀ *Flowers:* staminodes 5–∞, their anthers mostly reduced in size and sterile, or entirely absent. *Ovary* sessile, unilocular, with 3–6 placentas. Stigma sessile, with 3–5 short or elongate radial branches, these mostly dilated towards the apex and shortly bifid, rarely narrow, ± reflexed. *Fruit* indehiscent, globose or ovoid, rarely cylindrical or cucumber-like, few- to many-seeded; pericarp thick and hard to thin and fragile; exocarp brown, sometimes with distinct fibrose structure; mesocarp light-yellowish, very hard (stone-cells), *H. cauliflora* excepted; endocarp soft, mostly granular, dark-brown. *Seeds* densely packed in a pulp, angular-ovoid, with a membranous aril and very hard testa. Endosperm albuminous-oily. Embryo erect; cotyledons foliaceous.

Distr. About 40 *spp.* in Ceylon, W.–SW. Deccan Peninsula, Burma, Assam, Siam, Indo-China, S. China (Kwangsi), and Hainan, in *Malaysia:* 31 *spp.* in Sumatra, Malay Peninsula, Java, Borneo, and the Philippines. Fig. 5.

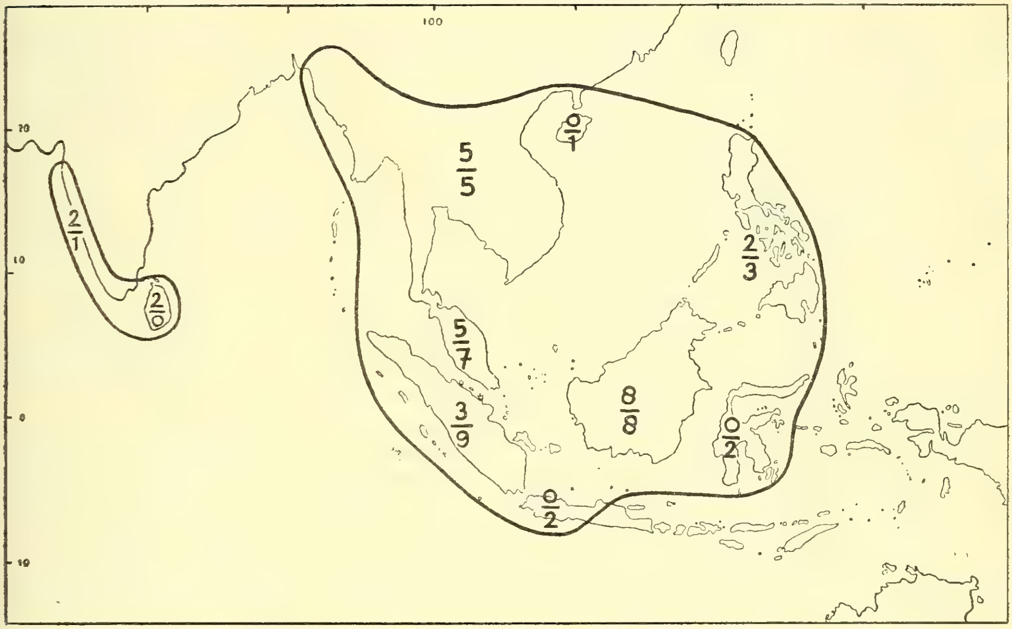

Fig. 5. Distribution of *Hydnocarpus*; the large partial area to the right corresponds with *sect. Taraktogenos.* The figure above the hyphen indicates the number of endemic species in each district, the figure below the hyphen the number of non-endemic species.

Ecol. Most species occur as substage shrubs or trees in evergreen rain-forests at low altitudes.

Uses. The oil extracted from the seeds of the greater part of the species is used for curing wounds and eczemes by the native peoples since very old times, especially in China, where the seeds are imported up to the present time. The oil of the Burmese *H. kurzii* is known as 'chaulmoogra-oil'; since 1854 is has been used as a remedy against lepra, but this has practically been abandoned today in Hawaii. It contains the glycerides of 2 fatty acids, *viz* chaulmoogric acid and hydnocarpic acid. These acids occur also abundantly in certain Malaysian representatives as *H. alcalae*, *H. cauliflora*, *H. subfalcata*, and *H. woodii* (*cf.* H. SCHLOSSBERGER, Chaulmoograöl und Verwandtes, in HEFFTER, Handb. Pharmak., Erg.-Werk vol. 5, 1937, containing a complete review on the subject). To cover the great need of chaulmoogra-oil, three species are or have been cultivated in tropical areas: *H. kurzii* (from Burma), *H. alcalae* (from the Philippines) and *H. anthelminthica* PIERRE (from Indo-China). Besides the above-mentioned fatty acids theseeds of several species contain glycosides which discharge hydrocyanic acid; they are used for fishpoisoning in the same manner as those of *Pangium edule.*

KEY TO THE SPECIES
(*based on leaves and ♂ flowers*)

1. Sepals 4 or 5, constant in number on the same specimen.
2. Sepals 4. Petals 4 or 8. Stamens (12–)15–30(–35). SECT. TARAKTOGENOS.
3. Petals 4, ± equal in size. Leaves serrate or shallow-crenate.
4. Petals and scales free. Sepals glabrous outside, only ciliate. Leaves 18–25 by $5^1/_2$–8 cm. **1. H. humei**
4. Petals and scales coherent or slightly connate at the base. Sepals rusty-tomentose outside. Leaves ($7^1/_2$–)9–13(–15) by 3–5(–6) cm . . . . **2. H. ilicifolia**
3. Petals 8, free, mostly slightly differing in size.
5. Pedicels slender to filiform, $1^1/_2$–3 cm. Leaves shallow-crenate . . . . . . **3. H. heterophylla**
5. Pedicels rather stout, thicker, $^1/_2$–1(–$1^1/_2$) cm. Leaves entire.
6. Petals rather firm, densely golden-sericeous outside. Filaments 1 mm, stout, ± densely longish pilose.
7. Petioles (0.6–)0.8–1.2(–$1^1/_2$) cm long, ± 1 mm thick.
8. Leaves at first covered with appressed rufous hairs beneath, finally ± glabrescent, rarely glabrous . . . . **4. H. kunstleri**
8. Leaves persistently rufous-tomentose beneath. . . . . **4a. H. kunstleri** *var.* **tomentosa**
7. Petioles $2^1/_2$–3(–$3^1/_2$) cm long, ± 2 mm thick . . . . **5. H. pinguis**
6. Petals membranous, glabrous outside, ciliate at the apex. Filaments *c.* 3–4 mm. Leaves always glabrous.
9. Filaments ± densely longish pilose . . . . **6. H. kurzii** *ssp.* **australis**
9. Filaments glabrous.
10. Flowers on the trunk. Leaves with 7(–8) pairs of nerves . . . . **7. H. calophylla**
10. Flowers axillary on foliate branches.
11. Nerves (4–)5–6 pairs ; reticulation lax. Petals *c.* $2^1/_2$ mm in diam. . . **8. H. tenuipetala**
11. Nerves (7–)8–9(–10) pairs; reticulations rather dense. Petals 4 mm in diam. **9. H. wrayi**
2. Sepals 5.
12. Petals 5–7. SECT. HYDNOCARPUS.
13. Stamens 5. Petals 5. Midrib always very prominent above. *Subsect. Oliganthera.*
14. Anthers subquadrangular; cells divergent or separated from each other by the thickened connective, minute (1 mm). Flowers small; sepals and petals 2–4 mm. Leaves rather distinctly serrate, sometimes shallow-crenate to nearly entire.
15. Inflorescences distinctly axillary. Stipules early caducous.
16. Nerves 4–6 pairs.
17. Young branchlets (tips) ± densely, leaves (specially beneath on midrib and lateral nerves) ± laxly covered with minute, appressed, simple hairs. Sepals 2–3 mm diam. **10. H. subfalcata**
17. Young branchlets and leaves entirely glabrous. Sepals 4 mm diam. **11. H. merrilliana**
16. Nerves (7–)8–9 pairs.
18. Sepals ± 2 mm diam. Leaves, specially beneath, covered with ferrugineous, stellate hairs on midrib and nerves . . . . **12. H. yatesii**
18. Sepals nearly 4 mm diam. Leaves covered with minute, simple, appressed hairs all over the undersurface . . . . **13. H. glaucescens**
15. Inflorescence distinctly (3–5 mm) supra-axillary. Stipules mostly still persistent in anthesis on the upper part of the young branches.
19. Peduncles 3–5 mm. Sepals in anthesis very laxly pilose or glabrescent outside. **14. H. nana**
19. Inflorescences sessile or nearly so, (sub-)fascicled. Sepals in anthesis densely ferrugineous-pubescent outside . . . . **15. H. elmeri**
14. Anthers oblong to cordate-oblong; cells parallel, connate, connective neither thickened nor dilated. Flowers larger; sepals at least 4 mm, mostly longer. Leaves strictly entire.
20. Inflorescences from the trunk or old big branches, racemose-panicled.
21. Lateral nerves 7–8 pairs. Filaments glabrous. . . . . **16. H. alcalae**
21. Lateral nerves 10–15 pairs. Filaments villous . . . . **17. H. cauliflora**
20. Inflorescences axillary on the younger branches, cymose, rarely reduced to few-flowered fascicles or a solitary flower.
22. Sepals $3^1/_2$ mm long. Lateral nerves 5–6 pairs . . . . **18. H. cucurbitina**
22. Sepals $^1/_2$–$1^1/_2$ mm long.
23. Leaves ovate-oblong, gradually attenuate towards the apex . . . **19. H. beccariana**
23. Leaf broadest in or above the middle, oblong to elongate-oblong, rarely obovate-oblong, mostly rather abruptly short-acuminate at the apex.
24. Lateral nerves very distinctly inarching along the leaf-margin, very prominent beneath, mostly impressed above . . . . **20. H. borneensis**
24. Lateral nerves suberect or curved, the inferior ones excurrent along the leaf-margin, only the uppermost 1 or 2 pairs slightly anastomosing.
25. ♂ Flowers solitary or in fascicles of 2–3(–6), peduncle very short –3 mm.

26. Flowers solitary. Pedicels filiform, 2–2½ cm . . . . **21. H. filipes**
26. Flowers in fascicles of 2–3 (very rarely up to 6). Pedicels stoutish, 2–3 cm. **22. H. castanea**
25. ♂ Peduncles 5–15 mm.
27. Inflorescences 2–3-branched, many-bracteolate. Petioles 2–4 mm. Nerves 7–8(–9) pairs. **23. H. scortechinii**
27. Inflorescences not or very shortly branched (the flowers from the upper part of the thickened peduncle one above the other). Petioles 5–15 mm. Nerves 9–12 pairs.
28. Filaments somewhat shorter than the anthers . . . . **24. H. curtisii**
28. Filaments as long as or mostly a little longer than the anthers . **25. H. sumatrana**
13. Stamens (6–)7–16. Petals 5–7. Midrib and nerves nearly always flat or slightly impressed above, very rarely somewhat raised. *Subsect. Pleianthera.*
29. Leaves elliptic-oblong. Stamens (6–)7–8 . . . . **26. H. woodii**
29. Leaves ovate-oblong. Stamens 14–16 . . . . **27. H. crassifolia**
12. Petals 10. Stamens 17–24. SECT. KERRANDRIAS . . . . **28. H. calvipetala**
1. Sepals and petals varying in number on the same specimen. SECT. ASTERIASTIGMA.
30. Sepals *c.* 5–(4–7). Petals *c.* 10–(8–12). Stamens *c.* 50–(35–70). Leaves with ferrugineous, stellate hairs beneath, specially on the nerves and midrib, characteristically dark-brown when dry. **29. H. anomala**
30. Sepals *c.* 7–(8–11). Petals *c.* 12–(8–14). Stamens 35–115. Leaves glabrous or with simple hairs.
31. Stamens *c.* 100–115. Leaves glabrous or nearly so, mostly olivaceous when dry. **30. H. gracilis**
31. Stamens *c.* 45. Leaves rufous- or ferrugineous-pubescent, specially on midrib and lateral nerves beneath, mostly red-brown when dry . . . . **31. H. polypetala**

KEY TO THE SPECIES
(*based on leaves and ± ripe fruit*)[1]

1. Exocarp fibrous-cancellate, *i.e.* composed of numerous firm radial fibres (protruding from the stony mesocarp) and much thinner tangential (± parenchymal) walls, dark brown when dry.
2. Fruit globose.
3. Fruit smooth, or rough by minute warts only.
4. Leaves covered beneath with stellate, rusty hairs, specially on midrib and nerves, typically dark brown when dry. Fruit 8½–10 cm diam. Fibrous exocarp 8–15 mm, brown; stony yellowish mesocarp 1½–2 mm; endocarp soft, granular, 2 mm, brown when dry. Seeds *c.* 40. **29. H. anomala**
4. Leaves glabrous or covered densely to sparsely with simple rather stiff hairs.
5. Fruit *c.* 6½ cm diam., glabrous. Exocarp fibrous, brown, 4–5(–7) mm; mesocarp stony, yellowish, 1 mm; endocarp brown, soft, 1 mm. Seeds *c.* 15 . . . . **4. H. kunstleri**[2]
5. Fruit *c.* 8½(–12) cm diam., brown- or blackish-velvety.
6. Fibrous exocarp 15–17 mm; stony yellowish mesocarp *c.* 1 mm; endocarp spongy. Seeds 10–15. Leaves mostly finely crenulate and a little rough by protruding tubercles . . **30. H. gracilis**
6. Fibrous exocarp 3–4(–6–8) mm; stony yellow mesocarp 1–2(–3) mm; endocarp soft, 1–2 mm. Seeds 12–18(–30). Leaves entire, glabrous, smooth to the touch. **6. H. kurzii** *ssp.* **australis**
3. Fruit with numerous flat-triangular appendages up to 1 cm long united at their bases and forming ± longitudinal crests, rusty-velvety, ± 9 cm diam. Fibrous exocarp (appendages excluded) 2–3 mm; stony yellowish mesocarp *c.* 1 mm; soft endocarp 1–2 mm. Seeds *c.* 20 . . **31. H. polypetala**
2. Fruit oblong, fusiform, manifestly (sometimes rather abruptly) attenuate at both ends.
7. Fruit axillary on the younger branches, 7–8 by 4–5 cm. Fibrous exocarp 3 mm; stony yellowish mesocarp ½ mm; soft endocarp 1 mm. Seeds several. Leaves with 8–9(–10) pairs of nerves, transverse veins ± distant, more or less concolorous when dry . . . . . . **9. H. wrayi**
7. Fruit from the trunk or old big branches, not yet known in mature state, but probably similar to that of *H. wrayi*. Leaves with 7(–8) pairs of nerves, mostly somewhat rough to the touch, veins very densely transverse and reticulate, much darker (brown or red-brown) beneath than above when dry. **7. H. calophylla**
1. Exocarp formed from ± parenchymatic walls which include ± irregularly arranged stone-cell groups (only visible under a lens).
8. Midrib of the leaves very distinctly prominent above.
9. Fruit from the trunk or big old branches.
10. Fruit oblong, 15–31 by 12–15 cm. Exocarp 0.3–0.7 mm; stony light mesocarp 6 mm; soft (pulpy) endocarp 7 mm. Seeds 80–100(–110). Leaves up to 25 by 11 cm. Nerves 7–8 pairs. **16. H. alcalae**

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(1) Not placed, as the fruit is not or imperfectly known: *11. H. merrilliana* (*cf. 13. H. glaucescens*) and *28. H. calvipetala.*

(2) See here also *5. H. pinguis* and *8. H. tenuipetala*, of which fruits are not yet known. From their leaves and the structure of their flowers it may be concluded that they probably possess fruits with fibrous exocarp similar to those of *H. kunstleri*, *7. H. calophylla*, and *9. H. wrayi*. Both have *kunstleri* leaves, but *H. tenuipetala* is quite glabrous and has petioles *c.* 1 cm long, whilst *H. pinguis*, also entirely glabrous, has bigger leaves on very stout, 2½–3½ cm long petioles.

10. Fruit globose, *c.* 8 cm diam. Exocarp very thin; mesocarp rather fragile, spongious, 6 mm; endocarp soft. Seeds several. Leaves 23–30 by 9–12 cm. Nerves 10–15 pairs. **17. H. cauliflora**

9. Fruit axillary on the younger branches.

11. Fruit very much longer than wide, cylindrical to cucumeriform or elongate-ovoid.

12. Fruit not or shortly and gradually attenuate at both ends.

13. Fruit cylindric-oblong, 9–11 by 4–5 cm, light brown when dry. Exocarp 0.3 mm; stony yellowish mesocarp 3 mm; granular endocarp 1 mm. Seeds *c.* 18. Midrib and nerves beneath and the young branches covered with stellate, rusty hairs . . . . **12. H. yatesii**

13. Fruit cucumber-shaped, 7½–12½ by 2½ cm, dark rusty-velvety or glabrescent. Seeds few. Leaves glabrous or nearly so. Nerves 5–6 pairs . . . . **18. H. cucurbitina**

12. Fruit ovate-oblong, 8 by 3 cm, abruptly attenuate at the apex into a marked beak, 1½–2 by 0.6 cm. Exocarp 1–1½ mm; light-yellow, stony mesocarp 0.3 mm; soft endocarp 1 mm. Seeds *c.* 10. Leaves ovate-oblong, coriaceous, glabrous. Nerves 9–10 pairs . . . **19. H. beccariana**

11. Fruit globose to depressed-globose, or broadly ovoid, sometimes contracted at the apex.

14. Fruit distinctly (3–5 mm) supra-axillary. Seeds 2–4. Nerves (5–)7–8 pairs. Stipules ± persistent, regularly present at the ultimate 2 or 3 leaf-axils at the apex of the branchlets.

15. Fruit globose, somewhat apiculate, brownish-green-velvety, 2½–3½ cm diam. Exocarp 0.2 mm; light yellow stone mesocarp 0.3 mm; soft endocarp ½ mm. Peduncle *c.* 1 cm. **14. H. nana**

15. Fruit globose, sordidly yellow-green- or rusty-tomentose, 4–5 cm diam. Exocarp 0.1–0.2 mm; light stony mesocarp 0.5–0.8 mm; soft endocarp 1–2 mm. Peduncle ½ cm. **15. H. elmeri**

14. Fruit distinctly axillary. Seeds mostly more than 4. Stipules mostly early caducous.

16. Nerves 11–14 pairs, strongly arched and characteristically anastomosing near the leaf-margin. Fruit ovoid, 6–8 by 4 cm, contracted (1–1½ cm) at the apex, fulvous-tomentose. Exocarp 0.3 mm; stony yellowish mesocarp *c.* 0.5–0.8 mm; endocarp *c.* 1 mm. Seeds 8–10. **20. H. borneensis**

16. Lateral nerves highly ascending along the leaf-margin, not or obscurely (sometimes the higher ones near the leaf-top) anastomosing.

17. Petioles thick and very short, 2–4(–5) mm. Blade elliptic-oblong, abruptly caudate, 12½–17½ by 6½–8½ cm. Nerves 7–8 pairs. Fruit ovoid, glabrescent, 3(–5) cm long, slightly 5–7-costate. Seeds 2–5 . . . . **23. H. scortechinii**

17. Petioles manifestly longer and more slender.

18. Fruit distinctly globose or somewhat depressed-globose, rounded at the apex.

19. Leaves ± serrate (rarely shallow-crenate), 9–13(–15) by 3–5(–6) cm, mostly grey-olivaceous when dry, with 7(–10) pairs of nerves; reticulations rather distinct. Fruit blackish-brown velvety, 4–5(–8) cm diam. Exocarp 0.2 mm; light-yellow stony mesocarp 0.5–0.8 mm; soft endocarp thin. Seeds *c.* 10 . . . . **2. H. ilicifolia**[1]

19. Leaves entire or nearly so (shallow-crenate in *3. H. heterophylla*). Stony yellow mesocarp thicker than in *H. ilicifolia*, 1–2 mm.

20. Peduncles relatively slender, *c.* 3, rarely up to 5 mm diam.

21. Leaves pale olivaceous or greenish-grey, mostly with whitish tubercles beneath when dry, ± shallow-crenate, 13–24 by 3½–8 cm. Nerves 6–7 pairs; reticulations obscure. Fruit 5½–6½(–8) cm diam., blackish-brown velvety. Exocarp 0.2 mm; light-yellow stony mesocarp *c.* 2 mm; soft endocarp 1.2–2 mm. Seeds 15–20. Peduncle 1½–2 cm.

22. Seeds 2–2½ by 1–1½ cm. . . . . **3. H. heterophylla**

22. Seeds 1.2–1.5 by 0.8–1 cm . . . . . . **3a. H. heterophylla** ***ssp.*** **philippinensis**

21. Leaves olivaceous above, light-brown beneath when dry, entire, 9–14(–20) by 3–5½ (–7½) cm. Nerves 6(–7) pairs; reticulations close and very distinct on both sides. Fruit 4–6(–6½) cm, glabrous or nearly so, minutely and densely tuberculate. Exocarp 0.3 mm; stony light-yellow mesocarp 1 mm; soft endocarp ½ mm, smooth and shining inside. Seeds *c.* 12. Peduncle *c.* 3 cm . . . . **21. H. filipes**

20. Peduncles relatively thick, (4–)6–12 mm, ½–2(–5) cm long. Leaves dark (reddish) brown when dry, entire, (13–)17–30(–35) by (5–)6½–8(–12) cm. Nerves 6–7(–8) pairs; reticulations rather distinct, specially underneath. Fruit dark brown velvety, (4–)5–6½ cm diam. Exocarp ½ mm; stony light yellow mesocarp 1–2 mm; soft endocarp 0.7–1 cm. Seeds 20–30. **22. H. castanea**

18. Fruit distinctly ovoid or globose-ovoid, apiculate or broadly contracted (mamillate) at the apex.

23. Pericarp golden-brown velvety inside and outside; fruit relatively small, ± 3½(–6) by *c.* 2½ cm, with 2–4(–7) seeds. Exocarp 0.2–0.5 mm; yellow, stony mesocarp ½–1 mm; soft endocarp 0.2–0.5 mm. Leaves olivaceous-brownish when dry, laxly beset with minute, appressed, simple hairs all over the surface beneath, entire or slightly serrate, often somewhat curved at the apex, 7½–14(–16) by 3–6(–8) cm. Nerves 4–6(–7) pairs; reticulations ± obscure . . . . **10. H. subfalcata**

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(1) See also *1. H. humei* with leaves 18–20(–25) by 6–7(–8) cm, of which ripe fruits are not yet known.

23. Pericarp glabrous inside.

24. Fruit grooved lengthwise, brown velvety, 7 by 5 cm. Exocarp $1^1/_2$ mm; stony light-yellow mesocarp 3–4 mm; endocarp 4–5 mm. Leaves brownish to olivaceous, somewhat glaucescent beneath when dry, with fine, appressed, simple hairs all over the surface beneath, 12–25 by (5–)6–8 cm. Nerves 8–9 pairs; reticulations visible . . . **13. H. glaucescens**

24. Fruit not or slightly 5-sulcate at the apex. Exocarp 0.1–0.2 mm; light yellow stony mesocarp *c.* 1 mm; endocarp early dissolute. Leaves reddish-brown when dry, shining, glabrous, (13–)15–25(–33) by 5–8(–12) cm. Nerves (8–)9–13(–14) pairs; reticulations very dense and prominent on both sides.

25. Fruit yellowish-velvety, *c.* 4 by $2^1/_2$ cm. Seeds few . . . . **24. H. curtisii**

25. Fruit rufous-tomentose, 7–8(–10) by *c.* 6 cm. Seeds *c.* 20 . . . . **25. H. sumatrana**

8. Midrib of the leaves flat or slightly impressed, very rarely obscurely raised above.

26. Leaves ± oblong-elliptic. Fruit globose or obovoid-globose, ± broadly attenuate in a thick stipe ($^1/_2$ cm diam.), brown, rough. Exocarp 1–2(–3) mm, dark brown, with occasional radial fibres; light yellow stony mesocarp 5–9 mm; endocarp obscure. Seeds *c.* 5–8 . . . . **26. H. woodii**

26. Leaves ovate to oblong-ovate. Fruit unknown . . . . **27. H. crassifolia**

1. Section Taraktogenos

(HASSK.) WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 21; SLEUM. Bot. Jahrb. 69 (1938) 14.—*Taraktogenos* HASSK. Nat. Tijd. Ned. Ind. 10 (1855) 127; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 297.

Sepals 4. Petals 4 or 8. Stamens (12–)15–30(–35).

Distr. Fig. 5.

1. Hydnocarpus humei RIDL. Kew Bull. (1926) 470; SLEUM. Bot. Jahrb. 69 (1938) 16.

Tree 3–10 m, glabrous. *Leaves* oblong-oblanceolate, rather long (3 cm) caudate-acuminate, cuneate at the base, chartaceous, shallow-crenate or mostly, specially towards the apex, ± serrate; nerves 8–9 pairs, prominent beneath, veins little but visibly reticulate-prominent on both sides; petiole 1–$1^1/_2$ cm. ♂ *Flowers* in condensed dichasia; peduncle thick, 6 mm long. Pedicels rather thick, 2 mm long. *Sepals* rounded, ciliate, 3 mm. *Petals* very thin, 2 mm across; scales fleshy, barbate at the apex, similar in shape to the petals. *Stamens* 15; filaments short, with longish white hairs; anthers oblong. ♀ *Flowers* unknown. *Fruit* nearly globose, blackish-brownish-velutinous, not known in the ripe state.

Distr. *Malaysia:* Mal. Peninsula (Selangor, Perak).

Note. Perhaps only a large-leafed form of *2. H. ilicifolia.*

2. Hydnocarpus ilicifolia KING, Ann. R. Bot. Gard. Calc. 5 (1896) 130, t. 151; RIDL. J. Str. Br. R. As. Soc. *no* 59 (1911) 72; Fl. Mal. Pen. 1 (1922) 161; CRAIB, Fl. Siam. En. 1 (1925) 96; BURK. Dict. (1935) 1208; SLEUM. Bot. Jahrb. 69 (1938) 17, 84; HENDERS. J. Mal. Br. R. As. Soc. 17 (1939) 36.—*H. serrata* (PIERRE) WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 21, *nom. nud.*; CRAIB, Fl. Siam. En. 1 (1925) 98.—*Taraktogenos serrata* PIERRE *ex* GAGNEP. Bull. Soc. Bot. Fr. 55 (1908) 525; Fl. Gén. I.C. 1 (1909) 224, t. 17 B, f. 9–16; *ibid.* Suppl. 1 (1939) 206.—*Taraktogenos microcarpa* PIERRE *ex* GAGNEP. *l.c.* 525, resp. 226, resp. 206.—*Taraktogenos subintegra* PIERRE *ex* GAGNEP. *l.c.* 526, resp. 226, resp. 206.—*H. microcarpa* GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 408.—*H. subintegra* GILG, *l.c.*—*Taraktogenos ilicifolia* KERR, The Record, Techn. & Sc. (Bangkok) Suppl. 7 (1930) 13; GAGNEP. Fl. Gén. I.C. Suppl. 1 (1939) 205.—*Taraktogenos heterophylla* [*non* (BL.) SLOOT.] MERR. Contr. Arn. Arb. 8 (1934) 109.

Medium-sized tree, 10–30 m, sometimes bushy. Trunk with grey bark; branchlets slender, appressed rusty-pubescent or mostly glabrous. *Leaves* lanceolate-oblong or oblong, rather variable in shape, broadly cuneate to nearly rounded at the base, gradually long-attenuate towards the apex and ± shortly acuminate, (sub)coriaceous, glabrous, remotely dentate or throny-serrate, but sometimes nearly entire; nerves 7(–10) pairs, prominent on both sides, veins manifestly reticulate; petiole (0.6–)1–$1^1/_2$ cm. *Cymes* corymbose, few-flowered, consisting of a *c.* $1^1/_2$ cm long peduncle and 2–3 branches $^1/_2$–1 cm long. Pedicels 5–6 mm, appressed rusty-pilose. *Sepals* subrotundate, 4 mm. *Petals* oblong, somewhat shorter than the sepals, truncate (erose) and ciliate at the apex, nearly glabrous outside, with a subquadrangular scale inside half their length. ♂ *Flowers:* stamens 14–20, white; filaments short, pubescent; anthers ovate-oblong. ♀ *Flowers:* staminodes *c.* 15. Ovary ovoid, rusty-tomentose, with 4 radiate, truncate stigmas. *Fruit* globose, rusty to blackish-brownish velvety, 4–5(–8) cm diam.; pericarp *c.* $1^1/_2$ mm. *Seeds* *c.* 10–15, ovoid, 1.3–1.5(–2.2) by 1–1.2(–1.5) cm.

Distr. Indo-China, Siam, in *Malaysia:* N. Sumatra (Atjeh), Malay Peninsula (Langkawi, Kedah, Perlis, Pahang).

Ecol. On quartzite and shale beach, or granite boulder slopes, mostly on rocky limestone hills, often very abundant, from sea-level (*Barringtonia*-formation) to 100 m.

Use. The oil extracted from the seeds is used for soap-making.

Vern. *Nipis kulit*, Kedah, *masi liman jantan*, Pahang.

3. Hydnocarpus heterophylla BL. Rumphia 4 (1848) 22, t. 178 B, f. 1; Mus. Bot. 1 (1849) 15; KOORD. Exk. Fl. Java 2 (1912) 631; Atlas 2 (1914) f. 349; SLEUM. Bot. Jahrb. 69 (1938) 18, 82.—*Taraktogenos blumei* HASSK. Nat. Tijd. Ned. Ind. 10 (1855) 127; MIQ. Fl. Ind. Bat. 1, 1 (1855) 110; HASSK. Flora 40 (1857) 529; Retzia ed. nov. (1858) 15; MIQ. Fl. Ind. Bat. Suppl. (1860) 159, 389; KOORD. & VAL. Bijdr. 5 (1900) 4; BACK. Schoolfl. Java (1911) 73; SLOOT. Bijdr. Flac. (1919) 71.—*Taraktogenos heterophylla* SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 304; HEYNE, Nutt. Pl. (1927) 1134; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 84, p. 3.

ssp. **heterophylla.** Tree up to 20(–36) m, glabrous except the inflorescence. Bark nearly black; branches pendent. *Leaves* oblong-lanceolate, long acute-acuminate, cuneate at the base, manifestly inequilateral, subcoriaceous, ± shining, entire or shallowly crenate, grey-greenish when dry and often with whitish, minute tubercles beneath, (10–)13–24 by 3¹/₂–8 cm; nerves 6–7 pairs, little prominent, veins rather obscurely reticulate; petiole (¹/₂–)1–1¹/₂ cm. Stipules rather persistent, triangular, nearly 1 mm. *Cymes* dichotomous, 4–8-flowered; peduncle *c.* 5 mm, ± as long as its 2 branches, ± densely rusty-velvety. Pedicels glabrous, thickened towards the apex, articulate at the base. *Sepals* subrotundate, concave, membranous, light-green or white, nearly glabrous, the outer 5–6 mm, the inner ones 8–10 mm. *Petals* subrotundate, thin, greenish-white, *c.* 5 mm diam., whitish-pilose outside in the upper half, fimbriate at the margin; scales half as long as the petals, ciliate, glabrous inside, densely sericeous outside. ♂ *Flowers:* stamens 20–32; filaments filiform, pubescent, 5–7 mm; anthers sagittate. ♀ *Flowers:* cymes shorter than in the ♂ inflorescence. Staminodes 15–24. *Ovary* ovoid, rusty-sericeous, slightly 3–5-sulcate at apex, crowned by the 4–5-lobed, radiate stigma. *Fruit* globose, 5¹/₂–6¹/₂(–8) cm diam., blackish-velvety; pericarp 4–5(–7) mm thick; peduncle 1¹/₂–2 cm. *Seeds* 15–20.

Distr. *Malaysia:* S. Sumatra (Palembang, Lampongs, Bencoolen), W. Java (Bantam, Bogor, Preanger), with a subspecies in SE. Borneo, N. Celebes, and the Philippines.

Ecol. In rain-forest, often on calcareous soil or on limestone rocks, scattered, 150–900 m. *Fl.* Jan.–June, *fr.* Apr.–Dec.

Uses. Wood white and very hard, but apparently not used. The seeds contain a fatty substance and are used against skin-diseases.

Vern. *Bĕtjampioh*, Palemb., *mĕdang katĕlapak*, Bencoolen, *kandar-lutung*, S, *lutung*, J.

ssp. **philippinensis** SLEUM. Bot. Jahrb. 69 (1938) 20.—*H. heterophylla* (*non* BL.) MERR. Philip. Bur. For. Bull. 1 (1903) 40.—*Cyclostemon iwahigensis* ELM. Leafl. Philip. Bot. 4 (1911) 1278 *pr. p. quoad fl.*—*Taraktogenos heterophylla* [*non* (BL.) SLOOT.] MERR. En. Philip. 3 (1923) 108.

Flowers and fruits smaller than in type. Sepals 3–4 mm diam. Petals 3 mm diam.

Distr. *Malaysia:* SE. Borneo (Kutei), Philippines (Luzon, Mindoro, Palawan, Negros, Leyte, Panay, Masbate, Ticao, Tablas, Busuanga Isl.), N. Celebes (Manado).

Ecol. In forests at low altitude.

Vern. Philippines: *Balik*, *busilayan*, *ouaslum*, *putian* ,P. Bis., *bato-bato*, Tagb., P. Bis., *butongmanók*, *haguphup*, Bik., *magluni*, Tagb., *matobato*, P. Bis., S.L. Bis., Celebes: *wanutèh*, Manado.

4. Hydnocarpus kunstleri (KING) WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 21; SLEUM. Bot. Jahrb. 69 (1938) 24.—*Taraktogenos kunstleri* KING, J. As. Soc. Beng. 59, ii (1890) 122; Ann. R. Bot. Gard. Calc. 5 (1896) 131, t. 152; SLOOT. Bijdr. Flac. (1919) 73; RIDL. Fl. Mal. Pen. 1 (1922) 162; BAK. *f.* J. Bot. 62 (1924) Suppl. 6; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 305; BAK. *f.* J. Bot. 63 (1926) Suppl. 143; HEYNE, Nutt. Pl. (1927) 1134; BURK. Dict. (1935) 1208.—*T. scortechinii* KING, J. As. Soc. Beng. 59, ii (1890) 122, *incl. var. gracilipes* KING (*nec H. scortechinii* KING, *l.c.* 120); RIDL. Fl. Mal. Pen. 1 (1922) 162.—*H. kingii* WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 21; SLEUM. Bot. Jahrb. 69 (1938) 24.

var. **kunstleri.** Tree 12–20(–35) m, trunk 25–40 cm diam., often with thin, high buttresses; branchlets ± densely fulvous-pilose, finally glabrescent. *Leaves* oblong-lanceolate or mostly oblong-elliptic to elliptic, cuspidate or sometimes more obtusely acuminate, ± inequilateral at the base, the narrower side cuneate, the broader one ± rounded, ± stiff coriaceous, shining, glabrous, mostly greyish above when dry, at first short appressed-pilose beneath specially on the midrib and lateral nerves, finally ± glabrescent with some scattered persistent hairs along the midrib beneath, rarely glabrous, entire or slightly shallow-crenate, (7¹/₂–)8¹/₂–15(–20) by 3¹/₂–7¹/₂(–8¹/₂) cm; midrib flat or a little grooved above, very prominent beneath; nerves 5–6, rarely more, turning red when dry, very prominent beneath, veins reticulate on both sides, specially beneath; petiole mostly stout and pilose. *Cymes* few-branched, (4–)6–8-flowered. Pedicels 5–8 mm, ± rusty-puberulous. *Sepals* green-white, suborbicular to elliptic, laxly pilose or nearly glabrous outside, glabrous inside, 6–7 by 4 mm. *Petals* ovate or broadly-oblong, 4–5 by 3 mm; scales nearly glabrous, erose, ciliate at the apex, 2¹/₂ mm. ♂ *Flowers:* stamens (20–)24–32(–35). ♀ *Flowers:* staminodes *c.* 17. *Ovary* ovoid, glabrous, sulcate; stigmas 4, oblong, reflexed. *Fruit* globose, smooth, *c.* 6¹/₂ cm diam., green (dark when dry), with thick pericarp.

Distr. *Malaysia:* Sumatra, Riouw, Malay Peninsula (rare: Perak, Selangor, Pahang), Borneo.

Ecol. Growing scattered on hilly, never inundated soil on sandy or clayey ground, mostly at low altitudes, in S. Sumatra up to 700 m.

Uses. Wood dull brown, rather hard, but not heavy, attacked by various insects, therefore used only where it is not in contact with the soil.

Vern. *Sĕtumpol*, Pahang, *kaju tanah*, Palemb., *gambir-gambir*, Karo, *banio-djirak*, *tulang bĕliung*, *tiga urat, babi kurus, tan liese, kĕrambil tupai, daru-daru, situmpol, sanumpol, pangin djaong,* M.

var. **tomentosa** (KING) SLEUM. Bot. Jahrb. 69 (1938) 25.—*Taraktogenos tomentosa* KING, J. As. Soc. Beng. 59, ii (1890) 123.—*Taraktogenos kunstleri* KING *var. tomentosa* (KING) RIDL. Fl. Mal. Pen. 1 (1922) 163.

Leaves more densely and persistently rufous-tomentose, specially underneath.

Distr. *Malaysia:* Malay Peninsula (Perak, Selangor, Kemaman, Pahang, Johore).

Vern. *Sĕtumpol,* Selangor, *mĕdang pĕrdam,* Pahang.

5. Hydnocarpus pinguis SLEUM. Blumea 7 (1954) 493.

High tree, glabrous; branchlets nigrescent. *Leaves* (oblong-)elliptic, ± abruptly obtusely acuminate (rarely subrotundate) at the apex, ± rounded at the base, inequilateral, thick-coriaceous, shining, entire, (11–)13–18 by (5–)7–10(–12) cm; midrib and lateral nerves reddish when dry, midrib ± flat above, very prominent beneath, lateral nerves 6–7 pairs, subcurvate, prominent specially beneath, veins laxly transverse and reticulate, raised on both sides; petiole very stout, 2–3 mm diam., thickened at apex and base, grooved by numerous transverse linear lenticels. *Cymes* short, on a thick, 5 mm long peduncle, nearly glabrous, not yet known in full developed state. ♂ *Flowers:* very similar to those of *H. kunstleri.*—♀ *Flowers* and *fruit* unknown.

Distr. *Malaysia:* Borneo (Sarawak, near Kuching), once found.

6. Hydnocarpus kurzii (KING) WARB. *ssp.* **australis** SLEUM. Bot. Jahrb. 69 (1938) 23.—*H. castanea* (*non* HOOK. *f.* & TH.) J. F. ROCK, U. S. Dep. Agr. Bull. *no* 1057 (1922) 12, pl. 3; GILG, in E. & P. Pfl. Fam. ed. 2, 21 (1925) 408, f. 177.—*Taraktogenos kurzii* (*non* KING) CRAIB, Fl. Siam. En. 1 (1925) 97; FISCHER, Kew Bull. (1927) 97, *p.p.*

Tree 12–20(–30) m; bark smooth; young branchlets fulvous-pubescent, rather soon glabrescent. *Leaves* lanceolate-oblong, shortly subacutely acuminate, cuneate at the base, equilateral, subcoriaceous, somewhat shining, olivaceous when dry, entire, glabrous, 15–22 by 4–6$^1/_2$ cm; midrib little prominent above, distinctly so beneath, nerves 7–8(–9) pairs, suberect, other interjacent ones ± distinct, veins transverse, reticulation prominent beneath; petiole 1.2–1.6 cm, thickened at the apex, glabrous. Stipules not seen, probably early caducous. *Cymes* abbreviated, 5–7(–9)-flowered, rather densely fulvous-substrigose-pubescent in all parts; peduncle 0.4–1(–1$^1/_2$) cm. Pedicels somewhat thickened, $^1/_2$–1 cm. ♂ *Flowers: sepals* ovate-rotundate, fulvous-pubescent outside, 5 by 4 mm. *Petals* broadly ovate, obtuse, ciliate; scales fleshy, densely ciliate, *c.* 2 mm. Stamens (15–)18–25(–30); anthers elongate-cordate. ♀ *Flowers* in few-flowered cymes. Pedicels 1$^1/_2$ cm. Sepals and petals a little larger than in the ♂ flowers. Staminodes 10–16. *Ovary* elliptic, 6–7-sulcate, fulvous-tomentose. *Fruit* globose, rugose, (5–)8–10 cm diam.; peduncle thick, *c.* 0.6 cm. *Seeds* angular-ovoid, *c.* 3 by 1$^1/_2$ cm.

Distr. N. Siam and Lower Burma (southwards to Tavoy), in *Malaysia:* Malay Peninsula (Pahang: base Kota Gelanggi, HENDERSON SF 22417, with ripe fruit; near the Gap, SYMINGTON For. Dep. F.M.S. 45009, Herb. SING.).

Note. It would be of interest to get flowering material to confirm the determination, *H. kurzii* being the true chaulmoogra-tree.

'*H. castanea* with fruits 3 in. long' mentioned by RIDLEY (Trans. Linn. Soc. II, 3, 1893, 276) from the banks of Tahan River, may belong here.

7. Hydnocarpus calophylla (RIDL.) SLEUM. Bot. Jahrb. 69 (1938) 26.—*Taraktogenos calophylla* RIDL. in HOOK. Ic. Pl. V, 2 (1932) t. 3167.

Shrub or mostly small tree up to 6 m; branchlets angular, puberulous, soon covered with a greyish bark. *Leaves* elliptic-oblong to oblong-cuspidate (1$^1/_2$–2$^1/_2$ cm), cuneate at the base, nearly equilateral, coriaceous, glabrous, a little rough to the touch when younger, ± shining, olivaceous above, brown beneath when dry, (18–)30–40 by (7–)9–13 cm; midrib and nerves rather flat above, manifestly prominent beneath. Stipules elongate-triangular, 6–10 mm, subpersistent. *Cymes* few-flowered, with a thick peduncle up to 1 cm, densely covered with persistent, ovate, densely fulvous-pilose bracts. Pedicels stout, 1–1$^1/_2$ cm, fulvous-puberulous. *Sepals* ovate, chartaceous, ± fulvous-pilose outside, 8 by 5 mm. *Petals* oblong, 4 by 3 mm; scales nearly orbicular, thick, whitish-hirsute. ♂ *Flowers:* stamens *c.* 20; anthers subcordate-oblong, 3–4 mm. ♀ *Flowers:* sepals and petals as in the ♂ flowers but slightly larger (10–11 by 6–7, respectively 6 by 2$^1/_2$ mm). Staminodes *c.* 17, anthers half as long as in the ♂ flowers. *Ovary* ellipsoid, angular at the base, ribbed, fulvous-tomentose, with 4 radiate stigmas. *Fruit* green, not yet known in ripe state, fusiform, at least 4 by 2 cm, on a stout peduncle 1$^1/_2$ cm long.

Distr. *Malaysia:* Borneo (Sarawak).

Ecol. In old jungle on slopes above streams.

8. Hydnocarpus tenuipetala SLEUM. Blumea 7 (1954) 494.

Small tree; young branchlets rather soon covered with a light-brown, older ones with a grey bark. *Leaves* elliptic-oblong or subovate-oblong, abruptly and shortly (1 cm) subacutely acuminate, rounded at the base, equilateral, thickly coriaceous, brown when dry, paler beneath, glabrous (only young ones sparsely pilose on midrib and lateral nerves beneath), entire, (8–)11–14 by 4$^1/_2$–6$^1/_2$ cm; midrib and nerves little prominent above, distinctly so beneath, the latter arcuate-ascending along the margin, dark when dry, veins distantly transverse, forming with the venules a rather lax net prominent on both sides; petiole 2 mm diam., rugose, 6–8 mm. *Cymes* few-flowered; peduncle thick, rufous-puberulous, 3–5 mm. Bracts several, ovate. Pedicels nearly glabrous, 3 mm. *Sepals* ovate-rotundate, concave, firmly membranous, *c.*

4 mm diam. *Petals* thin, broadly ovate, glabrous, fimbriate at the apex, with a thick, fleshy, hirsute scale nearly as big as the petals. ♂ *Flowers:* stamens *c.* 14; filaments slender, dilated at the base, $2^1/_2$–3 mm. ♀ *Flowers* and *fruits* not yet known.

Distr. *Malaysia:* Borneo (Sarawak), once found.

9. Hydnocarpus wrayi King, J. As. Soc. Beng. 59, ii (1890) 121; Ann. R. Bot. Gard. Calc. 5 (1896) 130, t. 150; Ridl. Fl. Mal. Pen. 1 (1922) 161; Sleum. Bot. Jahrb. 69 (1938) 27.

Small tree *c.* 8 (rarely up to 15) m; young branchlets puberulous, soon glabrescent. *Leaves* elliptic-oblong to oblong, 1–$1^1/_2$ cm cuspidate at the apex, nearly rounded or broadly cuneate at the base, ± inequilateral, subcoriaceous to coriaceous, entire, glabrous and somewhat shining above, pubescent on midrib and primary nerves beneath, (15–)20–25 by ($6^1/_2$–)$8^1/_2$–$12^1/_2$ cm; nerves suberect, very prominent beneath, veins manifestly transverse, reticulations prominent on both sides; petiole stout, $1^1/_4$ cm. ♂ *Flowers* in few-flowered, small, short-peduncled cymes. Pedicels *c.* 4 mm. Sepals subrotundate, pubescent outside, *c.* 6 mm diam. Petals broadly oblong, glabrous; scales erose, hirsute. Stamens 15–17. ♀ *Flowers:* solitary or in twos; peduncle thick, glabrous, *c.* 7 mm. Sepals as in the ♂ flowers. Petals suborbicular, $2^1/_2$ mm diam.; scale subquadrate, $1^1/_2$ mm. Staminodes *c.* 17. *Ovary* depressed-ovoid, densely fulvous-pilose, with a 5-lobed stigma. *Fruit* green, ± narrow-ovoid-elliptical, tapering to both ends, 7–8(–10) by 4–$5^1/_2$ cm, minutely fulvous-velvety, slightly longitudinally costate at the apex, crowned by 5 thick, large, separate, lignescent stigmas, many-seeded; peduncle $1^1/_2$–2(–$2^1/_2$) cm long, 6–7 mm diam. *Seeds* elongate, plano-convex, *c.* 2 cm.

Distr. *Malaysia:* Malay Peninsula (Perak; possibly also in Pahang), Borneo (Sarawak).

Ecol. In lowland forests, apparently rare.

2. Section Hydnocarpus

Sect. Euhydnocarpus Warb. in E. & P. Pfl. Fam. 3, 6a (1893) 21; Sleum. Bot. Jahrb. 69 (1938) 30.

Sepals 5. Petals 5.

1. Subsection Oliganthera

Warb. *l.c.*; Sleum. *l.c.*

Stamens 5.

10. Hydnocarpus subfalcata Merr. Philip. J. Sc. 4 (1909) 297; En. Philip. 3 (1923) 107; Perk. & Cruz, Philip. J. Sc. 23 (1923) 549, t. 1, f. 1 (fr.); Sleum. Bot. Jahrb. 69 (1938) 57.—*H. ovoidea* Elm. Leafl. Philip. Bot. 4 (1912) 1514.—*H. quadrasii* Elm. *l.c.* 1515; Merr. En. Philip. 3 (1923) 107.—*H. setumpul* Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 308, f. 3; Sleum. Bot. Jahrb. 69 (1938) 47.—**Fig. 6.**

Tree 5–15(–20–30) m; young branchlets ± densely rusty-pubescent. *Leaves* ovate-oblong or oblong, rarely ovate or lanceolate-oblong, sometimes subfalcate, ± abruptly subcaudate-acuminate, ± inequilateral at the base, one side cuneate, the other subrotundate, subcoriaceous, glabrous and shining above, pubescent at the midrib, dull and laxly covered with minute, appressed, simple hairs (well visible only with a lens) all over the undersurface, more distinctly pubescent on the midrib and primary nerves, $7^1/_2$–14(–16) by 3–6 (–8) cm, obscurely and distantly serrate or mostly ± entire; midrib and nerves little raised above, very prominent beneath, veins ± transverse, reticulations ± obscure; petiole ± pubescent, 5–7(–10) mm. ♂ *Cymes* obscurely branched, *c.* 5 mm peduncled, all over finely rusty-pubescent, few-flowered. Pedicels rather slender, 3–5(–8) mm. *Sepals* ovate, 2–3 by 2 mm, the inner 2 slightly smaller. *Petals* ovate-orbicular, membranous, ciliate, elsewhere glabrous, 2–$2^1/_2$ mm diam.; scales orbicular, pilose on both sides, $1^1/_2$ mm diam. Filaments subulate, thick, glabrous, $1^1/_2$ mm. ♀ *Flowers* 2–4, very shortly peduncled. Pedicels 6–8 mm. Sepals and petals similar to those of the ♂ flowers, but slightly larger 4–5, resp. 3–$3^1/_2$ mm long. Staminodes subulate-triangular, 2 mm; anthers 0. *Ovary* ovoid, rufous-tomentose; stigmas 3–5, rather narrow, radiate. *Fruit* ovoid, rarely subglobose, always ± attenuate at apex and base, obtuse, *c.* $3^1/_2$(–6) by *c.* $2^1/_2$ cm, inside and outside rusty-tomentose, with 2–4(–7) seeds. *Seeds* ovoid, variously compressed, *c.* $1^1/_2$ by 1 cm; pericarp rather thin, fragile.

Distr. *Malaysia:* S. Sumatra (Palembang), Borneo (Sarawak), Philippines (Luzon, Sibuyan, Samar, Mindanao).

Ecol. In thickets and forests on level, never inundated clayey ground, 15–25 m. *Fl.* March–May, *fr.* Oct.–Dec.

Vern. *Sĕtumpul,* M; Philippines: *amitan,* Ibn., *apanang,* C. Bis., *dalinias, putian,* Sbl., *damol,* S. L. Bis., *lagtang,* P. Bis., *ñgeret,* Tag., *pai,* Pang.

11. H. merrilliana Sleum. Bot. Jahrb. 69 (1938) 50, *nec* Li, J. Arn. Arb. 24 (1943) 446 (Kwangsi).

Large glabrous tree; branchlets slender. *Leaves* oblong to lanceolate-oblong, slightly curved and shortly acuminate at the apex, broadly attenuate at the base, somewhat inequilateral, subcoriaceous entire, 12–15 by $4^1/_2$ cm; midrib prominent on both sides, nerves 5–6 pairs, curved-ascending, little but distinctly raised on both sides, veins rather densely reticulate; petiole 8–10 mm. Stipules not seen. ♂ *Flowers:* few-flowered cymes; peduncle 8 mm, ferrugineous-tomentose as are the pedicels,

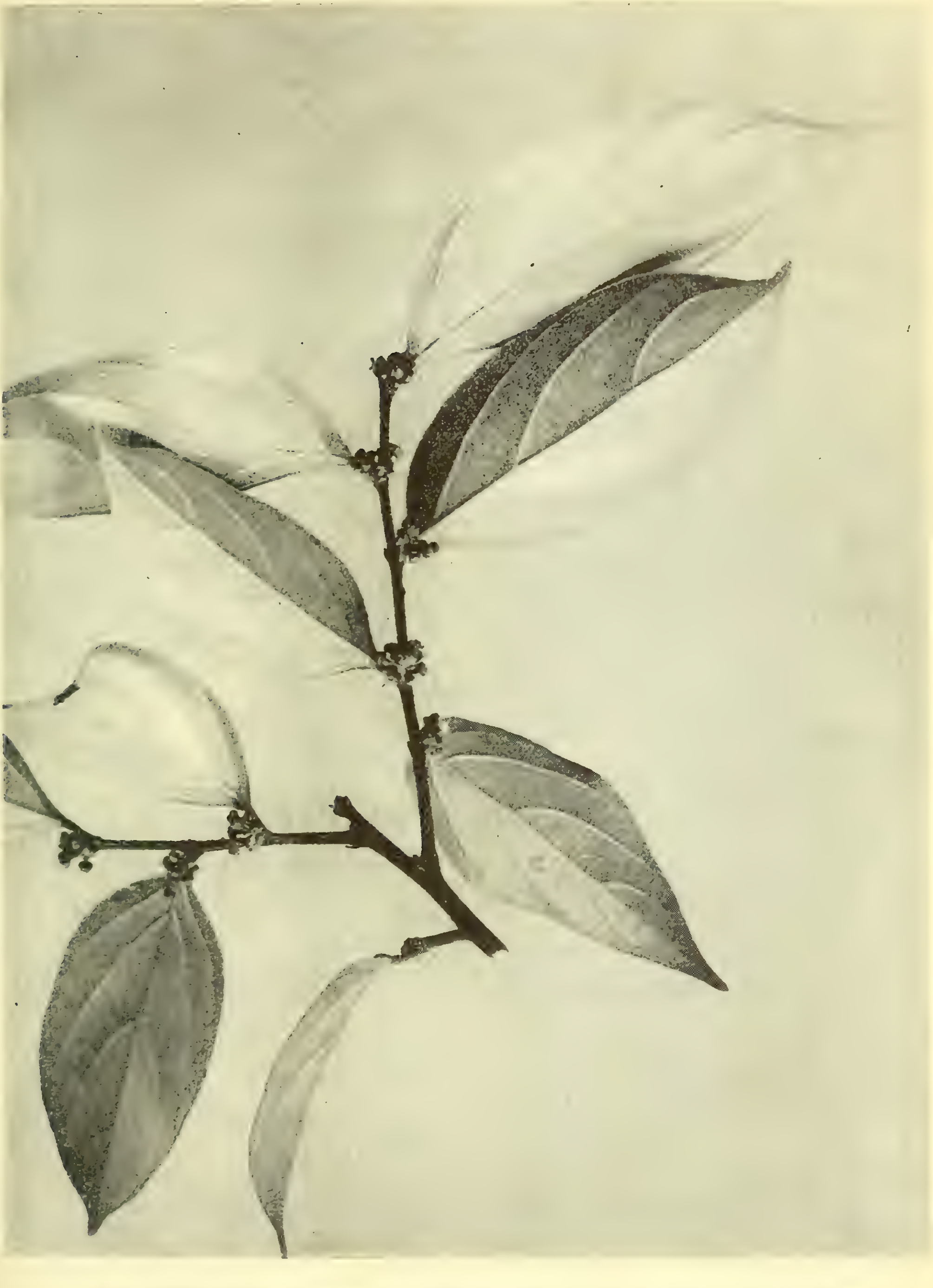

Fig. 6. *Hydnocarpus subfalcata* MERR. Flowering twig, showing underside of leaves. × ¾
(C.H.B. IV–F–49).

the latter 7–8(–12) mm. *Sepals* orbicular-ovate, densely ferrugineous-pilose outside, 4 by 3¹/₂ mm. *Petals* broadly oblong, membranous, glabrous, 4 mm; scales oblong, 3¹/₂ by 1¹/₂ mm, fleshy, ciliate, elsewhere glabrous. Filaments and anthers each 1¹/₂ mm long. ♀ *Flowers* and *fruit* unknown.

Distr. *Malaysia:* Sumatra (East Coast), once found. Possibly also further south in the Kuantan Districts, judging from sterile material.

Vern. *Situmpul,* M.

Note. Very near to *H. glaucescens* and possibly only a glabrous form of it.

12. H. yatesii MERR. Philip. J. Sc. 29 (1926) 402; Pap. Mich. Acad. Sc. 19 (1934) 174; SLEUM. Bot. Jahrb. 69 (1938) 49.

Tree *c.* 8 m; branchlets first covered with a dense, rusty-stellate tomentum, glabrescent. *Leaves* oblong, ± abruptly acuminate, attenuate at base, distinctly inequilateral, chartaceous to subcoriaceous, glabrous and shining above, dull and minutely stellate-pubescent on the midrib and nerves beneath, entire, (7–)12–17 by (3–)5–7 cm; midrib and lateral nerves little prominent above, distinctly so beneath, veins ± transverse, reticulations little distinct on both sides; petiole pubescent, 8–10(–14) mm. Stipules lanceolate, acuminate, densely rusty-stellate-pubescent, 8–10 by 2 mm, rather early caducous. ♂ *Cymes* depauperate, all over rusty-stellate-pubescent; peduncle 5–8 mm, 2–4(–6)-branched at the apex, branches curved, up to 7 mm, each bearing 4–6 biseriate flowers. Pedicels 3–4 mm. *Sepals* orbicular-ovate, outer ones 1¹/₂–2 mm, inner ones slightly larger. *Petals* suborbicular, membranous, 2¹/₂ mm diam., ciliate, rusty-pubescent on the back; scales broad-obovate, thick, densely pubescent on both sides, 1–1¹/₂ mm. Filaments thickened at the base, glabrous, 1¹/₂ mm; anthers reniform, 0.6 by 1 mm. ♀ *Flowers* not yet known. *Fruit* oblong-cylindric, obtuse and obscurely 5-angled at the apex, covered with minute, irregular tubercles and a very short rusty-velvety tomentum, 9–11 by 4–5 cm. *Seeds c.* 18, 2–2¹/₂ cm long.

Distr. *Malaysia:* Sumatra (East Coast, E. Tapanuli).

Ecol. Lowland rain-forests, along creeks, rare and scattered, up to 450 m.

Vern. *Kaju si deppoh, k. golom lisak,* Tapanuli, *djilok,* Sum. E.C.

13. Hydnocarpus glaucescens BL. Rumphia 4 (1848) 22; Mus. Bot. 1 (1849) 15; MIQ. Fl. Ind. Bat. 1 (1859) 110; *ibid.* Suppl. 1 (1860) 159; SLOOT. Bijdr. Flac. (1919) 63; Bull. Jard. Bot. Btzg III, 7 (1925) 308, SLEUM. Bot. Jahrb. 69 (1938) 48.—*H. setumpul* (*non* SLOOT.) BAK. *f.* J. Bot. 64 (1926) Suppl. 142.

Tree 10–25 m; young branchlets laxly appressed-rusty-pilose, older ones glabrous, angular. *Leaves* oblong, shortly acuminate at the apex, very inequilateral at base (cuneate at the narrower side, rounded at the wider one), coriaceous or nearly so, glabrous and shining above, opaque and glaucescent beneath, ± distinctly serrate, 12–25 by (5–)6–8 cm, lateral nerves nearly plane above, little but visibly raised beneath, veins transverse, numerous, slightly reticulate; petiole ± laxly covered with appressed hairs, 1¹/₂–2 cm long. Stipules not seen, probably very early deciduous. ♂ *Cymes* 0.6–1 cm peduncled, very shortly branched, 6–8-flowered, rather densely covered with appressed, nearly strigose ferrugineous hairs; pedicels 2–4 mm. *Sepals* ovate-rotundate, obtuse, pubescent outside, glabrous inside, green. *Petals* elliptic, minutely erose and ciliate at the apex, elsewhere laxly pubescent, 2¹/₂ mm across; scales ovate, thick, densely rufous-pilose on both sides, specially inside, 2 mm, slightly divided at the apex. Anthers reniform, 1¹/₄ mm wide; filaments subulate, very thickened at the base, glabrous, 1 mm. ♀ *Flowers* not yet known. *Fruit* subglobose-ovoid, markedly contracted at the apex, *c.* 1¹/₂ cm, 'umbonate' with 5 vertical grooves, *c.* 7 by 5 cm, dark-brown- or rusty-velvety with many light dots; peduncle woody, 0.8–1.5 by 0.9 cm.

Distr. Sumatra (Atjeh to Padang Highlands, Lampongs).

Ecol. In primary forest on never inundated hilly ground and clayey soil, rather rare and scattered, up to 600 m.

Vern. *Langsat,* Atjeh.

14. Hydnocarpus nana KING, J. As. Soc. Beng. 59, ii (1890) 118, incl. *var. pubescens* KING, *l.c.* 119; Ann. R. Bot. Gard. Calc. 5 (1896) 128, t. 147; RIDL. Fl. Mal. Pen. 1 (1922) 159; BURK. & HENDERS. Gard. Bull. Str. Str. 3 (1925) 346; *ibid.* 4 (1928) 223; SLEUM. Bot. Jahrb. 69 (1938) 37.

Shrub or small tree, up to 6 m, stem 5–7 cm across; branchlets rusty-pilose. *Leaves* subovate-oblong to lanceolate-oblong, ± elongate-acuminate and slightly curved at the apex, ± rounded at the base, inequilateral, chartaceous to subcoriaceous, glabrous above except the midrib and nerves, rusty-pilose beneath specially on the midrib and nerves, but sometimes nearly entirely glabrescent, 6¹/₂–12¹/₂ by 2–4(–6) cm, mostly distinctly (1 mm) serrulate; midrib and nerves slightly raised or a little impressed above; nerves 5–8 pairs, curved-ascending, mostly manifestly prominent beneath as is the midrib, veins ± transverse, not or only obscurely reticulate; petiole pubescent, 3–5(–8) mm. Stipules subovate-lanceolate, acute, 5–7 mm, pubescent, finally caducous. ♂ *Flowers* in few-flowered, 2-branched cymes; peduncle ¹/₂ cm, flowering branches each with 3–4 biseriate, white flowers. Pedicels slender, *c.* 3 mm. *Sepals* rounded, 2 mm diam.. *Petals* oblong, 1¹/₂ mm long, somewhat fleshy, sericeous outside by rather longish white hairs; scales oblong, half as long as the petals. Filaments thick, 1 mm, laxly pilose. ♀ *Flowers* solitary, supra-axillary; pedicels *c.* 1 cm. Sepals and petals as in the ♂ flowers. *Ovary* ovoid, yellowish-tomentose. *Fruit* globose, somewhat apiculate, minutely rugose, brownish-greenish-velvety 2¹/₂–3¹/₂ cm diam.; peduncle *c.* 1 cm; pericarp thin, fragile. *Seeds* (2–)3–4, plano-convex, 1¹/₄ cm long.

Distr. *Malaysia:* Malay Peninsula (Penang, Perak, Selangor, Pahang, Kemaman, Johore, Kedah, Wellesley).

Ecol. Forests on hilly ground, 100–650 m.

Vern. *Alai*, M.

15. Hydnocarpus elmeri MERR. Pl. Elm. Born. (1929) 207; SLEUM. Bot. Jahrb. 69 (1938) 53.

Small tree up to 18 m; young branches angular, initially slightly ferrugineous-pubescent, glabrescent. *Leaves* oblong or ovate-oblong, shortly obtusely acuminate or cuspidate, cuneate to rotundate at the base, mostly distinctly inequilateral, chartaceous to subcoriaceous, brown when dry, shining above, dull beneath, glabrous or slightly pubescent on the midrib and nerves, 7–20 by 3½–8 cm; nerves 7–8 pairs, little prominent above, markedly so beneath, veins ± transverse and little prominent on both sides, reticulations rather lax; petiole 8–15 mm. Stipules ovate-lanceolate, pubescent, 7–8 by 2 mm, rather soon caducous. ♂ *Flowers* in dense, sessile, supra-axillary clusters, densely rusty-pubescent all over. Pedicels 1–3 mm. *Sepals* ovate-elliptic, obtuse, 2 by 1½ mm. *Petals* obovate, white, *c.* 1 mm long, densely rufous-papillose on both sides; scales minute, densely white-pilose, reddish when dry. Filaments fleshy, densely ferrugineous-papillose, hardly 1 mm. ♀ *Flowers* unknown. Young fruit subglobose, ferrugineous-tomentose, with 3 bifid, reflexed stigmas. *Fruit* globose, 4–5 cm diam., sordidly yellow-green, rufo-tomentose-punctate, with thin fragile pericarp; peduncle thick, 5 mm. *Seeds* 1–3, oblong-trigonous, 2½–3 by 1½ cm; testa striate-maculate.

Distr. *Malaysia:* Br. N. & SE. Borneo.

Ecol. Primary forest on hilly ground, 130–200 m.

Vern. *Malantidang*, M.

16. Hydnocarpus alcalae C. DC. Philip. J. Sc. 11 (1916) Bot. 37; MERR. En. Philip. 3 (1923) 107; SANTOS & WEST, Philip. J. Sc. 40 (1929) 485; TOLENTINO-VALLARTA, Nat. & Appl. Sc. Bull. Univ. Philip. 5 (1936) 27; SLEUM. Bot. Jahrb. 69 (1938) 55, 78; BROWN, Useful Pl. Philip. 2 (1950) 507, f. 237; QUIS. Med. Pl. Philip. (1951) 628.

Tree, 4–7 m, or shrub; branchlets glabrous. *Leaves* ovate-oblong, acuminate at the apex, very inequilateral at base, subcoriaceous, firm, shining, olivaceous when dry, glabrous, entire or shallow-crenate, 15–25 by 7–11 cm; midrib little prominent above, markedly raised beneath, lateral nerves prominent beneath, veins transversal, reticulations distinct but little raised; petiole stout, glabrous, *c.* 1 cm. Stipules not seen. *Flowers* in pseudo-racemose, glabrous panicles, ♂ in fascicles of 3 or 4, ♀ solitary from the trunk or big branches, each panicle 15–30(–60) cm long, with very distantly arranged, reduced cymes; cymes subsessile to 1–2 mm long, peduncled, bearing 2–4 fascicled flowers on top. Pedicels 1¼–2 cm. ♂ *Flowers: sepals* ovate, greenish, 1¼ by ¾ cm. *Petals* elliptic, greenish-white or cream, villose at margin, *c.* 0.8 by 0.6 cm; scales ovate, densely white-pilose specially at the apex, glabrous near the base, fleshy, 5 by 3½ mm. Filaments *c.* 10 mm, thickened at the base, glabrous; anthers cordate-oblong, 5 by 3 mm. ♀ *Flowers:* similar to the ♂ ones, but slightly larger. Pedicels 1¼–4 cm. *Sepals* 1¼–2 by 1–1½ cm. *Petals* 1.1–1.2 by 0.8–1 cm. Filaments 7–8 mm; anthers sterile, 2–3 mm. *Ovary* elliptic, yellowish stellate-velvety; stigmas 5–7, slightly stellate-pubescent. *Fruit* very large, obovoid, pendent, 15–31 by 8–15(–20) cm, dark-brown with purple and greenish spots, somewhat rugose, reticulate by numerous fissures when dry. *Seeds* 80–110, subglobular-ellipsoid, 3–5 by 2½–3 cm, polyedric, with a light-yellow aril, embedded in a fragrant, adstringent pulp.

Distr. *Malaysia:* Philippines: S. Luzon (Albay Prov.), now planted and naturalized on Mt Maquiling (Laguna Prov.) and elsewhere.

Ecol. Damp ravines at low altitudes.

Uses. This species possesses the largest fruits known in the genus. The oil extracted from the seeds yields chaulmoogric and hydnocarpic acid and is used by the Filipinos as a good cure for wounds.

Vern. *Dúdu* or *dudóa*, Bik.

17. Hydnocarpus cauliflora MERR. Philip. J. Sc. 9 (1914) 323; En. Philip. 3 (1923) 107; SLEUM. Bot. Jahrb. 69 (1938) 56.

Small tree, glabrous, the inflorescences excepted. *Leaves* broadly oblong to ovate-oblong, shortly acuminate at the apex, attenuate to cordate-rounded at the base, chartaceous or subcoriaceous, shining on both sides, entire, 23–30 by 9–12 cm; nerves prominent and conjunct along the margin, veins ±transverse, reticulations little prominent. *Raceme-like panicles* from the trunk fulvous-tomentose all over, 5–15 cm. ♂ *Flowers:* pedicels stout, 3 mm, subtended by an attenuate-oblong bract, 2 mm long. *Sepals* rounded, villose, 5 mm. *Petals* elliptic, rounded at the apex, thinner than the sepals, 3 mm, laxly appressed pilose outside; scales 1 mm, slightly lobed. Filaments 1½ mm; anthers ovate, 1–1.2 mm. ♀ *Flowers* unknown. *Fruit* globose, *c.* 8 cm across, with several compressed, ovoid seeds, 2 by 1½ cm; pericarp rather fragile.

Distr. *Malaysia:* Philippines: Mindanao (Cotabato Prov.).

Ecol. In primary *Dipterocarp*-forest at low altitude.

18. Hydnocarpus cucurbitina KING, J. As. Soc. Beng. 59, ii (1890) 120; Ann. R. Bot. Gard. Calc. 5 (1896) 129, t. 149; RIDL. Fl. Mal. Pen. 1 (1922) 161; SLEUM. Bot. Jahrb. 69 (1938) 34.

Tree 20–25 m; branches spreading, hanging, innovations ferrugineous-pubescent. *Leaves* oblong or elliptic-oblong, ± abruptly and obtusely subfalcate-acuminate, cuneate at the base, subcoriaceous, entire, rather shining, 8½–12½ by 3½–5½ cm; nerves arcuate, as the veins slightly but distinctly prominent. ♂ *Inflorescence* subcymose, ferrugineous-tomentose, 1–1½ cm peduncled, 3–6-branched. Pedicels 8 mm. *Sepals* ovate, ferrugineous-pubescent outside, *c.* 3½ by 1½–2 mm. *Petals* ovate-rounded, pale green, glabrous, membranous; scales fleshy, ciliate, nearly as large as the petals. Filaments short, nearly conical, 1½ mm; anthers ovate-cordate, 2 mm. ♀ *Flowers* solitary or in twos. Pedicels shorter, but sepals and petals similar as in the ♂ flowers. *Ovary* subcylindrical, glossy ferrugineous-tomentose. *Fruit* narrow-obovoid or cylindrical, mamillate at the apex, contracted at the base, pale green when fresh, dark brown when dry, glabrescent, 7½–1½ by 2½ cm; peduncle thick, *c.* 2½ cm. *Seeds* few, *c.* 2½ cm long.

Distr. *Malaysia:* Malay Peninsula (Perak: Goping).

Ecol. Open jungle, 150–350 m.

19. Hydnocarpus beccariana SLEUM. Bot. Jahrb. 69 (1938) 50.

Tree, young branches rather terete, slender, glabrous. *Leaves* oblong-ovate, gradually acuminate, cuspidate and acute at the very tip, rounded at the base, somewhat inequilateral, coriaceous, glabrous, entire, brown and shining when dry, (9–)12–18 by 3½–5½ cm; midrib prominent on both sides, nerves 9–10 pairs, curved-ascending towards the margin, little prominent above, more so beneath, veins densely reticulate and prominent on both sides, specially beneath; petiole 6–8 mm, very thickened at the apex, rugose. Stipules not seen. ♂ *Flowers* in 2–3-flowered dichasia; peduncle 0.6–1.3 cm. Pedicels rather thick (1–)1½–2½ cm, as the sepals ferrugineous-velvety by stellate hairs. *Sepals* broadly-oblong, 1.2–1.5 by ½–0.6(–0.8) cm, inside rubescent and greyish-sericeous. *Petals* oblong, purpurascent when dry, glabrous, fleshy, 1–1.3 by 0.4–0.5 cm, each including a fleshy, oblong, densely pilose scale nearly as long as the petals, but much narrower. Filaments slender, somewhat broadened at the base, glabrous, 5 mm; anthers oblong, 5–6 by *c.* 2 mm. ♀ *Flowers* not known. *Fruit* solitary, oblong to subovoid-oblong, slightly narrowed at the base, very attenuate at the apex, 1.5–2 by 0.6 cm, densely minutely tuberculate, rusty-velvety, 8 by 3 cm; peduncle 0.8 by 0.7 cm; pericarp rather thin. *Seeds c.* 10, variously angular, 1.2 by 1 cm.

Distr. *Malaysia:* Borneo (Sarawak: Kuching), once found.

20. Hydnocarpus borneensis SLEUM. Bot. Jahrb. 69 (1938) 52; AIRY SHAW, Kew Bull. (1949) 158.—*H. hutchinsonii* (*non* MERR. 1920) MERR. Pl. Elm. Born. (1929) 207.

Tree, (4–)10–18(–30) m; young branchlets initially covered with rusty, fascicled and simple hairs, soon glabrescent. *Leaves* oblong to broadly-oblong, ± abruptly acuminate, mostly inequilateral at the base, subcoriaceous, first laxly fasciculate-pilose on midrib and nerves, specially beneath, later glabrous, shining and olivaceous or brown above when dry, dull red-brown beneath, 15–30 by 6–9 cm; midrib little prominent above, manifestly so beneath, nerves mostly a little impressed above, very prominent beneath, reticulations distinct only beneath; petiole 1–1½ cm. Stipules ovate-lanceolate, 7 by 2 mm, pubescent, rather early caducous. *Cymes* rusty-tomentose all over, reduced to (2–)3 or 4 'white and yellow' or greenish-white, fragrant flowers; peduncle 3–6 mm only, stout. Pedicels of the ♂ flowers rather slender 1½–2 cm, those of the ♀ ones shorter and stouter, *c.* 5 by 2 mm. *Sepals* ovate, 10–12 by 6 mm, finely and densely ferrugineous-tomentose outside, greyish-pubescent inside. *Petals* white to yellowish, oblong, rather dark-purple when dry, glabrous, involute, 12–15 by 4 mm; scales lanceolate, 10 by 2 mm, pilose towards the apex. ♂ *Flowers:* filaments thick, elongate-triangular, 5 mm; anthers oblong-subsagittate, 5 mm. Rudiment of ovary hirsute. ♀ *Flowers:* filaments deltoid, 1½ mm, fleshy; anthers 0. *Ovary* elongate-ovoid, yellowish-tomentose, cylindrically contracted towards the apex; stigma nearly peltate, lobes very short. *Fruit* depressed-ovoid or bottle-shaped, contracted at the apex or apiculate, fulvous-tomentose, 6–8 by *c.* 4 cm when fully developed, upper attenuate part 1–1½ cm long; pericarp thin. *Seeds* 8–10, *c.* 2 cm across.

Distr. *Malaysia:* Borneo (Br. N. Borneo; Sarawak: Mt Dulit).

Ecol. In primary *Dipterocarp*-forest at low altitudes in hilly or steep localities.

Uses. Wood hard.

Vern. *Andara*, *madansat*, Kwijau, *pasir-pasir*, *nangka-nangka*, M, *ĕmpupuak*, Dusun.

21. Hydnocarpus filipes SYMINGTON & SLEUM. Bot. Jahrb. 69 (1938) 40.

Tree; young branchlets slender, angular, glabrous or nearly so, brownish. *Leaves* oblong, subcaudate-acuminate (1–2 cm), cuneate at the base, slightly inequilateral, chartaceous to subcoriaceous, glabrous, olivaceous above and brown beneath when dry, entire, 9–14(–20) by 3–5½(–7½) cm; midrib raised above, very prominent beneath, nerves 6(–7) pairs curved-ascending, veins rather densely reticulate and prominent on both sides; petiole slender, thickened at the apex, 1–1.6 cm, dark when dry. Stipules not seen. Flowers always solitary. Pedicels 2–2½(–3) cm, filiform, laxly fulvous-tomentose. ♂ *Flowers: sepals* oblong, ferrugineous-velvety on both sides, 8–10 by 4 mm. *Petals* elongate-oblong, purpurascent when dry, glabrous, 11–13 by 3 mm; scales narrow-oblong, pilose at the apex, 6–7 by 1½ mm; anthers oblong, 3½ mm; filaments subulate, glabrous, 2½–3 mm. ♀ *Flowers:* sepals and petals similar to those of ♂ flowers, but larger *viz* 5, respectively 5–6 mm wide. Filaments elongate-triangular, 2–2½ mm. *Ovary* ovoid, contracted at the apex, fulvous-tomentose. *Fruit* globose to subglobose, 4–6(–6½) cm diam., fulvous-velvety and provided with minute warts; peduncle 3 cm long, 3–4 mm thick. *Seeds c.* 12.

Distr. *Malaysia:* Malay Peninsula (Selangor, Pahang, Trengganu).

Vern. *Sĕtumpol*, M.

22. Hydnocarpus castanea HOOK. *f.* & TH. Fl. Br. Ind. 1 (1872) 197; KING, J. As. Soc. Beng. 59, ii

18; Kurz, For. Fl. Burma 1 (1877) 77; J. Str. Br. R. As. Soc. *no* 59 (1911) 72; Fl. Pen. 1 (1922) 159; Craib, Fl. Siam. En. 1 1925) 96; Henders. Gard. Bull. Str. Settl. 4 (1926) 93; Sleum. Bot. Jahrb. 69 (1938) 38; Henders. J. Mal. Br. R. As. Soc. 17 (1939) 36.

Glabrous tree, 15–20(–30) m, up to 60 cm diam.; bark pale whitish grey or brownish, smooth; branches stout, angular, smooth, glabrous. *Leaves* elliptic-oblong or oblong, gradually attenuate and rather abruptly acuminate, ± rounded at the base, slightly inequilateral, coriaceous, entire, ± shining, red-brown when dry, (13–)17–30(–35) by (5–)6½–8(–12) cm; nerves 6–7(–8) pairs, curved-ascending, prominent specially beneath, veins ± densely reticulate, little raised above, more distinct so beneath; petiole stout, thickened at both ends, 1½–2 cm. Stipules linear-oblong, rusty-tomentose, 4 mm, very early caducous, leaving pale scars. *Flowers* white, sweet-scented. ♂ *Flowers:* cymes few-flowered, 2–3 mm peduncled or the flowers essentially in fascicles, rusty-pubescent all over. *Sepals* obovate, 6–7 by 4–5 mm, greyish-tomentulose inside. *Petals* narrow-oblong, 8–11 by 3 mm, glabrous; scales linear, 7 by 1½ mm, pilose at the apex. Filaments subulate, glabrous, 2½ mm; anthers oblong-cordate, 2½ mm. Rudiment of the ovary rufous-tomentose. ♀ *Flowers:* pedicels 1½–2½ cm. Sepals and petals similar to those of ♂ flowers, but 8–11 by 5, resp. 12–15 by 3–4 mm; scale 11 mm. Filaments subulate, thick, 2 mm, without anthers. *Ovary* ovoid, contracted into a conical beak, yellowish-tomentose. *Fruit* globose or depressed-globose, (4–)5–6½ cm diam., minutely rugose, rather scurfy, first fulvous-velvety, glabrescent. *Seeds c.* 20–30, densely packed and variously angled, 2.5–3.3 by 1.8–2.5 cm.

Distr. Tenasserim, S. Siam, in *Malaysia:* Sumatra (Asahan), Malay Peninsula (Perak, Kedah, Langkawi, Pahang, Selangor, Dindings, Penang, Malacca).

Ecol. Dense forests, swampy ground, often along small streams, 100–150 m, also on limestone cliff bases. Reported by Henderson (1926) from Frazer Hill (Selangor), at 1100–1200 m (material not seen).

Uses. Wood whitish.

Vern. *Kula*, Pattani, *alai batu*, M, *tĕngkurak lang*, *tĕmbikar periyok*, Kedah, *gĕnggulak*, Perak.

23. Hydnocarpus scortechinii King, J. As. Soc. Beng. 59, ii (1890) 120; Ridl. Fl. Mal. Pen. 1 (1922) 161; Sleum. Bot. Jahrb. 69 (1938) 35.

Glabrous tree. *Leaves* subovate-elliptic-oblong or elliptic, abruptly narrowly caudate-acuminate, rounded at the base, slightly inequilateral, subcoriaceous, shining, entire, 12½–17 by 6½–8½ cm; nerves curved-ascending and little prominent on both sides, veins distinctly and densely reticulate. ♂ *Flowers:* peduncle rusty-tomentose, 1–1½ cm; pedicels *c.* 1.8 cm. *Sepals* oblong-elliptic, obtuse, rusty-velvety outside, greyish-puberulous inside, 8–9 by 4 mm. *Petals* glabrous, purpurascent when dry, 8–9 by 3 mm; scales linear, 5 by 1 mm, ciliate. Filaments conical, 2 mm; anthers oblong, 4 mm. ♀ *Flowers:* solitary, rarely 2. *Sepals* and *petals* similar to those of the ♂ flowers, but slightly larger. Pedicel stout, 2–3 mm. *Ovary* ovoid, subcylindrically attenuate in the upper part, yellowish or greyish-tomentose, slightly 5-ribbed. *Fruit* ovoid, rather glabrous, with 5 longitudinal ribs, 3(–5) by 2½ cm. *Seeds* 2–5, 1½ by 1¼ cm.

Distr. *Malaysia:* Malay Peninsula (Dindings: P. Pangkor).

Note. This species comes nearest to *H. curtisii.*

24. Hydnocarpus curtisii King, J. As. Soc. Beng. 59, ii (1890) 119; Ann. R. Bot. Gard. Calc. 5 (1896) 129, t. 148; Ridl. Fl. Mal. Pen. 1 (1922) 160, f. 18; Rock, U.S. Dep. Agr. Bull. *no* 1057 (1922) 14; Craib, Fl. Siam. En. 1 (1925) 96; Sleum. Bot. Jahrb. 69 (1938) 36.

Tree 5–8 m, rarely shrub, branchlets glabrous. *Leaves* lanceolate-oblong, rarely ovate-oblong, somewhat inequilateral and ± rounded at the base, rather abruptly acuminate at the apex, subcoriaceous, entire, glabrous, shining on both surfaces, (15–) *c.* 20(–30) by 5½–7½ cm; midrib prominent specially below, nerves arcuate, sometimes slightly impressed above, prominent beneath, reticulations rather dense and raised on both sides; petiole 5–10 mm. ♂ *Flowers* in small, few-flowered cymes; peduncle ½–1 cm. Pedicels rusty-puberulous, *c.* 1.9 cm. *Sepals* elliptic-ovate, minutely rusty-pubescent outside, 8 by 4 mm. *Petals* narrow-oblong, nearly glabrous, 1.2 by 0.3–0.4 cm; scales linear, 6 by 1½ mm, nearly glabrous. Filaments 2½ mm; anthers 3½ mm. ♀ *Flowers* subsolitary. Pedicels 6–15 mm. Sepals and petals slightly larger than in the ♂ flowers. *Ovary* elongate-ovoid, fulvous-tomentose, obscurely 5-costate near the apex. *Fruit* subglobose-ovoid, protracted at the apex, slightly 5-sulcate, yellowish-velutinous when dry, 3.7–4 by 2½ cm. *Seeds* 5–6, *c.* 1 cm long.

Distr. S. Siam (Surat), in *Malaysia:* Malay Peninsula (Langkawi, Penang, Pahang, Johore, Negri Sembilan).

Vern. *Kikir buntal*, M.

Note. Differs from *H. sumatrana* only by the smaller fruit; both species have very similar leaves.

25. Hydnocarpus sumatrana (Miq.) Koord. Exk. Fl. Java 2 (1912) 631; Sloot. Bijdr. Flac. (1919) 65; Bull. Jard. Bot. Btzg III, 7 (1925) 312; Sleum. Bot. Jahrb. 69 (1938) 51.—*Bergsmia sumatrana* Miq. Fl. Ind. Bat. Suppl. (1860) 159, 389; Koord. & Val. Bijdr. Booms. Java 5 (1900) 33; Koord. Atlas Baumarten 2 (1914) f. 348.—*Ryparosa sumatrana* Warb. in E. & P. Pfl. Fam. 3, 6a (1893) 21. —*H. hutchinsonii* Merr. Philip. J. Sc. 17 (1920) 291; En. Philip. 3 (1923) 107; Perk. & Cruz, Philip. J. Sc. 23 (1923) 548; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 313; Sleum. Bot. Jahrb. 69 (1938) 54; Brown, Useful Pl. Philip. 2 (1950) f. 238.

var. **sumatrana.** Tree (7–)15–25 m; tips of branches ferrugineous-sericeous. *Leaves* oblong or subovate-oblong, rarely lanceolate-oblong, ± abrupt-acuminate, distinctly inequilateral at base, coriaceous to subcoriaceous, entire, shining, reddish-brown when dry, glabrous (sometimes very laxly pilose on midrib and nerves beneath), (13–)15–25(–33) by 5–9(–12) cm; midrib prominent on both sides, nerves little prominent or slightly impressed above, distinct beneath, veins densely reticulate and rather prominent on both sides; petiole 1–1½(–2) cm. Stipules not seen, apparently very early caducous. ♂ *Flowers* in 2–4-flowered cymes; peduncles 0.8–1.4 cm, rusty-pubescent. Pedicels rather slender, 1½–2 cm, somewhat thickened at the apex, rusty-velvety. *Sepals* greenish-white, ovate-oblong, ferrugineous-tomentose on both sides, 8–11 by 4–6 mm. *Petals* oblong, glabrous, 11–13 by 4–5 mm, involute, probably white *in vivo*, but intensively red-coloured when dry; scales linear-oblong, fleshy, ciliate, 7–10 by 1–1½ mm. Filaments subulate, glabrous, 3–5 mm; anthers oblong, 4 mm. Rudiment of ovary pilose. ♀ *Flowers* 1–2, *c.* 1½–2½ cm peduncled. *Sepals* slightly larger than in the ♂ flowers, up to 16 by 6 mm, but *petals* similar to those in the ♂ flowers. Filaments elongate-deltoid, obtuse, 2 mm, appressed to the ovary. *Ovary* ovoid, contracted at the apex, densely fulvous-pilose, distinctly sulcate lengthwise. *Fruit* subglobose to ovoid-globose, slightly attenuate and sulcate at the apex or apiculate, densely fulvous-tomentulose and provided with fine tubercles, 4–6(–8) cm across; pericarp thin, fragile. *Seeds* (10–)20–30(–45), irregularly compressed, 2 by 1½ cm.

Distr. *Malaysia:* Sumatra, S. Central Java (Banjumas), Br. N. & SE. Borneo, Celebes (S. & SE. Celebes, Manado), Philippines (Mindanao, Basilan, Tawi-Tawi).

Ecol. In rain-forests on never inundated, sandy or clayey soil and hilly or steep ground, scattered, 30–200 m. *Fl.* Aug.–Dec., *fr.* Sept.–June.

Vern. *Buntut kaju*, Palembang, *limus buntu*, J, *lĕmonuh, ingleoh, madansat, nangka-nangka, andara*, Borneo, *wulosu*, S. Cel.. Philippines: *bagarbas*, Lan., *kamupang*, Sul., *mangasaluká, mansaloka, mangabo, mangasalokág*, Yak., *tioto, sugalingayau*, Sub.

var. **pentagyna** (SLOOT.) SLEUM. Bot. Jahrb. 69 (1938) 52.—*H. pentagyna* SLOOT. Bijdr. Flac. (1919) 64; Bull. Jard. Bot. Btzg III, 7 (1925) 311.—*H. curtisii* KING *var. sumatrana* BAK. *f.* J. Bot. 62 (1924) Suppl. 6.

Leaves more coriaceous, shining, smaller, 9–15 by 4½–5½ cm, with very dense and prominent reticulations.

Distr. *Malaysia:* S. Sumatra (E. Palembang: Rawas River), once found, *c.* 200 m.

Note. Very similar but not quite identical specimens have been found in Borneo: Sarawak (BECCARI 2038, ♂) and N. Borneo: Mt Kinabalu (CLEMENS 32639, sterile), 1700 m, and in the Philippines: Palawan: Puerto Princesa (EDAÑO PNH 192, fr.), recently described as *H. palawanensis* MERR & QUIS., Philip. J. Sc. 82, 1953, 330, t. 3, low alt.

2. *Subsection Pleianthera*

WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 21; SLEUM. Bot. Jahrb. 69 (1938) 58. Stamens (6–)7–16.

Distr. Fig. 7.

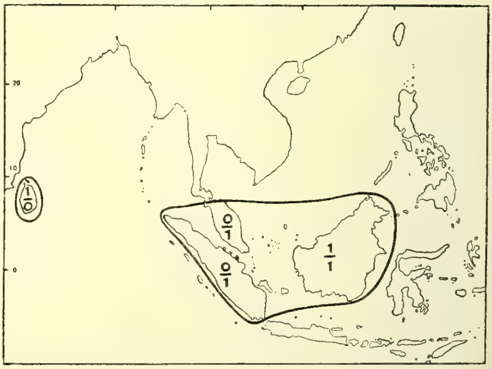

Fig. 7. Distribution of *Hydnocarpus sect. Hydnocarpus subsect. Pleianthera.* The figure above the hyphen indicates the number of endemic species in the district, the figure below the hyphen the number of non-endemic species.

26. Hydnocarpus woodii MERR. Pl. Elm. Born. (1929) 208; SLEUM. Bot. Jahrb. 69 (1938) 60.—*H. punctifera* SLOOT. *ex* DEN BERGER, Bull. Jard. Bot. Btzg III, 9 (1928) 233, *nom. nud.*—*H. stigmatophora* SLOOT. *ex* DEN BERGER, *l.c.* 234, *nom nud.* —**Fig. 8a–e.**

Tree (18–)25–30(–37) m, glabrous the inflorescences excepted; branchlets rather thick, soon covered with grey bark. *Leaves* mostly oblong-elliptic rarely subovate-elliptic, gradually narrowed towards the apex, mostly rather abruptly contracted at the apex (1–1½ cm) and subacute, cuneate or rarely subrotundate at the base, ± equilateral, manifestly coriaceous when fully developed, stiff, olivaceous-grey-green and mostly very shining and smooth above when dry, dull and mostly brownish beneath, entire, the apical ones mostly much smaller than the lower ones, (6–)10–18 by (3½–)4–6(–7) cm; nerves mostly obscure and veins little visible above, all conspicuously prominent underneath, veins ± transverse, reticulations fine, scattered black points not rarely present; petiole 1–2(–2.7) cm. Stipules not seen, probably very early caducous. *Cymes* axillary on leafless branchlets (possibly cauline also), few-flowered, finely rusty-pubescent; peduncles stout, up to 1 cm, with many scars. Pedicels *c.* 1 cm.

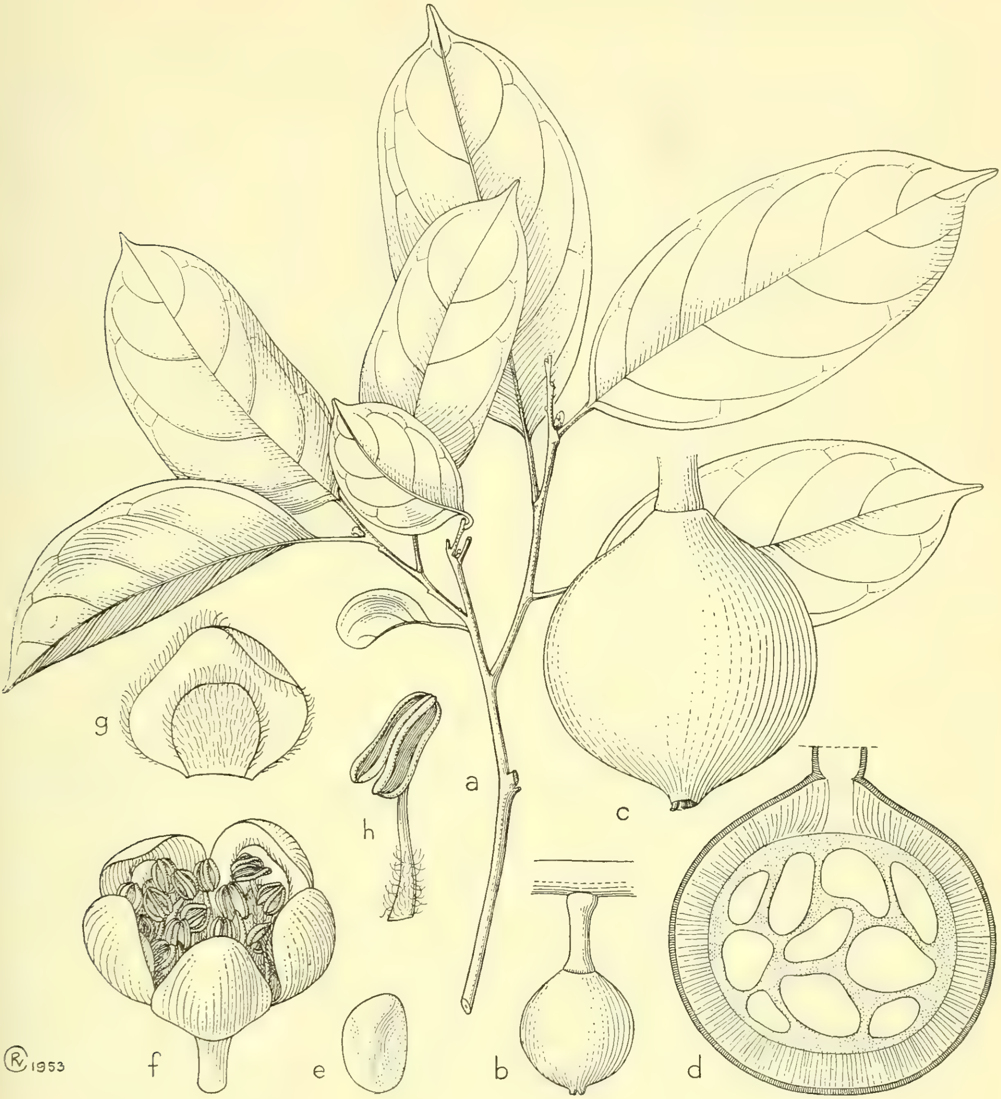

Fig. 8. *Hydnocarpus woodii* MERR. *a*. Sterile twig, × 1/2, *b*. young fruit, × 1/2, *c*. ripe fruit, × 1/2, *d*. fruit, longitudinal section, × 1/2, *e*. seed, × 1/2.—*Hydnocarpus crassifolia* SLEUM. *f*. ♂ flower, × 2, *g*. petal with scale, × 5, *h*. stamen, × 5 (*a* after Br. N. Born. For. Dep. A 830, *b* after HALLIER 3293, *c* after SING. F.N. 16396, *d* after SING. F.N. 32364, *e* after ELMER 20303, *f–h* after the type BECCARI 3972).

♂ *Flowers: sepals* elliptic-ovate or nearly orbicular, densely ferrugineous-stellate-pubescent outside, glabrous inside, 5–6 by 4 mm, the inner ones slightly larger. *Petals* membranous, white, suborbiculate, glabrous, somewhat purplish when dry, densely ciliate, 4–5 mm diam.; scales thick, oblong-elliptic, densely whitish-yellowish-villous on both sides, 2–3 mm long. Filaments subulate, ± densely whitish-pilose in their inferior half, (3–)4 mm; anthers oblong-subcordate, *c*. 2 mm. ♀ *Flowers* similar to the ♂, but with 5–7 staminodia and ovoid, ferrugineous-tomentose ovary; stigmas 4, radiate, thick, each 4 mm long. *Fruits* mostly solitary, rarely in fascicles on old branchlets, globose or mostly globose-obovoid, attenuate at the very base into a short broad stipe, (5–)7–8 cm diam., brown, somewhat rugose and mostly with many fine irregular fissures when dry, glabrous, with very thick (*c*. 1–1½ cm) pericarp, exocarp dark-brown, perforated with stout, lighter-colour ed fibres, radiating or protruding from the stony mesocarp (but not fibrous-cancellate in a distinct sense). *Seeds* c. 5–8, irregularly ovoid, (2½–) 3–3½ cm.

Distr. *Malaysia:* Sumatra (also Mentawei Isl. and Riouw), Malay Peninsula (Pahang, Negri Sembilan, Perak, Selangor, E. Johore, Malacca), Borneo.

Ecol. In rain-forests on flat or hilly, never inundated sandy, clayey or stony soil, rather common but scattered, up to 200 m.

Uses. Wood pale brown, close textured, not used.

Vern. Sumatra: *Madang miang*, W. Coast, *kaju tanah*, Palemb., *kĕrambil tupai*, Riau, *niur mentji*, *kĕlapa tikus*, Atjeh, *partangisani motji*, Tapanuli, *bo-ahlo*, *bogolo*, Mentawei. Borneo: *kĕlapa djankai*, *pinanak*, *kuhui*, *kohoi*, *londing*, *gĕmpadi*, *apa*, *pevor*, *empilis*; *karpos*, Mal.. Mal. Pen.: *sĕtumpol*, *kulau*, Selangor, Perak, *mĕndol*, Pahang.

Note. Distinct from *H. octandra* THWAIT. from Ceylon only by minor characters.

27. Hydnocarpus crassifolia SLEUM. Bot. Jahrb. 69 (1938) 61.—**Fig. 8f–h.**

Tree; branchlets stout, terete, greyish-corticate, innovations finely brown-tomentose. *Leaves* ovate to oblong-ovate, gradually acuminate, rather abruptly (1–1½ cm) contracted and acute at the apex, rounded at the base, thick-coriaceous, stiff, glabrous except the ± densely and minutely stellate-pubescent midrib beneath, rather shining above, paler beneath, brownish when dry, entire, 10–14 by 5–7 cm; midrib very prominent beneath, nerves curved, lower ones excurrent along margin, upper ones ± enarching, all nearly obscure above, little raised beneath, veins laxly reticulate and little prominent on both sides; petiole stout, 1½–2 cm. ♂ *Dichasia* axillary. Pedicels ferrugineous-puberulous, 1–1½ cm. *Sepals* 5, orbicular-elliptic, densely ferrugineous-pubescent outside, glabrous inside, greenish when fresh, c. 6–7 by 4 mm. *Petals* 5–6, mostly 7, suborbicular, membranous, greenish, glabrous, ciliate, *c.* 4 mm across; scales ovate, golden-villous inside, 2 mm. Filaments subulate towards the apex, flattened and whitish pilose near the base, 4 mm; anthers broad-ovate, 2 mm. ♀ *Flowers* and *fruit* unknown.

Distr. *Malaysia:* Borneo (Sarawak), once found.

Note. The inflorescences seen by me were very inadequate. The flowers described were not attached to the plant; they were said to have an unpleasant odour.

3. Section Kerrandrias

SLEUM. Bot. Jahrb. 69 (1938) 14, 61.

Petals 10. Stamens 17–24. Sepals 5.

28. Hydnocarpus calvipetala CRAIB, Kew Bull. (1928) 234; SLEUM. Bot. Jahrb. 69 (1938) 61.—*Taraktogenos calvipetala* KERR, The Record, Techn. & Sc. (Bangkok) Suppl. 7 (1930) 13.

Tree 8–10 m; young branchlets sparsely covered with appressed, fulvous hairs, soon glabrescent, with greyish bark. *Leaves* oblong, long-acuminate or caudate at the apex, ± inequilateral, cuneate or subrotundate at the base, rigidly chartaceous, glabrous, entire, 17–24 by 5–7 cm; midrib rather flat above, prominent beneath, nerves (6–)7 pairs, prominent beneath, veins transverse, numerous, subparallel and prominent. ♂ *Inflorescence* cymose, subumbelliform; peduncle stout, 1–1½ cm, secondary peduncles *c.* ½ cm long. Pedicels glabrous, thin, up to 1½ cm. ♂ *Flowers* white. *Sepals* subrotundate-elliptic, 6–8 by 4–6 mm, glabrous on both sides, ciliolate. *Petals* ± elliptic, rounded at the apex, somewhat unguiculate at the base, glabrous, ciliate towards the apex, 4(–5½) mm diam.; scales thick-carnose, broad-oblong, subtruncate at the apex, *c.* 2½ mm across, densely pilose at the apex. Filaments glabrous 2–3(–6) mm; anthers subsagittate, 3 mm, with broad connective. ♀ *Flowers* and *fruit* unknown.

Distr. S. Siam (Surat: Langsuan), 100 m, to be expected to occur in the N. part of the Malay Peninsula.

Vern. *Kabao.*

4. Section Asteriastigma

(BEDD.) WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 21.—*Asteriastigma* BEDD. For. Man. Bot. (1873) t. 266 anal. pl. 27; Ic. Pl. Ind. Or. 1 (1874) 59, t. 242.—*Hydnocarpus sect. Vanslootenia* SLEUM. Bot. Jahrb. 69 (1938) 14, 62.

Sepals 4–10. Petals 8–14. Stamens 35–115.

Distr. Fig. 9.

29. Hydnocarpus anomala (MERR.) SLEUM. Bot. Jahrb. 69 (1938) 65.—*Taraktogenos anomala* MERR. Philip. J. Sc. 29 (1926) 401.—*H. lasionema* AIRY SHAW, Kew Bull. (1949) 157.

Buttressed tree (10–)20–25(–50) m; bark smooth, scaling-off in small irregular pieces; branchlets densely rusty-stellate-pubescent. *Leaves* oblong or elliptic-oblong (rarely oblanceolate), shortly (1–1½ cm) cuspidate, ± rounded to cuneate, rarely subcordate at the base, mostly slightly inequilateral, entire, chartaceous to subcoriaceous, ± shining and dark-brown when dry, glabrous above,

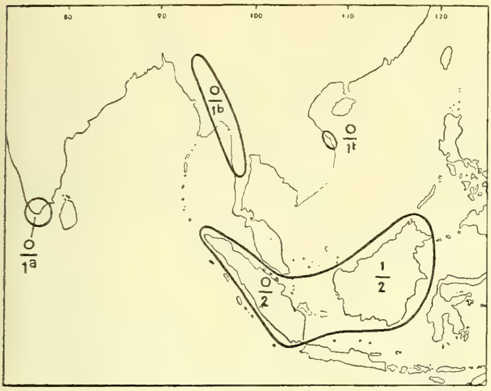

Fig. 9. Distribution of *Hydnocarpus sect. Asteriastigma*. The figure above the hyphen indicates the number of endemic species in the island or area, the figure below the hyphen the number of non-endemic species, eventually followed by *a* and *b* for different subspecies.

± densely to sparsely covered with fine, fascicled or mostly stellate, ferrugineous hairs beneath, specially on midrib and lateral nerves, (10–)15–22(–25) by 5–9 cm; midrib and nerves flat above, very prominent beneath, nerves 5–7(–8) suberect, excurrent at the leaf-margin, veins ± transverse, slightly prominent above, more so beneath, rather laxly reticulate with venules; petiole ± densely rusty-stellate-pubescent, 2–3 cm. ♂ *Cymes* mostly few-flowered, minutely rusty-stellate-puberulous; rhachis stoutish, 1–4 cm long. Pedicels rather slender, 1–2½(–3) cm long, articulated at the base with the very short peduncle. *Sepals* (4–)5–6(–7), broad-ovate, chartaceous, light-green, outer 2–3 concave, *c.* 1–1½ cm diam., glabrous inside, inner ones membranous, smaller, glabrous on both sides but the innermost 1–2 sometimes with a pubescent longitudinal stripe on their back and subpetaloid, always without scales. *Petals* white, outer ones obovate, 1–1½ by 0.8 cm, inner ones gradually smaller, 10 by 3–2 mm, all densely covered with appressed, golden sericeous hairs outside, glabrous inside and with a basal, ± obovate, thick, golden-haired scale 3–5 mm. Stamens 35–50; filaments 6–9 mm, subulate, incrassate at the base and with longish, golden hairs in the lower part, glabrescent towards the apex; anthers oblong-elliptic, 3–4 mm. ♀ *Flowers* not yet known. *Fruit* globose, green, glabrous, 8½–10 cm diam.; peduncle 2½ cm long, 1 cm thick; pericarp fibrose.

Distr. *Malaysia:* Borneo (also Banguey Isl.).

Ecol. In primary forests on hilly, sloping to steep, never inundated sandy or clayey soil, 90–400 m.

Uses. Heart-wood light brown, used in native house-building.

Vern. *Jaui*, Kayan, *djangan*, *pajang balaan*, *tetek*, Dayak, *kaju ulan*, Kaju, *oparan bukit*, S. Kinabatangan.

30. Hydnocarpus gracilis (SLOOT.) SLEUM. Bot. Jahrb. 69 (1938) 64.—*Taraktogenos gracilis* SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 301, f. 2.

Tree 25–35 m; branchlets slender, glabrous, the laxly rusty-pilose tips excepted. *Leaves* oblong-lanceolate, subcuspidate-acuminate and acute at the apex, cuneate at the base, ± inequilateral, chartaceous to subcoriaceous, olivaceous and ± dull when dry, mostly a little rough on both sides by numerous minute tubercles, practically glabrous or very scarcely appressed-pilose specially on midrib and nerves beneath, finely crenulate or mostly subentire, 10–15(–18) by 3½–5½(–6½) cm; midrib and nerves somewhat prominent on both sides, nerves 6–7 pairs, arcuate, excurrent along the margin, veins ± transverse, rather densely and prominently reticulate on both sides; petiole 1–1½ cm. Stipules minute, densely rusty-pilose, early deciduous. ♂ *Flowers* in few-flowered cymes; peduncle thick, striate, fulvous-puberulous, ½–1 cm. Pedicels stoutish, thickened towards the apex, glabrous, 1–1¼ cm. *Sepals* 8–10(–11), ± orbicular, unequal, *c.* 5–8 mm diam., glabrous on both faces, ciliate. *Petals* 12(–14), variable in size, outer ones spathulate, inner ones oblong to lanceolate, membranous, erose at the apex, long-fimbriate, 6–7 by 5–2½ mm; scales subquadrate, 2 mm, manifestly shortly lobed at the apex, fleshy, glabrous. Filaments slender, densely set with patent, whitish hairs, 4–5 mm. Rudiment of the ovary minute, pilose. ♀ *Flowers* similar to the ♂, but mostly solitary, with numerous staminodes. *Ovary* ovoid, rusty-velvety, with 5 radiate, large, ± bilobed stigmas. *Fruit* globose, somewhat depressed, densely nigrescent-velvety, 6–8½(–11) cm diam.; exocarp fibrous; peduncle 3–4 by 1½–2½ cm, very thickened upwards

Distr. *Malaysia:* Sumatra (Atjeh, East Coast, Palembang, Bencoolen), SE. Borneo.

Ecol. In never or periodically (during the west-monsoon) inundated forest on level or hilly ground and clayey or sandy soil, rather common but scattered, 10–100 m.

Vern. *Kaju sĕbija*, *manau*, *simarbanban*, *kudin*, *lontar kuning*, Sumatra, *mata ulat*, *kĕrsik*, Atjeh, *karup*, *gisak*, *babot*, *enta buruk*, *bĕlangian*, *rasak lagar*, *umpasdungan*, *talan*, Borneo.

31. Hydnocarpus polypetala (SLOOT.) SLEUM. Bot. Jahrb. 69 (1938) 62.—*Taraktogenos polypetala* SLOOT. Bijdr. Flac. (1919) 74; Bull. Jard. Bot. Btzg III, 7 (1925) 297, f. 1; HEYNE, Nutt. Pl. (1927) 1135.—*Taraktogenos grandiflora* MERR. J. Str. Br. R. As. Soc. *no* 86 (1922) 332.—**Fig. 10.**

Tree 7–20 m; bark pale brown, cracked; young branches, inflorescences and leaves beneath on midrib and nerves ± densely ferrugineous-pubescent, otherwise glabrous or nearly so. *Leaves* oblong to elliptic-oblong, rarely lanceolate-oblong, abruptly (1–2 cm) acuminate at the apex, subrounded at the base, slightly inequilateral, subcoriaceous, entire, red-brown and mostly dull when dry, 16–35 by 6½–11 cm; midrib and nerves little distinct above, very prominent beneath, nerves in 9–12 pairs, curved-anastomosing, veins

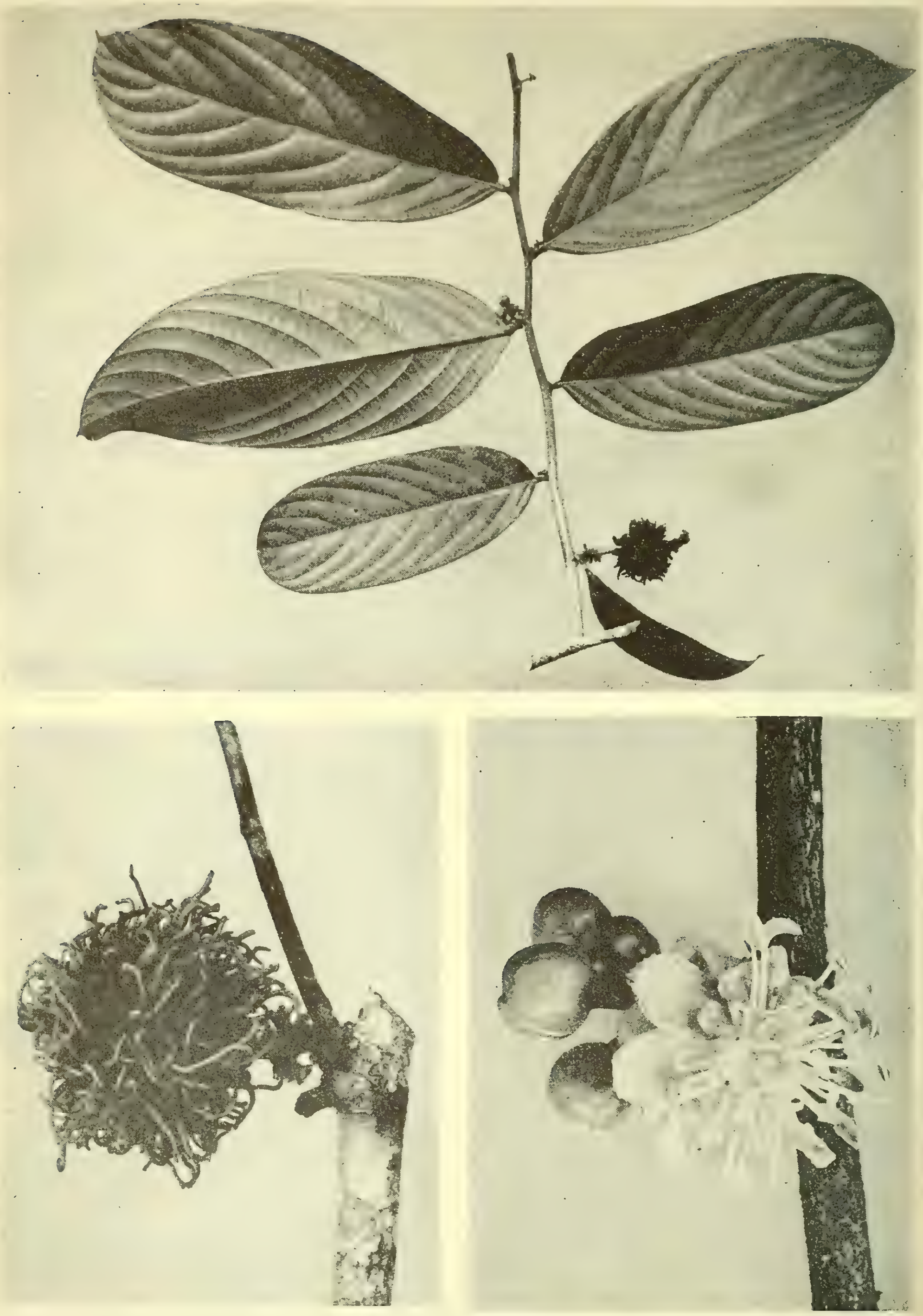

Fig. 10. *Hydnocarpus polypetala* (SLOOT.) SLEUM. Above, fruiting twig, × $^{1}/_{5}$, below, immature fruit ± nat. size and flower nat. size (C.H.B. IV–F–25).

subparallel, reticulations prominent; petiole 5–8 mm. Stipules oblong-lanceolate, subpersistent, 6–11 by 3 mm. *Cymes* compact, sometimes 3–4 fasciculate, few-flowered, ± densely ferrugineous-pubescent; peduncle stout, 1 cm. Pedicels 1¼–1½(–2½) cm. ♂ *Flowers: Sepals* 8–10, yellow-green, orbicular, very unequal, the 2 outer ones 1½ cm diam., 2 subsequent ones 2 cm diam., inner ones gradually smaller, all glabrous. *Petals* white or greenish, 8–12, ± obovate, unequal, outer ones ± oblong, *c.* 1 by 0.8 cm, inner ones orbicular to ovate, nearly glabrous, gradually decreasing in size, 9–7 by 8–5 mm, all fimbriate; scales thick, sulcate, ± densely brownish-pubescent, 3–4 by 1½–3 mm. Filaments slender, glabrous, 1 cm; anthers elliptic, 3–4 mm. Rudiment of ovary pilose, 2 mm. ♀ *Flowers* as the ♂ ones, but staminodes numerous; anthers sterile and slightly smaller in size. *Ovary* ovoid, ferrugineous-velvety; stigmas 5, radiate, flat, dilated and irregularly bilobed at the apex, blackish. *Fruit* globose, *c.* 9 cm diam., densely covered with numerous, irregular appendages, these flat, elongate-triangular and obtuse, softly ferrugineous-tomentose, *c.* 5–10 mm long, coherent at their bases and forming ± longitudinal crests. *Seeds c.* 20, *c.* 2 by 1 cm.

Distr. *Malaysia:* Sumatra (Palembang), Borneo. A specimen cultivated in Hort. Bog. is stated to have come from Banka.

Ecol. In primary forest on level, never inundated localities, on sandy or clayey soil, along river-banks, mostly scattered, seldom gregarious, 10–600 m.

Uses. Wood light-brown. Oil is extracted from the seeds.

Vern. *Pĕtjah periuk*, Palembang, *kĕlapa bout*, W. Central Borneo, *namih*, *baliutod*, *pĕgalasong*, Br. N. Borneo.

Excluded

Hydnocarpus moluccana (ROXB.) SPR. Syst. 4 *cur. post.* (1827) 93.—*Vareca moluccana* ROXB. Hort. Beng. (1814) 18, *nomen nudum;* Fl. Ind. ed. CAREY 1 (1832) 647; BENN. & BR. Pl. Jav. Rar. 3 (1844) 209. Ins. Molucc. *cf.* WIGHT & ARN. Prod. 1 (1834) 30 = possibly *Rinorea* (*Violaceae*).

Hydnocarpus laevis MIQ. Fl. Ind. Bat. Suppl. (1860) 159, 388; BOERL. Cat. Hort. Bog. 1 (1899) 54 = *Cyclostemon laevis* (MIQ.) J. J. S. Ic. Bog. 4 (1910) t. 307, 308 = *Drypetes laevis* (MIQ.) PAX & HOFFM. Pfl. R. Heft 81 (1922) 240.

Hydnocarpus tamiana PULLE, Nova Guinea 8 (1912) 671 = *Aphania cuspidata* (BL.) RADLK. (*Sapindaceae*) and not as VAN SLOOTEN assumed belonging to *Durandea*, *cf.* SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 314; Nova Guinea 14 (1927) 194.

Hydnocarpus unonifolia ELMER, Leafl. Philip. Bot. 5 (1913) 1779; MERR. En. Philip. 3 (1923) 108; SLEUM. Bot. Jahrb. 69 (1938) 57 = *Annonacea* (*cf. Orophea* or *Mitrephora*)!

Hydnocarpus sp.? HASSK. Neuer Schlüssel zu RUMPHIUS Herb. Amb., in Abh. Naturf. Gesellsch. 9, 2 (1866) 333.—*Malum aruanum* RUMPH. Herb. Amb. 7 (1755) 55, t. 24, f. 1.

After RUMPHIUS known from the Aru Islands as *caim gulur*. This is apparently no *Flacourtiacea*, *cf.* MERR. Interpr. Rumph. Herb. Amb. (1917) 510; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 307.

7. SCAPHOCALYX

RIDLEY, J. Bot. 58 (1920) 148; Fl. Mal. Pen. 1 (1922) 163.—**Fig. 11.**

Dioecious trees. *Leaves* alternate, triplinerved from the base, with many nerves at ± right angles from the midrib and ladder-like parallel to each other. Stipules not present. ♂ *Flowers* in axillary or slightly supra-axillary, few-flowered fascicles inserted on top of agglomerate, very short tubercles (*i.e.* reduced peduncles of an originally cymose inflorescence), both on young shoots and old wood. Pedicels elongate, very slender, articulated at the base. Bracts 0. *Calyx* membranous, closed in bud, spathaceous, reflexed in anthesis. *Petals* 5(–6), imbricate, narrow-oblong, slightly connate at the base, membranous, each provided with a narrow-triangular scale up to 1/3 of the length of the petal at the base inside. *Stamens* 5–6(–7); filaments subulate, covered with long, papillose, white hairs in their lower part, glabrous towards the filiform tip; anthers versatile, linear-oblong, shortly cordate at the base, dorsifix near the base. Rudiment of ovary 0. ♀ *Flowers* not yet known. *Capsule* rather large, indehiscent, globose, crowned by (4–)6–7(–8) minute stigmas, with several seeds embedded in a pulp; pericarp thin-leathery, fragile. *Seeds* ovoid-oblong, irregularly compressed, with membranous aril; testa smooth, rather hard; endosperm albuminous-oily; embryo straight; cotyledons vertical, reniform, foliaceous; radicula very thick, short, transverse as is the embryo.

Distr. Two *spp.* in the Malay Peninsula.

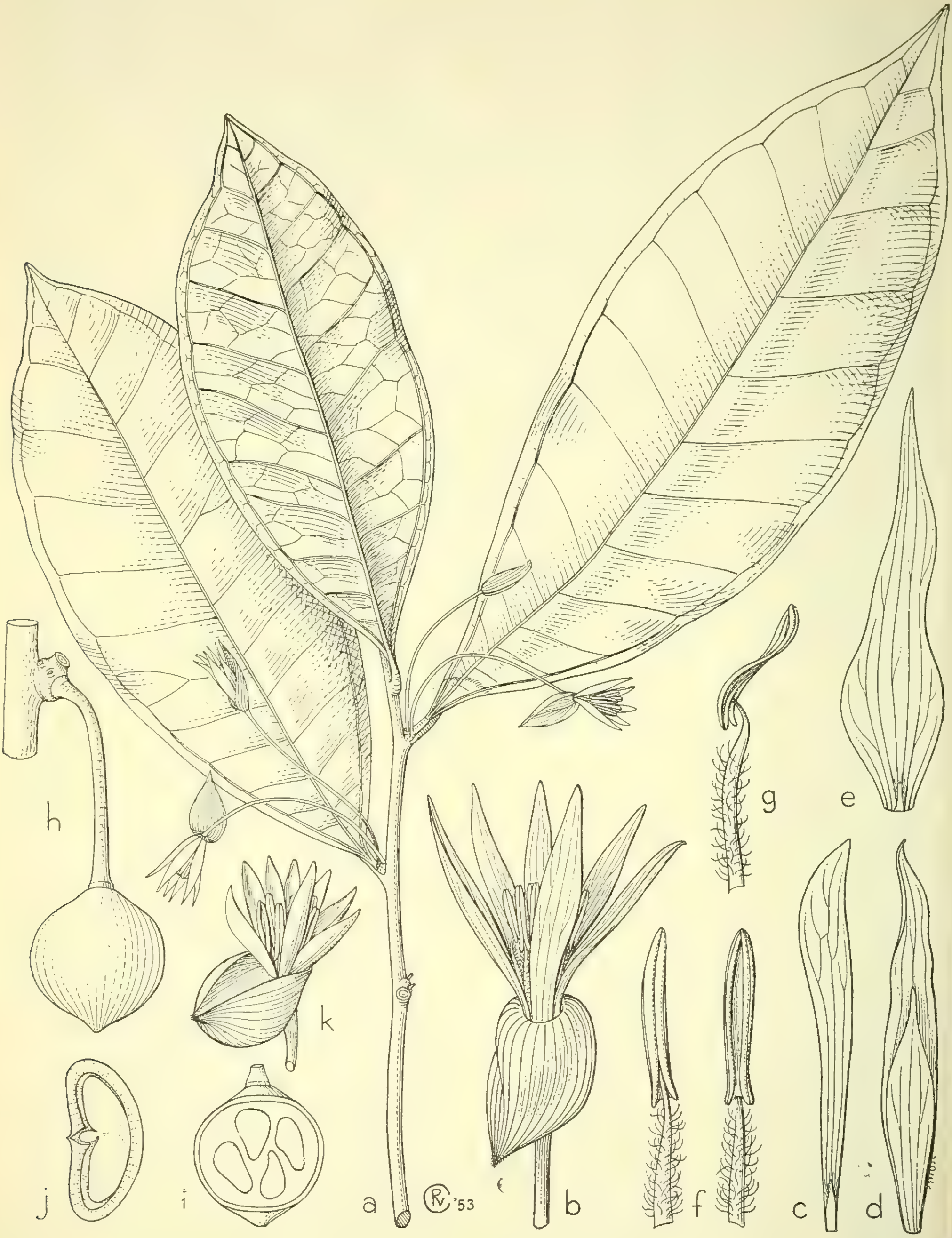

Fig. 11. *Scaphocalyx spathacea* Ridl. *a.* Twig with ♂ flowers, × $^{2}/_{3}$, *b.* ♂ flower, × $2^{1}/_{4}$, *c.* petal with normal scale, × $3^{1}/_{3}$, *d–e.* petal with abnormal scale, × $3^{1}/_{3}$, *f–g.* stamens, × $5^{1}/_{2}$, *h.* young fruit, × $^{2}/_{3}$, *i. ditto*, in section, × $^{2}/_{3}$, *j.* seed, longitudinal section, × $1^{1}/_{2}$.—*Scaphocalyx parviflora* Ridl. *k.* ♂ flower, × $3^{2}/_{3}$ (*a–g* after Sing. F.N. 24020, *h–i.* after Sing. F.N. 10898, *j.* after Sing. F.N. 29626, *k.* after the type Ridley 14736).

KEY TO THE SPECIES

1. Flowers 1½–2 cm. Pedicel 3–4 cm. Leaves with *c.* 12–18 pairs of nerves running from the midrib to the basal nerves. Petiole 0.6–1 cm . . . . **1. S. spathacea**

1. Flowers 5 mm only. Pedicel 5–6 mm. Leaves with *c.* 13 pairs of nerves running from the midrib to the basal nerves. Petiole 1½–2 cm . . . . **2. S. parviflora**

1. Scaphocalyx spathacea RIDL. J. Bot. 58 (1920) 149; Fl. Mal. Pen. 1 (1922) 164; HENDERS. Gard. Bull. S.S. 4 (1928) 223.—**Fig. 11a–j.**

Slender tree 3–8(–15) m; branchlets terete, red-brown or violaceous-pruinose when dry, with many longitudinal fissures and elliptic, pallid lenticels. *Leaves* elliptic to elliptic-oblong, shortly rather abruptly acuminate at the apex, cuneate at the base, triplinerved from the base, subcoriaceous, glabrous, entire or slightly undulate, 15–20 (–25) by 5–7½(–8½) cm; midrib and both side-nerves little raised above, very prominent beneath, basal side-nerves ascending along the margin to the leaf-top, anastomosing with numerous secondary nerves from the midrib (these rather prominent beneath) and other subparallel, intercalar, less distinct nerves, veins little but visibly prominent and laxly reticulate on both sides; petiole rugose, thickened. ♂ *Fascicles* 2–3(–5)-flowered from pubescent tubercles. Pedicels laxly pilose. *Calyx* ovoid-oblong, beaked, laxly pilose or nearly glabrous, parallel-nerved from base to top, ± 1¼ by ½ cm. *Petals* oblong-linear, acuminate, slightly fleshy, glabrous, said to be bright yellow, purplish when dry, *c.* 1.5 by 0.2–0.3 cm; scales pilose towards the apex, 3–4 by 1 mm. Filaments 6–7 mm; anthers 4–5 by ½ mm. *Fruit* shortly apiculate, greenish or somewhat rusty-pilose, soon glabrescent, set with numerous small tubercles, red-brown when dry and rough to the touch, (2½–)3½–4½ cm diam.; pericarp 0.6 mm thick. *Seeds* 6–7(–10), densely packed in a juicy pulp, each with a greenish aril which exudes a milky juice, 1–1½ by 0.6–0.8 cm; peduncle 3–4½(–7) by 0.3 cm, thickened at the apex, rugose.

Distr. *Malaysia:* Malay Peninsula (Kelantan, Trengganu, Selangor, Pahang, Johore, Negri Sembilan, Malacca), not common. *Fl.* Nov–Apr., *fr.* Dec.–July.

Ecol. In dense forest or deep shade, up to 550 m.

Uses. Wood not durable, but used in house-building.

Vern. *Kĕlat-bĕludu*, Pahang, *teje*, Selangor, *poko manilo*, Malacca.

2. Scaphocalyx parviflora RIDL. J. Bot. 58 (1920) 149; Fl. Mal. Pen. 1 (1922) 164.—**Fig. 11k.**

Leaves broader, elliptic-acuminate, up to 22 by 7–11 cm. ♂ *Flowers* only known in bud. *Calyx* 5 by 3 mm. *Petals* (sometimes 8) *c.* 4–5 by 2 mm, yellowish-white; scales minute, 1 mm. Filaments pilose 1 mm; anthers 3 mm. ♀ *Flowers* and *fruit* not yet known.

Distr. *Malaysia:* Malay Peninsula (Perak-Temengoh), once found.

Notes. RIDLEY states, that in *S. parviflora* the calyx 'splits into 4 acute points tipped with hairs', but this could not be recognized when examining the type. *S. parviflora* is possibly only a very young stage of *S. spathacea*; the twigs of the type-specimen have the appearance of suckers as they are filled with a big pith.

8. PANGIUM

[RUMPH. Herb. Amb. 2 (1743) 182, t. 59]; REINW. [*ex* BL. Cat. (1823) 112, *nom. nud.*] Syll. Ratisb. 2 (1825) 12.—**Fig. 12–15.**

Dioecious, more rarely andromonoecious tree. *Leaves* spirally arranged and crowded at the ends of the branches, long-petioled, in young trees 3-lobed, in old ones broadly ovate, with cordate to truncate base, acute-acuminate, palmately-nerved. Stipules 0. *Flowers* usually unisexual, but the terminal flowers of the ♂ inflorescence sometimes hermaphrodite; ♂ flowers in few-flowered pseudoracemes, ♀ flowers mostly solitary in the axils of the upper leaves. Pedicels elongate, articulated above the middle, with one (fl. ♂) or several (fl. ♀) linear, caducous, basal bracts. *Calyx* closed before anthesis, nearly globose, disrupted afterwards irregularly in 2–3(–4) caducous segments. Petals (4–)5–8(–9), imbricate, each with a large, vaulted, thick, hairy scale inside at the base. ♂ *Flowers: stamens* 20–25(–31), free; filaments thick, flat, with a linear stripe of hairs ventrally; anthers minute, ovate, dorsifixed. Rudiment of pistillode 0. ♀ *Flowers: staminodes* as many as petals, rarely more, alternating with them. *Ovary* thick-walled, with 2–4 many-ovuled placentas; stigma sessile, discoid, rounded or nearly trigonous, with (2–) 3–5 short, impressed rays, slightly lobed at the margin. *Fruit* large, indehiscent;

pericarp coriaceous. *Seeds* many, large, transversal- or triangular-ovoid, in an oily and fleshy, sweet, aromatic, edible pulp. Testa hard, reticulate-ribbed, with a linear hilum. Endosperm large, oily.

Distr. Monotypic, throughout *Malaysia*, extending to Melanesia and Micronesia.

Note. The fossil *Pangium treubii* Racib. Bull. Ac. Sc. Krakau (1909) 283, f. 1–3 (fr.) has been described from the Miocene of West Java.

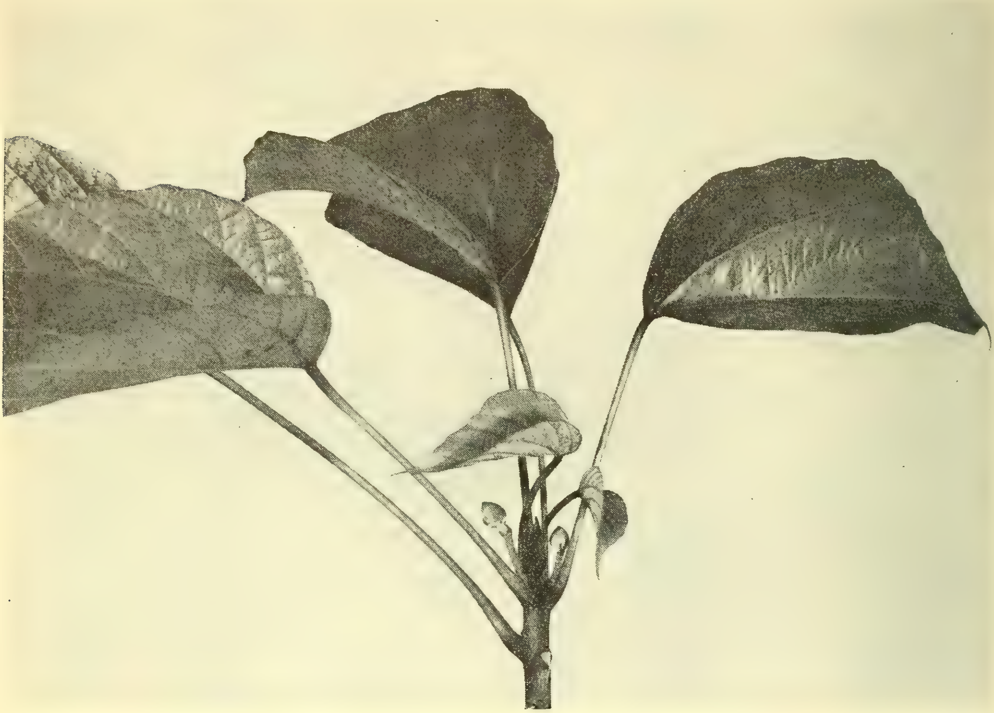

Fig. 12. *Pangium edule* Reinw. ♀ Buds (C.H.B. XIX).

1. Pangium edule Reinw. [*ex* Bl. Cat. (1823) 112, *nom. nud.*] Syll. Ratisb. 2 (1825) 13; Benn. & Br. Pl. Jav. Rar. 3 (1844) 205, t. 43; Bl. Rumphia 4 (1849) 20, t. 178; Mus. Bot. 1 (1849) 14; Miq. Fl. Ind. Bat. 1, 2 (1858) 109; Suppl. (1860) 89, 159; F.-Vill. Nov. App. (1880) 13; Vidal, Sin. Atl. (1883) 13, t. 7, f. D; King, J. As. Soc. Beng. 59, ii (1890) 124; Warb. Bot. Jahrb. 13 (1891) 384; Greshoff, Nutt. Ind. Pl. (1894) t. 4; Treub, Ann. Jard. Bot. Btzg 13 (1896) 1–86; Koord. Minah. (1898) 474; Vorderman, Teysm. 10 (1899) 77–84; Engel, Teysm. 11 (1900) 223; K. & V. Bijdr. Booms. 5 (1900) 6; Volkens, Bot. Jahrb. 31 (1901) 469; Becc. Nelle For. Born. (1902) 598; Cost. & J. J. S. Ann. Jard. Bot. Btzg 19 (1904) 150, t. 21, f. 41; Back. Fl. Bat. 1 (1907) 68; Voorl. Schoolfl. Java (1908) 16; Schoolfl. Java (1911) 72; Koord. Exk. Fl. Java 2 (1912) 631; Back. Trop. Natuur 1 (1912) 125, pl.; Koord. Atlas Baumart. (1914) f. 347; Merr. Interpr. Rumph. (1917) 376; Sp. Blanc. (1918) 274; Sloot. Bijdr. Flac. (1919) 79; Brown, Bull. Philip. Isl. Dep. Agr. Bur. For. *no* 21 (1920) 129; Philip. Agr. Rev. 13 (1920) 360, t. 23; Minor Prod. Philip. For. 2 (1921) 161, 348, f. 70; Merr. En. Philip. 3 (1923) 108; Philip. J. Sc. 24 (1924) 115; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 314; Gilg, in E. & P. ed. 2, 21 (1925) 411, f. 181, 182; Merr. Philip. J. Sc. 29 (1926) 400; Heyne, Nutt. Pl. (1927) 1135; White & Francis, Proc. R. Soc. Queensl. 39 (1928) 66; White, J. Arn. Arb. 10 (1929) 243; Burkill & Haniff, Gard. Bull. S.S. 6 (1930) 173; Ochse, Ind. Groenten (1931) 294, f. 188; Kanehira, Tokyo Bot. Mag. 45 (1931) 331; Fl. Micron. (1933) 246, f. 115; Burk. Dict. (1935) 1652; Guillaumin, J. Linn. Soc. Bot. 51 (1938) 549; Corner, Wayside Trees (1940) 308; Back. Bekn. Fl. Java (em. ed.) 4 (1942) fam. 84, p. 4; Brown, Useful Pl. Philip. 2 (1950) 507, f. 329; Quis. Med. Pl. Philip. (1951) 629.—*Pangium* Rumph. Herb. Amb. 2 (1743) 182, t. 59.—*P. rumphii* Voigt, Hort. Suburb. Calc. (1845) 85.—*Hydnocarpus polyandra* Blanco, Fl. Filip. ed. 2 (1845) 445; ed. 3 (1879) 200, t. 391; Merr. Sp. Blanc. (1918) 274.—*P. ceramense* Teysm. & Binn. *ex* Boerl. Cat. Pl.

Hort. Bot. Bog. 1 (1899) 53.—*P. naumannii* WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 23; GILG, *op. cit.* ed. 2, 21 (1925) 411.—**Fig. 12–15.**

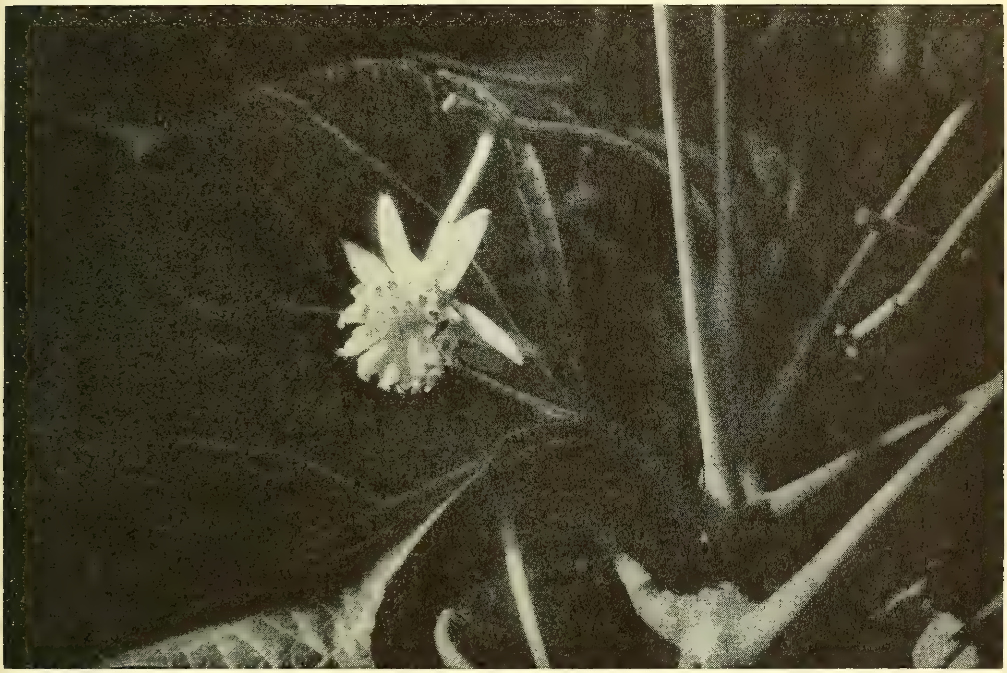

Fig. 13. *Pangium edule* REINW. Twig with ♂ flower (C.H.B. XI–B–VI).

A polygamous-dioecious, medium-sized to lofty, buttressed tree, up to 40 m, with a dense crown and ± drooping branches; trunk up to 1 m diam.; young branches ± densely rufescent-tomentose, old branches glabrous, with large leaf-scars. Bark reddish-brown or brownish-grey to dark brown, smooth or somewhat roughened by flaky decortication and horizontal fissures. *Leaves* large, ovate-cordate, entire, dark-green, glabrous, shining above, but dull and rusty-scurfy beneath especially on the veins, (10–)12–30(–40–60) by 8–20(–25–40) cm, 5–7-nerved from the base; petiole 7–30(–50) cm, much swollen at the base. ♂ *Racemes* 4–9-flowered, sometimes the bigger terminal flower (or rarely the 2 highest flowers) hermaphrodite, the others smaller and with stamens only, 6–24 cm long including the stout, 5–12 cm, long rusty-tomentose peduncle. Pedicels 2$^1/_2$–4 cm, brown-pubescent, sustained by a subulate bract 1–3 cm. Calyx rusty-scurfy in bud, lobes reflexed in anthesis, glabrescent, $^3/_4$–1$^1/_4$(–2) cm long. *Petals* ovate-oblong, somewhat fleshy, ciliate, patent, later on reflexed, bright pale green, 1$^1/_2$–2$^1/_2$ cm, each provided with an ovate or subrounded, densely appressed-hairy scale. *Stamens* inserted on a flat, villous disk, half as long as the petals. ♀ *Flower* mostly solitary, 6–9(–12) cm pedicelled, and with 5–8 anantherous staminodes (occasionally in few-flowered racemes (then the flowers seemingly ☿ but really ♀ as the 20–25 staminodes carry empty anthers). *Calyx* and *petals* as in ♂, but petals somewhat larger. Disk annular, small, fleshy, pubescent, surrounding the ovary at its base. *Ovary* ovoid, sessile, sericeous. *Fruit* somewhat asymmetrical, mostly oblong-ovoid ('pear-shaped'), 15–25(–30) by 7$^1/_2$–12(–15) cm, variable in size, brownish, rather scurfy and rough by small lenticels, bluntly tipped at each end, pendent from a thick, brown, curved stalk, 8–15 cm long, 7–12 mm diam., containing about 20 irregularly shaped seeds which are closely packed; pericarp 6–10 mm thick, becoming soft and mushy in the ripe fruit. *Seeds* (3–)4–6 by 2–3(–4) cm, enclosed by a white, fleshy aril, greyish-white when fresh, blackish when weather-beaten, leathery.

Distr. Melanesia (New Ireland, New Britain, New Hebrides), Micronesia (Yap), and throughout *Malaysia*.

Ecol. Primary and secondary rain-forests, in many regions chiefly in deforested localities, always in isolated specimens though locally common, wild or semi-cultivated, also along river-banks, in teak-forests, on both dryland and temporarily inundated places, on stony or clayey soil, chiefly below 300 m, but up to 1000. *Fl.* Jan.–Dec., *fr.* mostly at the beginning of the rainy season.

The seeds are well fitted to dispersal by water and have excellent floating capacity; they are frequently found in the beach drift. Occasionally

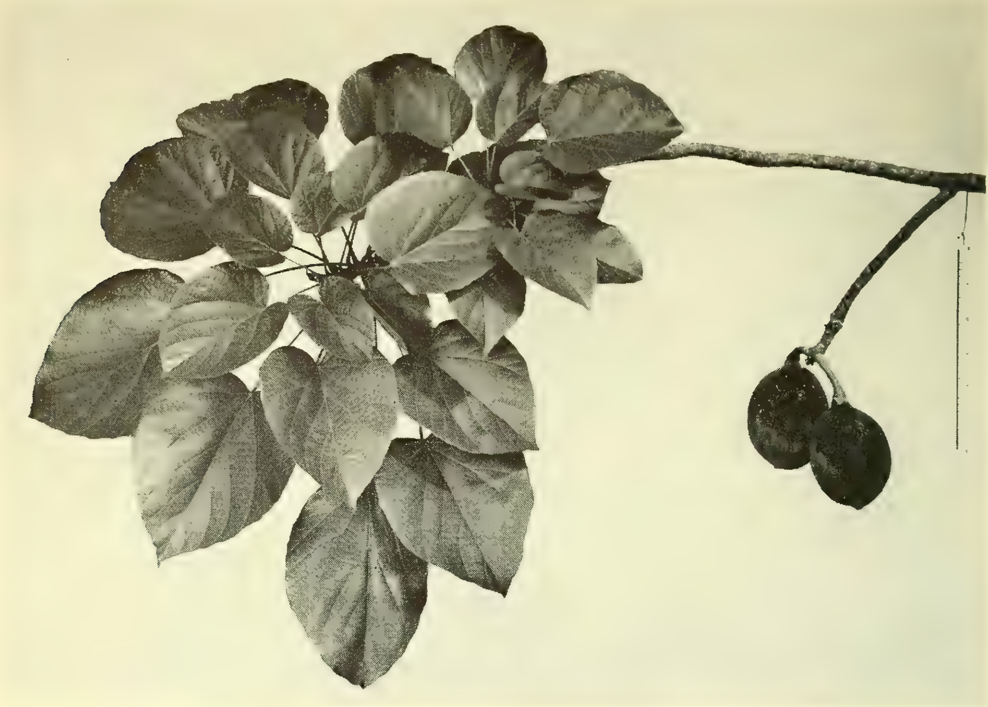

Fig. 14. *Pangium edule* REINW. Fruiting twig, × 1/11 (C.H.B.).

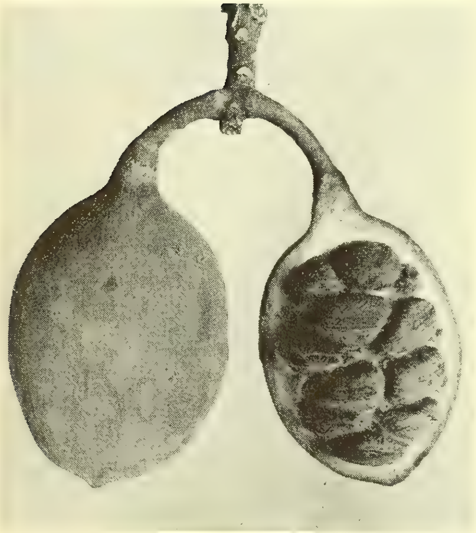

Fig. 15. *Pangium edule* REINW. Fruits; the shell and pulp of one have been removed halfway, × 1/5 (C.H.B.).

trees are found in the beach forest, but *Pangium* is certainly not a beach tree as has been sometimes wrongly assumed.

Trees which produce mostly male flowers also may bear fruit as the terminal flower in many inflorescences is often bisexual.

Uses. *Pangi* is used for many purposes throughout its area of distribution. The tree starts fruiting when *c.* 15 years old. Leaves, seeds and most other parts of the tree contain a high percentage of gynocardin, a glucoside which readily yields prussic acid, which is fugitive and is eliminated from the seeds before using them in various ways (washing, soaking, roasting, subterranean storage), so that they can be eaten when boiled or roasted. There are various methods to prepare them, *cf.* HEYNE (1927) and BURKILL (1935); the product is known in Indonesia as *kluwak*, *kĕlĕwik*, *trasi putjung*, *bĕtong*, *dagé*, *katjap pangi* or *jaruk*. Fresh leaves or seeds or their oil are used as an antiseptic, desinfectant or antiparasitic, to preserve meat, to prepare dart poison or to kill fish; the bark is also used as piscicide. Raw seeds are especially poisonous to poultry. The oil extracted from the seeds is a substitute for coconut oil in cooking; it can also be used as an illuminant or for making soap. The sapwood and heart-wood is (light-)yellow, with a disagreeable odour, rather hard, but little durable, used for construction of houses by the people of the Div. East Coast of Sumatra. The shells are used as rattles on dancing masks in New Guinea (Wide Bay).

Vern. *Kĕpajang*, *pangi*, standard M; *pakĕm*, Bali, J, Md, *patjung*, *pitjung*, S, *putjung*, J, S; *payang*, Mal. Pen.; *gĕmpangi*, *hapèsong*, Toba, *kaju tuba buwah*, Lampong, *binuang*, Simalur, *jĕho*, Enggano, *kapèntjuĕng*, *kapètjong*, *simaung*, Minangk.; *kuam*, *pakĕm*, Borneo; *(ma)pangi*, Minah.; *pangi*, Ambon; *pañgi*, S. L. Bis., P. Bis., Bik., *salingkumut*, Mand.; *kalowa*, Sumbawa, Makass.; *ngafu*, Tenimber; *booija*, Sula, *lakufussa*, Mangoli, *calloi*, *lioja*, Ceram, *kapait*, Buru, *il*, Aru; *awaran*, W. New Guin. *igu(w)ié*, Manokwari, *kakara*, Mimika, *orlan*, Maclay coast, *amigi*, Sulka, *seika*, Upper Waria, *atombo*, Rabaul.

9. TRICHADENIA

THWAITES in HOOK. J. Bot. & Kew Gard. Misc. 7 (1855) 196, t. 8.

Dioecious trees. *Leaves* spirally arranged, large, rather shortly petioled. Stipules foliaceous, caducous. *Flowers* unisexual, in simple and panicled, axillary racemes. *Calyx* calyptriform, disrupting irregularly from the apex or laterally. *Petals* 5, imbricate, each with a lanceolate, fleshy, hirsute scale adnate to the inner side of the base. ♂ *Flowers:* stamens 5, alternating with the petals; filaments stout, terete; anthers oblong, dorsifix. Rudiment of ovary sometimes present. ♀ *Flowers:* staminodes 0. *Ovary* sessile, with 3 placentas, each with 1 (rarely 2) ovules. Styles 3, short, divergent; stigmas dilatate, reniform, crenate. *Fruit* spherical, berry-like, indehiscent, 1–3-seeded; pericarp crustaceous when dry. *Seeds* with oily endosperm, testa bony.

Distr. Two *spp.*, one endemic in Ceylon, the other in *E. Malaysia*, the Philippines, and Melanesia (New Georgia, New Britain). Fig. 16.

1. Trichadenia philippinensis MERR. Philip. J. Sc. 4 (1909) Bot. 298; En. Philip. 3 (1923) 108.—*Vitex curvifrutescens* ELM. Leafl. Philip. Bot. 8 (1915) 2873.

Tree 15–20(–40) m high; buttresses plank-like, up to 2 m high; bark whitish-grey to yellowish-brown, rough; branches stout, glabrous, with very large leaf-scars; branchlets densely ferrugineous-pubescent. *Leaves* borne in pseudo-whorls at end of branchlets, elliptic-oblong or oblong, dark green brown when dry, shining, subcoriaceous, glabrous above, ferrugineous-pubescent on the midrib and rather laxly pilose beneath especially along the nerves, rather sharply and abruptly acuminate at the apex, broadly cuneate to ± rounded at the base, entire or obscurely repand in the upper portion, 14–30 by 6–15(–20) cm; nerves (8–)10–12 pairs, prominent, reticulations distinct, rather lax; petiole 3–8 cm. Stipules linear-lanceolate, pubes-

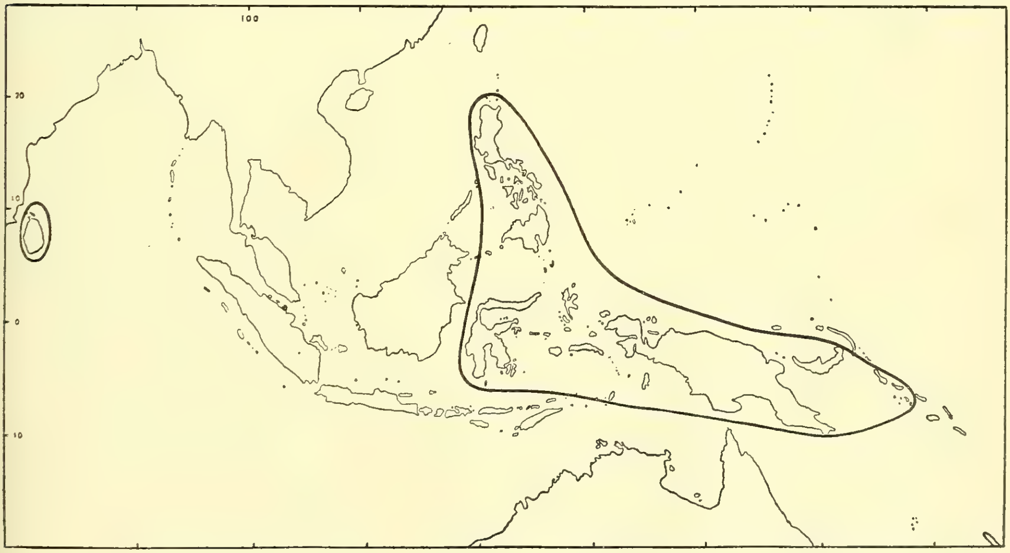

Fig. 16. Distribution of *Trichadenia*. Two closely allied species: *T. zeylanica* THWAITES and *T. philippinensis* MERR.

cent, 6 mm. *Racemes* ferrugineous-puberulent, up to 10 cm. *Flowers* solitary or in groups of 2–3, green-yellow. *Calyx* glabrous, lobes *c.* 3–4 by 2–3 mm. *Petals* elliptic-ovate, obtuse, *c.* 4 by 2½–3 mm; scale 3 mm. ♂ *Flowers:* filaments 2½ mm; anthers 2 mm. ♀ *Flowers:* ovary ovoid, pubescent. *Fruit* subglobose, glabrous, green, *c.* 2 cm diam., 3-seeded; pericarp coriaceous.

Distr. Melanesia (Solomons: New Georgia & New Britain), in *Malaysia:* Philippines (Luzon, Sibuyan, Panay, Negros, Mindanao), S. Celebes, Moluccas (Morotai, Buru, Batjan, Tenimber Isl., Key Isl.), New Guinea, Schouten Isl.. Fig. 16.

Ecol. Primary or old secundary forest in level or hilly, never inundated localities, 5–100(–500 m in the Philippines), apparently rather common occasionally, but mostly growing scattered or being fairly rare. *Fl. fr.* Jan.–Dec.

Uses. Wood pale orange, hard, close grained; sapwood not defined.

Vern. Philippines: *Tadong, tandong,* Tag., *malapíñggan,* Tag., Bik., *bagolipag, banau,* Bik., *banaog, linab, malapáñgi,* P. Bis., *ibal,* Pang., *magalinabut, magamabut,* Bag.; *kabini,* Buru, *popotan,* Batjan, *titiée,* Tenimber; New Guinea: *impaiwen, ankieéu, n'kieéu, aiga,* Manokwari, *ogeoga,* Inanwatan, *mamperiwen,* Schouten Isl., *waratj, kanuk, bavorie, abujet,* Hollandia, *garapo,* Upper Waria, Milne Bay.

Note. *Trichadenia zeylanica* THWAIT. differs by its coarsely sinuate-dentate leaves, *c.* 6 lateral nerves and the petals 7 mm long.

10. RYPAROSA

BL. Bijdr. (1825) 600; KING, J. As. Soc. Beng. 59, ii (1890) 124; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 317.—*Ryparia* BL. [Fl. Jav. praef. VIII (1828), *nom. nud.*] *ex* ENDL. Gen. (1840) 1118; HASSK. Cat. Hort. Bog. (1844) 239 (*Rhyparia*); MIQ. Fl. Ind. Bat. I, 2 (1859) 361.—*Bergsmia* BL. Rumphia 4 (1849) 23, t. 178 c, 1 & 2; Mus. Bot. 1 (1849) 16.—*Aspidandra* HASSK. Versl. & Med. Kon. Acad. Wet. Afd. Natuurk. 4 (1856) 141; Flora 40 (1857) 532.—*Gertrudia* K. SCH. in K. SCH. & LAUT. Fl. Deut. Schutzgeb. (1900) 454, t. 15; GILG, Bot. Jahrb. 55 (1918) 292.—**Fig. 18–20.**

Trees or rarely shrubs, dioecious. *Leaves* spirally to seemingly distichously or suboppositely arranged, entire, mostly greyish-green or pallid beneath when dry, with a darker shining subtriangular spot at the upper side of the very base, tapering into the petiole, penninerved, finely papillose, glabrous or often ± densely beset with appressed, bicrural or (through reduction) simple hairs underneath, these sometimes minute (lens!); petiole longish, thickened at both ends, often curved at the apex. Stipules 0. *Racemes* elongated, spiciform, interrupted, solitary or 2–3 together in the axils of whether or not fallen leaves, or from thick tubercles on the stem. *Flowers* small. Pedicels slender. Bracts minute, subulate, subpersistent. *Calyx* globose, closed in bud, 3–4-lobed in anthesis, later recurved, *Petals* 4–5, imbricate, later recurved, densely sericeous-tomentose outside, nearly glabrous inside, at the base inside with a hairy, ovate scale half as long as the petals. ♂ *Flowers:* stamens 5(–4), central, episepalous, their filaments usually connate into a column, or rarely practically free and divergent; anthers ovate, extrorse. Rudiment of ovary 0. ♀ *Flowers:* staminodes 5(–4, or absent), alternating with the petals, free or shortly connate at the base, small, whether or not with rudimentary anthers. *Ovary* sessile, densely hairy, with 2–3(–4) placentas each with 1 or few ovules. Stigmas 2–5, obovate or subreniform, impressed or flat, ± bilobed, radiating, sessile and then mostly very close together (very rarely spaced), or shortly stalked and spaced, their apex flattened and ± reniform. *Berry* capsular, with ± coriaceous, rather thin pericarp, 1–6-seeded, mostly globose or angular corresponding to the number of seeds. *Seeds* globose to semiglobose or variously compressed, embedded in a little, readily drying up pulp; testa coriaceous.

Distr. About 18 *spp.*, 1 restricted to S. Siam, 1 through *Malaysia* extending to both S. Siam and the Andamans & Nicobars, 16 only in Malaysia. Fig. 17.

Ecol. In rain-forest, from the lowland to the montane zone.

Note. The characters used for specific distinctions in this genus appear to be difficult and can be recognized satisfactorily only with the use of a lens. It is not certain, that the antithesis 'infl. cauline–infl. axillary' will hold. Furthermore the hairiness is caducous with age. Several species are known only in the ♂ or ♀ state, and the improvement of the key will depend on future complete material of these species. Four apparently new species could not be described on account of inadequacy of the specimens.

KEY TO THE SPECIES[1]

1. ♂ and/or ♀ inflorescences cauline, *i.e.* from distinct tubercles of the stem or old big branches, or both cauline and axillary.
 2. Column of filaments ± densely covered with whitish rather long hairs, at least in the upper part. **11. R. javanica**
 2. Column of filaments or free filaments glabrous.
  3. Leaves glabrous or practically so (some scarce hairs on the midrib or nerves, but not on the intervenium beneath).
   4. Stigmas 2. Lenticels orbicular to elliptic, not numerous. Fruit transverse-oblong, somewhat depressed in the middle, 1–2-seeded.
    5. Stigmas sessile, reflexed, very close together on ovary and fruit. Nerves (6–)7–9 pairs. **1. R. cauliflora**
    5. Stigmas spaced on the ovary, flat-discoid, slightly stalked.
     6. Nerves 5–7 pairs. Fruit smooth, brown-velvety. . . . . **2. R. scortechinii**
     6. Nerves 8–10(–12) pairs. Fruit glabrescent, minutely verrucose . . . . . **3. R. inconstans**
   4. Stigmas 3(–5). Lenticels ± linear.
    7. Stigmas slightly stalked, rather spaced on ovary and fruit, flat-discoid. Leaves ± narrow-oblong, (20–)23–45 cm long.
     8. Fruit shortly and broadly pear-shaped, 4–6-seeded, with rather thick pericarp. Nerves excurrent along leaf-margin. Lenticels numerous . . . . **4. R. fasciculata**
     8. Fruit subglobose, 1–3-seeded, with rather thin pericarp. Lateral nerves (at least the superior ones) curved-anastomosing along leaf-margin. Lenticels sparse . . . . . . **5. R. glauca**
    7. Stigmas on the ovary sessile, radiate from the centre, reflexed, very near together in fruit. Leaves elliptic or ovate-elliptic, 11–20(–22) cm long . . . . **6. R. baccaureoides**
  3. Leaves densely or sparsely pilose all over the undersurface.
   9. Stigmas 2, subsessile. Hairs golden to ferrugineous, spreading, densely covering the branchlets, the midrib and nerves, not so densely on the intervenium . . . . **7. R. hirsuta**
   9. Stigmas 3(–5), sessile. Hairs very pallid, appressed, scattered on midrib, nerves and veins (only visible with a lens), branchlets soon glabrescent . . . . **6. R. baccaureoides**
1. ♂ and/or ♀ inflorescences axillary, *i.e.* from the leaf-axils of young foliate or defoliate branches.
 10. Leaves ± densely, rarely laxly covered with mostly ferrugineous spreading hairs underneath.
  11. Petioles relatively slender, 1–1½ mm diam. Nerves 4–5(–6) pairs, suberect. Hairs pale, very laxly arranged on the surface, more densely on midrib and nerves beneath. Stigmas 2, sessile, spaced on the ovary . . . . **8. R. wallichii**
  11. Petioles relatively thick, 2–2½ mm diam. Nerves (5–)6–8(–10) pairs, curved-ascending.
   12. Stamens 4. Filaments free, divergent. Stigmas 2, subsessile, very distant from each other on the ovary and fruit . . . . **7. R. hirsuta**
   12. Stamens 5. Filaments connate into a column. Stigmas 2, sessile, very close together on the ovary. **9. R. calotricha**
 10. Leaves covered underneath with fine, very short, or longer strigose, pallid, appressed hairs, or subglabrous, or entirely glabrous.
  13. Nerves 10–12 pairs. Petioles 5–10 mm long . . . . **10. R. multinervosa**
  13. Nerves 2–9 pairs. Petioles mostly longer.
   14. Column of filaments ± densely covered with whitish rather long hairs, at least in the upper part. Inflorescences mostly on lower, defoliate parts of the branchlets . . . . **11. R. javanica**
   14. Column of filaments (or rarely free filaments) glabrous. Inflorescences mostly in the upper leaf-axils.
    15. Nerves 2(–3) pairs, very elongate-erect. Young fruit nearly sessile . . . **12. R. kostermansii**
    15. Nerves 4–9 pairs. Fruit 2–5 mm peduncled.
     16. Leaves ± densely pilose all over the surface beneath.
      17. Young shoots and branchlets very densely and ± persistently, dark rusty-hirsute. Underside of the leaves equally and subdensely, midrib and nerves densely covered with substrigose yellow-brown hairs. Stigmas 2, sessile, very close together on the ovary . **13. R. micromera**
      17. Young shoots with a short, rusty-silky, subhirsute tomentum, rather soon glabrescent. Midrib and nerves less densely hairy.
       18. Stigmas 2, slightly stalked and divergent on the ovary. Leaves chartaceous, mostly densely covered with substrigose, rather long, appressed pale hairs beneath. Fruit transverse-oblong, (1–)2-seeded . . . . **14. R. caesia**

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(1) Imperfectly known and not placed: *R. minor* RIDL.

18. Stigmas 3(–4), sessile, radiate, reflexed and very close together on the ovary. Leaves laxly covered beneath with fine, appressed, brown or pale hairs, but mostly entirely glabrous.
    19. Leaves coriaceous; reticulations strong and very prominent on both surfaces. **15. R. kunstleri**
    19. Leaves subcoriaceous; reticulations little prominent on both surfaces. **6. R. baccaureoides**
16. Leaves entirely glabrous (or sometimes with solitary hairs on the midrib beneath).
    20. Stigmas 2, flat, subsessile, near together. Rhachis golden-brown-tomentose. Fruit 1–2-seeded, glabrous . . . . **16. R. acuminata**
    20. Stigmas 3(–4).
        21. Nerves 3–4 pairs. Leaves rather thin, finely reticulate. Fruit subglobose when 2-seeded, fusiform-oblong when 4–6-seeded . . . . **17. R. hullettii**
        21. Nerves 5–7 pairs.
            22. Leaves coriaceous; reticulations distinctly prominent on both sides. Fruit globose, dark velvety-brown, little glabrescent, *c.* 3 cm diam., 4–6-seeded . . . . **15. R. kunstleri**
            22. Leaves subcoriaceous; reticulations little prominent on both sides. Fruit depressed-globose (when 2-seeded) or rounded-trigonous (when 3-seeded), 1½–2 by 2–2½ cm, brownish-hirsute (up till now known only from cauline inflorescences) . . **6. R. baccaureoides**

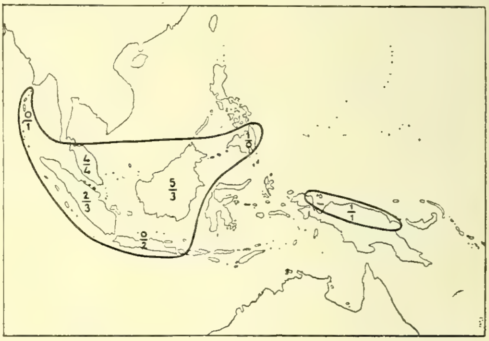

Fig. 17. Distribution of *Ryparosa*. The figure above the hyphen indicates the number of endemic species in the island, the figure below the hyphen the number of non-endemic species.

1. Ryparosa cauliflora MERR. Philip. J. Sc. 9 (1914) Bot. 325; En. Philip. 3 (1923) 109.

Tree 10 m; branchlets terete, ± densely covered with appressed, rusty hairs, soon glabrescent. *Leaves* broad-oblong to obovate-oblong, subcoriaceous, ± rounded, but 1–1½ cm cuspidate at the very apex, broadly cuneate at the base, dilutely olivaceous and shining above, pale greyish beneath, practically glabrous, but with very few, solitary, bristle-like hairs on the under surface specially on the nerves and midrib, rather densely hirsute towards the base, (16–)20–35 by (6½–)9–14(–17) cm; midrib nearly flat above, very prominent beneath, nerves rather straight and subparallel, slightly curved and anastomosing near the leaf-margin, very little raised above, distinctly so beneath, veins irregularly transverse, rather coarsely reticulate, little prominent above, more so beneath; petiole stout, 2–3 mm diam., rather densely ferrugineous-hirsute, (2½–)3–4(–9) cm. *Inflorescences* solitary, rather densely ferrugineous-pubescent, up to 35 cm long. ♂ *Flowers:* only seen in buds on *c.* 10 cm long spike-like racemes. Pedicels 2 mm. *Calyx* densely ferrugineous-pilose. *Petals* 4, thin; scale ovate, densely ferrugineous-villose. Stamens 5; column glabrous. ♀ *Inflorescence* not seen. *Fruit* transverse-oblong, 2-seeded, 1½ by 2½ cm, covered with a short rusty-brown tomentum, tubercles not very prominent; stigmas reniform, impressed lengthwise. *Seeds* globular-ovoid, *c.* 1 cm diam.

Distr. *Malaysia:* Philippines (Mindanao, Tinago Isl., Surigao).

Ecol. Forests at low altitude.

Vern. *Buñganon*, P. Bis.

2. Ryparosa scortechinii KING, J. As. Soc. Beng. 59, ii (1890) 126; Ann. R. Bot. Gard. Calc. 5 (1896) 134, t. 156; RIDL. Fl. Mal. Pen. 1 (1922) 166.—*Ryparia scortechinii* RIDL. Trans. Linn. Soc. II, 3 (1893) 276.

Rather small, slender, spreading tree, 5–12 m, trunk 15–20 cm diam.; branchlets appressed rusty-hirsute, glabrescent, red-brown when dry. *Leaves* oblong-lanceolate to oblanceolate, gradually attenuate at the apex, sometimes ± abruptly cuspidate (1–2 cm), ± broadly cuneate to subrotundate at the base, coriaceous or firmly chartaceous, dark-green above, bluish-green beneath when alive, olivaceous-brownish above when dry, much paler (glaucous) beneath, glabrous, sometimes laxly beset with short, bristle-like, appressed hairs on the midrib beneath, (15–)20–25(–37) by (6–)8–10(–15) cm; midrib flat or little grooved above, very prominent beneath, nerves elongate curved-ascending, obscurely anastomosing near the leaf-margin, little prominent above, strongly so beneath, veins rather densely reticulate and prominent on both sides; petiole thick, stout, ± densely ferrugineous-hirsute, glabrescent, 2½–6 (–7) cm. *Racemes* solitary, shortly ferrugineous-hirsute, pendulous, the ♂ slender, 10–25 cm, the ♀ mostly shorter. *Calyx* rusty-pilose outside; lobes 3, ovate, 2 mm. *Petals* 4–5, oblong, subacute, 2 by 1 mm; scales ovate, densely fulvous-silky, 1 mm. ♂ *Flowers:* stamens 5; column glabrous. ♀ *Flowers:* calyx and petals slightly larger than in the ♂. Staminodes 5, glabrous, very short; anthers minute, early caducous. *Ovary* ovoid, later somewhat 4-angled, densely rusty-tomentose. *Fruit* angular, with green or white dots, mostly transverse-oblong, *c.* 2 by 3 cm, retuse at the apex when 2-seeded, or rarely subglobose, *c.* 2 cm diam., when 1-seeded; pericarp thin, fragile, velvety-black; peduncle 1–2 mm. *Seeds* plano-convex to subglobular.

Distr. *Malaysia:* Malay Peninsula (Perak, Penang, Selangor, Pahang, Kelantan, Trengganu).

Ecol. Dense forests, up to 300 m.

Vern. *Tukol, talon,* M.

3. Ryparosa inconstans CRAIB, Kew Bull. (1926) 154.

Tree 8 m; branchlets appressed-ferrugineous-pubescent when young, soon glabrescent. *Leaves* oblong-oblanceolate or oblong-elliptic, acuminate, nearly mucronate at the very apex, cuneate or rounded at the base, subcoriaceous, glabrous, pallid beneath, 37–70 by 13½–17 cm; nerves little prominent above, more so beneath, conspicuously anastomosing at the leaf-margin, veins reticulate-prominent on both sides; petiole thick, up to 7½ cm. ♂ *Flowers* not yet known. ♀ *Racemes* up to 40 cm, rhachis appressed-ferrugineous-pubescent. Pedicels 3–4 mm. *Calyx*-lobes deltoid, obtuse, ferrugineous-puberulous outside, 3½ by 3 mm. *Petals* oblong, 3½ by 2 mm; scale densely hirsute, 2 mm. *Ovary* subglobose, attenuate at the base, densely ferrugineous-hirsute. *Fruit* transverse-oblong, retuse at the apex, 2 by 3 cm.

Distr. S. Siam (Pattani: near Bachaw), once found.

Ecol. Evergreen forest, 500 m.

4. Ryparosa fasciculata KING, J. As. Soc. Beng. 59, ii (1890) 127; Ann. R. Bot. Gard. Calc. 5 (1896) 135, t. 158; RIDL. Fl. Mal. Pen. 1 (1922) 166; BURK. Dict. (1935) 1923.—*Ryparia fasciculata* RIDL. Trans. Linn. Soc. II, 3 (1893) 276.

Tree (10–)15–20(–35) m; branchlets red-brown, the younger parts very soon glabrescent, longitudinally striate; lenticels linear-oblong, 1–2 mm. *Leaves* narrow-oblong, coriaceous or nearly so, gradually attenuate and mostly slightly curved at the apex, cuneate at the base, rarely rounded, shining and bluish- to greyish-olivaceous above when dry, much paler beneath, 23–40 by (6–)7–10 (–12) cm, midrib mostly somewhat raised above, very prominent beneath, nerves suberect, (5–)6–7 (–9) pairs, little prominent above, strongly so beneath, veins ± manifestly transverse, reticulations dense and prominent on both sides; petiole thick, (1½–)2–3½(–5) cm. *Racemes* mostly numerous, in fascicles of 3–10 from each tubercle, slender, 15–25(–30) cm, rusty-hirsute. Pedicels 2–3 (–5) mm. *Flowers* light yellowish-brown, exactly as in *R. scortechinii*, but ovary more attenuate at the base and with 3 stigmas. *Fruit* yellowish-green, rusty-tomentose, triquetrous, the base substipitate-attenuate, apex very shortly mamillate, 3–4(–4½) by 2½–3 cm; peduncle thick, 1–2 mm. *Seeds* 3, enclosed in a white pulp of excellent flavour.

Distr. *Malaysia:* Malay Peninsula (Perak, Selangor, Kuantan, Malacca).

Ecol. In dense forests up to 300 m, apparently not common.

Uses. Wood dark dirty or light in colour, hard and durable, used for house-building and beams. The fruit is said to possess decidedly purgative qualities.

Vern. *Talón, tukol,* Selangor, *rambai ayam, pokok lemos, tajam b'lat, mesekang, putih,* Malacca, *putat gajah, sĕrungkup, talan.*

Note. In the sterile state to be distinguished from the very similar *R. scortechinii* by the numerous, elongate-linear lenticels on the branchlets, which are in *R. scortechinii* very few in number and short orbicular-elliptic in shape.

5. Ryparosa glauca RIDL. J. Bot. 74 (1936) 225.

Tree *c.* 5–6 m; branchlets brown-red when dry, glabrous, with sparse oblong-linear lenticels. *Leaves* narrow-oblong to oblong, ± shortly subacute-acuminate, broadly cuneate at the base, coriaceous, glabrous, pallid green or olivaceous when dry, shining above, dull and lighter-coloured beneath, (20–)25–45 by (6–)7–12(–13) cm; midrib impressed above specially towards the base, very prominent beneath, nerves 8–9 pairs, raised on both sides, reticulations rather dense and prominent; petiole stout, 2–3 mm thick, glabrous, (2½–)3–7 cm. *Racemes* spiciform, mostly solitary, slender, rather densely cinereous-subferrugineous-pubescent, 15–30 cm. Pedicels 1 mm. *Calyx*-lobes ovate, thin, 1½ mm. *Petals* 5, ovate-oblong, thick, 2–2½ mm; scale oblong, densely whitish-villose, 1½ mm. ♂ *Flowers:* staminal column slender, glabrous, 2½ mm. ♀ *Flowers* not seen. *Fruit* glabrescent, a little rough by many brown, corky lenticels; peduncle 5–6 mm long and 3 mm diam.

Distr. *Malaysia:* Borneo (Sarawak), at low altitude.

6. Ryparosa baccaureoides SLEUM. Blumea 7 (1954) 495.

Small tree; branchlets red-brown when dry, appressed-ferrugineous-pubescent, rather soon glabrescent, subterete; lenticels elliptic or mostly elongate-elliptic. *Leaves* acute-acuminate, broadly cuneate to rounded at the base, subcoriaceous, brownish-olivaceous, somewhat shining and glabrous when dry, greyish-greenish, pale and dull beneath, nerves and veins as well as undersurface mostly laxly covered with very small appressed pallid hairs, or glabrous, (11–)13–20(–22) by (5–)6–9(–12) cm; midrib slightly grooved above, very prominent into the apex beneath, nerves 5–6 pairs, curved-ascending and manifestly anastomosing near the margin, nearly flat above, very prominent beneath, veins rather densely reticulate, prominent specially beneath; petiole 2½–4(–9) cm, brown when dry, dark ferrugineous-pubescent, soon glabrescent, longitudinally striate. ♂ *Racemes* axillary or cauline, 8–12 cm, slender, spiciform; rhachis ± densely ferrugineous-pilose. Pedicels 3 mm. *Calyx* lobes ovate, ferrugineous-pilose outside, nearly glabrous inside, *c.* 3 mm diam. *Petals* oblong, acuminate, dark red when dry, *c.* 3 by 2 mm; scale ovate, golden-villous, 2 mm. Column of filaments glabrous, 4 mm. ♀ *Racemes* solitary or in fascicles of 2–3, cauliflorous; rhachis rather stout, 2 mm thick, pendent in anthesis, angular, 20–30 cm, rather densely ferrugineous-pilose. Pedicels 1½ mm. *Calyx* lobes and *petals* a little larger than in the ♂ flowers. Staminodes 5, reduced to short filaments. *Ovary* ovoid-subglobose, densely ferrugineous-hirsute. *Fruit* 1½–2 by 2–2½ cm, brown-hirsute and rugose; pedicel thick, 2 mm.

Distr. *Malaysia:* N. Borneo (Kinabalu).

Ecol. Mountain-forest, 1000–1600 m.

7. Ryparosa hirsuta J. J. SMITH, Ic. Bog. 4 (1910) 57, t. 317; SLOOT. Bijdr. Flac. (1919) 90; MERR. En. Born. (1921) 411; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 318.

Tree 20–25 m; ultimate branchlets covered with a dense golden-brown or rusty tomentum; branches terete, with greyish bark and few elliptic lenticels. *Leaves* oblong or slightly obovate-oblong, acute-acuminate, rarely obtuse, cuneate to rounded at the base, subcoriaceous, brownish-olivaceous above, paler and more ferrugineous beneath when dry, shining and glabrous above, dull beneath, (15–)18–30 by (7–)8–12(–14) cm; midrib flat or slightly immersed above, very prominent beneath, nerves (5–)6–8(–9) pairs, suberect, little anastomosing at the margin, little or not prominent above (but often markedly dark-coloured), manifestly so beneath, veins transverse and prominent beneath, reticulations rather dense, little but visibly raised on both sides; petiole rather thick, ferrugineous-tomentose, 2½–5(–8½) cm. *Racemes* said to be 'cauline', but as far as seen from dried material, apparently axillary on defoliate twigs, mostly solitary, sometimes fascicled, ♂ ones very slender and (15–)20–55 cm, ♀ ones stouter, 8–15 cm, less densely set with flowers, always densely golden-brown, nearly hirsute-tomentose. ♂ *Flowers:* pedicels 1 mm. *Calyx* lobes 4, *c.* 1 mm, densely ferrugineous-pilose outside, glabrous inside. *Petals* 4, cream, oblong, subacute, 1.8 by 1 mm; scales ovate, 0.7 mm. *Stamens* 4, free, divergent, filaments 1 mm. ♀ *Flowers:* pedicels 3–5 mm. *Calyx* lobes 2½ mm. *Petals* 3 by 2 mm; scales very thick, 1½ mm. Staminodes 4, reduced to short glabrous filaments. *Ovary* subglobose, densely ferrugineous-hirsute. *Fruit* slightly depressed-globose (when 1-seeded, *c.* 2½ cm diam.) or mostly a little transverse-oblong (when 2-seeded, 2½ by 3–3½ cm), dark brown, initially tomentose, but soon glabrescent and somewhat rough. *Seeds* oval-semiglobose, *c.* 2–2½ by 1½ cm.

Distr. *Malaysia:* Borneo.

Ecol. Mountain-forest, 1000–1150 m.

Vern. *Poh-poh*, S. Kinabatangan.

8. Ryparosa wallichii RIDL. J. Str. Br. R. As. Soc. *no* 73 (1916) 139; Fl. Mal. Pen. 1 (1922) 165.

Tree; young branches with dense, dark-ferrugineous tomentum, ± concealing the sparse pallid elongate-elliptic lenticels. *Leaves* lanceolate-oblong, shortly (1 cm) acute-acuminate, cuneate at the base, subcoriaceous, olivaceous, glabrous and shining above, pallid and dull beneath, 12–20 by 3–5 cm; midrib slightly impressed above, very prominent beneath, lateral nerves suberect-ascending, in 5 pairs, nearly flat above, prominent beneath, veins laxly reticulate and little raised; petiole at first brownish-ferrugineous-hirsute, later glabrescent at least at one side, rather thick, 1½ mm diam., 2–3 cm. ♂ *Flowers:* buds in 5–8 cm long spike-like dark-ferrugineous-tomentose racemes. ♀ *Inflorescence* not seen. Immature *fruit* ovoid-subglobose, ± ferrugineous-tomentose, apparently 2-seeded.

Distr. *Malaysia:* Malay Peninsula (Penang, Selangor).

Note. Very near *R. acuminata* in general appearance, but with scattered, spreading, rather pale hairs on the underside of the leaves. The description above is based upon WALLICH's specimens from Penang (7847B, *lectotype*, K; 7847A, *leg.* FINLAYSON, K, apparently also from Penang) and a specimen with young fruits collected by HOSHIM (SF 2937, K) at Federal Hills, Kuala Lumpur, which is doubtless conspecific with WALLICH's plants. RIDLEY included his *no* 14163 (Singapore: Garden jungle, SING) in his description of *R. wallichii*, but this specimen I refer to *R. scortechinii*.

9. Ryparosa calotricha MILDBR. Notizbl. Bot. Gart. Mus. Berl.-Dahlem 10 (1928) 339.

Tree 8–20 m; young branchlets fulvous-hirsute or -tomentose, the old ones entirely glabrous, terete, covered with a thin, greyish peeling bark; lenticels sparse, orbicular-elliptic; bark grey or brownish-grey. *Leaves* elliptic-oblong, shortly obtusely or subacutely acuminate, cuneate at the base, rigidly chartaceous, upper surface olivaceous when dry, glabrous, rather dull, lower surface densely covered with a rufous, soft tomentum of ± spreading hairs specially on midrib, nerves, and veins, 13–20(–25) by (5–)6–9(–10) cm; midrib flat or somewhat immersed and tomentose in the lower half above, very prominent beneath, nerves (6–)7–9(–10) pairs, curved-ascending and excurrent along the margin, little or not prominent above, manifestly prominent beneath, veins ± transverse and prominent beneath, reticulations slightly prominent on both sides; petiole rufous-tomentose, 1½–3(–4) cm, rather stout, 1½–2 mm diam. ♂ *Racemes* many-flowered, up to 11 cm, fulvous-hirsute; pedicels 3–4 mm; ♀ *racemes* similar, but mostly shorter, their rhachis stouter and the flowers less densely arranged; pedicels 4–5 mm. ♂ *Flowers* only known in bud; staminal column glabrous. ♀ *Inflorescences* not yet known. Very young *fruits* broadly obovoid, fulvous-tomentose, with short filiform staminodes (without anthers).

Distr. *Malaysia:* New Guinea (Manokwari, Sepik).

Ecol. In primary forests, at very low altitude.

Vern. *Bijsje bijka*, Manokwari.

10. Ryparosa multinervosa SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 318, f. 4; HEYNE, Nutt. Pl. (1927) 1138.

Tree 10–23 m, sometimes buttressed; bark smooth; innovations rusty-tomentose, branchlets soon glabrescent; lenticels oblong, pallid. *Leaves* oblong or mostly ovate-oblong, gradually attenuate to the apex, sometimes rather abruptly (½–1½ cm) acuminate, subacute, broadly cuneate to rounded at the base, glabrous, shining and olivaceous-brownish above when dry, dull, pallid and dilutely yellowish-brownish beneath, undersurface laxly covered with fine, appressed, pallid hairs, more densely so to nearly hirsute on the midrib and nerves, 20–32 by 9–14 cm; midrib little raised above, very prominent beneath, nerves curved-ascending, rather distinctly anastomosing near the margin, rather flat above, prominent beneath, veins transverse-parallel, manifestly prominent beneath, reticulations dense and little prominent on both sides; petiole ferrugineous-tomentose, soon glabrescent. ♂ *Racemes* 20–30 cm, densely, finely rusty-tomentose, flowers only known in very young buds. ♀ *Flowers* (seen only below developed ovary): sepals and petals 3 mm; staminodes 4–5, manifestly pilose, 1 mm. *Ovary* appressed-ferrugineous-tomentose, the 2 sessile, ± rounded-reniform stigmas very close together. Peduncle *c.* 2 mm. Nearly mature *fruit* depressed-globose, ferrugineous-tomentose to glabrescent, minutely verrucose, (1–)2-seeded, *c.* 2½ by 1½ cm; pericarp thin, fragile; stigmas 2, *c.* 2–3 mm spaced.

Distr. *Malaysia:* N. Sumatra (Simalur Isl.).

Ecol. Scattered but rather common in lowland forests.

Uses. Heart-wood hard and durable. Fruits sour but edible.

Vern. *Mauseu uru, sikasa ilir, taramajang silai, djamboij, elul sawali,* Simalur.

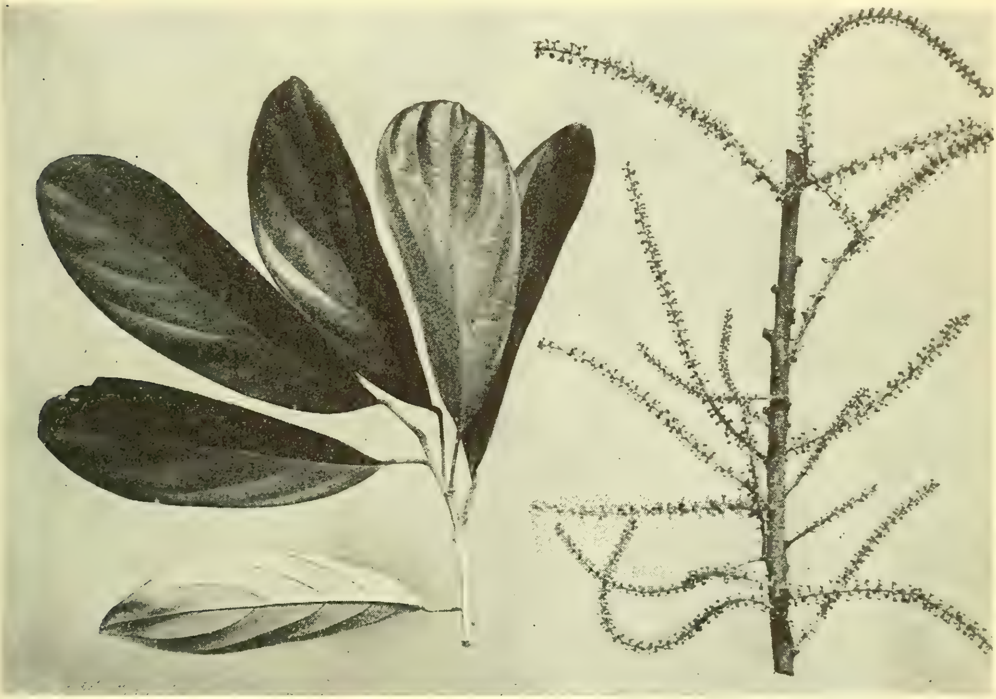

Fig. 18. *Ryparosa javanica* (Bl.) Kurz, ♀, × ⅕ (C.H.B. III–F–15).

11. Ryparosa javanica (Bl.) Kurz *ex* Koord. & Val. Bijdr. Booms. 5 (1900) 11; *l.c.* 6 (1900) 185; Back. Schoolfl. Java (1911) 72; Koord. Exk. Fl. Java 2 (1912) 631; Atlas 2 (1914) f. 350; Sloot. Bijdr. Flac. (1919) 85; Bull. Jard. Bot. Btzg III, 7 (1925) 324.—*Bergsmia javanica* Bl. Rumphia 4 (1849) 23, t. 178 c, f. 2; Miq. Fl. Ind. Bat. I, 2 (1859) 111.—*Ryparia javanica* Kurz, J. Bot. 11 (1873) 234.—*Ryparosa caesia* (*non* Bl.) Kurz, J. As. Soc. Beng. 45, ii (1876) 117; For. Fl. Br. Burma 1 (1877) 78; Sloot. Nova Guinea 14 (1924) 190.—*R. wrayi* King, J. As. Soc. Beng. 59, ii (1890) 126; Ann. R. Bot. Gard. Calc. 5 (1896) 133, t. 155; Sloot. Bijdr. Flac. (1919) 89; Ridl. Fl. Mal. Pen. 1 (1922) 165; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 323.—*R. kurzii* King, J. As. Soc. Beng. 59, ii (1890) 125; Ann. R. Bot. Gard. Calc. 5 (1896) 133, t. 154.—*R. longipedunculata* Boerl. Cat. Hort. Bog. (1899) 55; Koord. & Val. Bijdr. Booms. 5 (1900) 12.—*Gertrudia amplifolia* K. Sch. in K. Sch. & Laut. Fl. Deut. Schutzgeb. (1901) 455, t. 15; Gilg, Bot. Jahrb. 55 (1918) 292.—*R. amplifolia* Mildbr. Notizbl. Berl.-Dahlem 10 (1928) 339.—**Fig. 18–19.**

Tree 15–20(–30) m; bark grey to pale brown, rather smooth; branchlets appressed-rusty-tomentose apically, lower parts soon glabrescent, striate, light red-brown, later with a grey bark; lenticels sparse, oblong-elliptic. *Leaves* oblong or obovate-oblong, usually shortly (1–1½ cm) acuminate, acute or obtuse at the base, olivaceous when dry, shining and glabrous above, yellowish on the lower surface when dry, young ones minutely pubescent beneath, mostly glabrous beneath when adult, ± subcoriaceous, variable in size, 12–35 (–45) by $4^1/_2$–12(–14) cm; midrib mostly slightly impressed above, very prominent beneath, nerves 5–6 (in New Guinea sometimes up to 9) pairs, mostly curved-ascending rarely suberect, rather distant, nearly flat above, manifestly prominent beneath, veins ± distinctly transverse, reticulations fine, little but visibly prominent on both sides; petiole (1–)$1^1/_2$–6 cm, pubescent or glabrescent, $1^1/_2$–2(–3) mm diam. *Racemes* all or for the greater part on defoliate twigs (very rarely also on old branches), 6–40(–70) cm, solitary or occasionally in fascicles of 2 or 3, densely subsericeous-rusty-tomentose; rhachis slender. Pedicels 2–3(–5) mm. *Calyx* lobes 3–4, ovate, acuminate, 2–$2^1/_2$ mm. *Petals* 4–5, ovate-oblong, nearly 3 by 2 mm; scale nearly half as long as the petals, villous. ♂ *Flowers:* staminal column 3–4 mm. ♀ *Flowers:* staminodes pilose, without anthers, up to 1 mm. *Ovary* ovoid, somewhat contracted at apex and base, densely rusty-sericeous-tomentose, soon glabrescent, with 2(–3), thick, reflexed, sessile, broadly obovate or reniform stigmas. *Fruit* globose to depressed-globose, ($1^1/_2$–)$2^1/_2$–3 cm across, glabrous, dilute-brown and with slightly elevated lighter spots when dry, rather smooth (tubercles not or little prominent), crowned by 2 ± spaced stigmas or their rests; pericarp *c.* 1 mm thick, fragile; peduncle 5–8 mm. *Seeds* mostly 2, ± oblong, slightly curved, $1^1/_2$–2 cm long; aril fleshy, light-yellow.

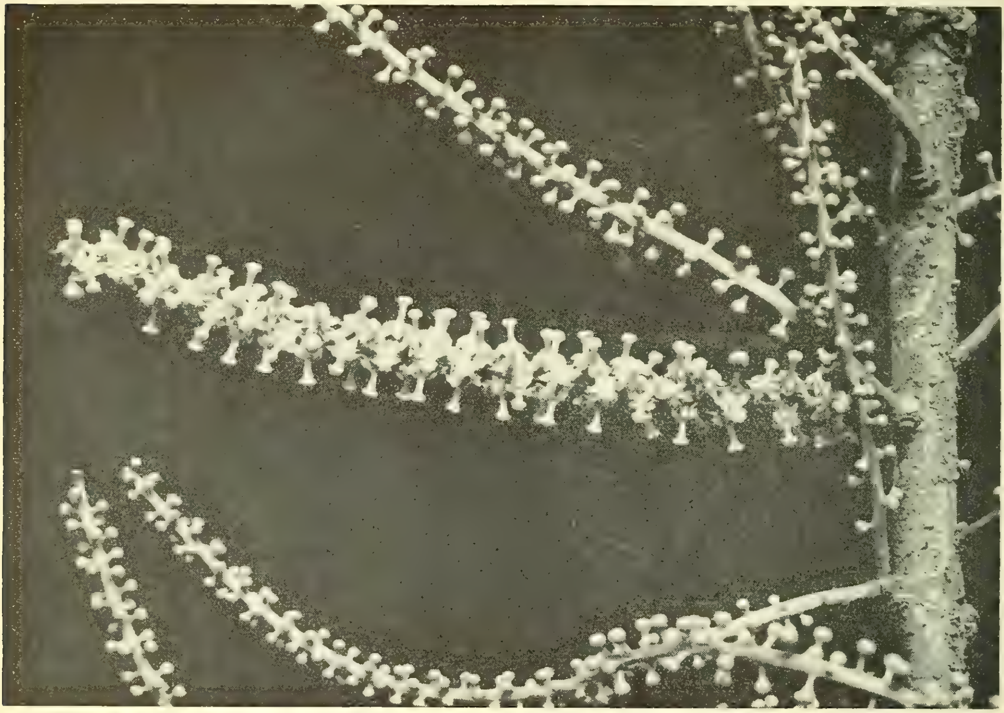

Fig. 19. *Ryparosa javanica* (BL.) KURZ, ♀ inflorescences, × 4/5 (C.H.B. III–F–15).

Distr. Andamans, Nicobars, and S. Siam, in *Malaysia:* Malay Peninsula (Perak, Selangor, Pahang), Sumatra, Java, Bali, Borneo, New Guinea.

Ecol. Rain-forests, scattered, on not or only periodically inundated ground, 50–300, rarely up to 1100 m; *fl.* June–Jan., *fr.* May–Oct.

Uses. Wood yellowish brown.

Vern. *Bungin*, Indragiri, *badja*, *tjingkuang*, Sum. E.C., *mĕdang ajou*, Benkulen, *ki sijung*, *huru gading*, *h. tangkalak*, *ki mĕngati*, *ki manjĕti*, S, *adem ati*, *langit*, *wera*, Banjumas, *buru merak*, *hendog*, *sapi*, *kadju*, Besuki.

Note. Most of the New Guinean material has 7–8 (very rarely up to 9) pairs of nerves, and the fruits are more markedly tubercled, but the column is pilose within or at least in the upper part, which indicates the conspecificy or very close relationship with *R. javanica sens. stricto*. The New Guinean material at hand is too incomplete to allow a clear segregation of *R. amplifolia* as a distinct taxon.

12. Ryparosa kostermansii SLEUM. Blumea 7 (1954) 496.

Tree 14–20 m, bole 12 m, diam. 12–20 cm, somewhat fluted; buttresses 1 m high; bark grey or pale brown to dark brown-red, smooth, pitted; branchlets angular, densely covered with minute, olivaceous, appressed hairs; lenticels oblong to elongate-oblong. *Leaves* oblong, gradually attenuate at the apex into a rather fine, acute acumen (1–1½ cm), cuneate at the base, firmly chartaceous, olivaceous, glabrous and dull above, cream-pallid or greyish-greenish and opaque beneath when dry, rather densely covered over the whole surface beneath with minute, fine, but rather stiff, pale, appressed hairs (well visible only by a lens), (10–) 12–20 by (3–)4–7 cm; midrib slightly immersed above, very prominent and sometimes set with short strigose hairs beneath, lateral nerves erect in 2 (rarely 3, then the outermost ones faint) pairs, little prominent above, manifestly so beneath, veins ± obscurely transverse, reticulation distinct on both sides, but little prominent; petioles rather thin (1–1½ mm), (1–)1.2–1.8 cm, densely set with olivaceous, appressed, sericeous hairs. ♂ and ♀ *flowers* not yet known; developed ovaries and very young fruits several on 5–9 cm long racemes; rhachis slender, 1½ mm diam., densely covered with olivaceous, appressed hairs. Pedicels 1 mm long, 1½ mm diam. Immature *fruit* subglobose, covered with a dark-olivaceous or grey-green, short tomentum and with numerous tubercles; stigmas 2, broad-reniform, sessile, very close together on the developed ovary, 1–2 mm spaced on the submature fruit (*c.* 1½ cm diam.). *Seeds* 1–2.

Distr. *Malaysia:* SE. and W. Borneo (? Sarawak).

Ecol. Forests, on sandy or sandy-loamy soil, 30–700 m.

Vern. *Kakapasan*, Bandjar, *lĕmbuan*, *bĕtikĕl*, *daju*, Dyak.

Note. Fruiting material from Sarawak possibly belongs to this species: ripe fruit depressed-globose, finely tubercled, with lighter spots, 2½–3 by 3–3½ cm, with short peduncle (G. Silang, vern. *tampol batu*).

13. Ryparosa micromera SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 325, f. 5.

Tree up to 30 m; bark grey-brown; innovations and young branchlets rather dark rusty-tomentose or nearly hirsute, somewhat striate; lenticels elliptic. *Leaves* mostly oblong, sometimes obovate-oblong, rarely lanceolate-oblong, acutely or obtusely acuminate, cuneate to rounded at the base, subcoriaceous, densely rusty-hirsute on both sides when very young, but glabrous when adult, rather dull and greenish-olivaceous or -glaucous above when dry, yellowish-olivaceous and much paler beneath, 6½–12 by 2¾–4½ cm; midrib and 5–6 pairs of suberect nerves rather obscure above, very prominent beneath, veins ± indistinctly transverse, reticulations little prominent above, more so beneath; petiole initially rusty-tomentose, soon glabrescent, 1½–2½ cm, 1 mm diam. *Inflorescences* mostly in the axils of the upper leaves, sometimes also from lower defoliate parts; ♂ ferrugineous-tomentose, 3½–6 cm long, rhachis slender; ♀ ones seen only in fruiting state, somewhat stouter, *c.* 4–5 cm long. *Calyx* lobes ovate, *c.* 1½ mm. Petals 4, ovate-oblong, 2 by 1 mm; scales ovate, *c.* ½ mm.—♂ *Flowers:* column glabrous, 1½–2 mm. ♀ *Flowers* not yet known. Immature fruit subglobose, fulvous-tomentose, (1–)2-seeded, with 2 sessile, subreniform stigmas; peduncle 1½ mm.

Distr. *Malaysia:* Sumatra (Palembang), possibly elsewhere (sterile specimens).

Ecol. Primary forest, on hilly never inundated sandy soil at low altitude.

Vern. *Tindjar blukar abang*, *t.b. mèrah*, *kĕpayang*, M.

14. Ryparosa caesia BL. Bijdr. (1825) 601; KURZ, J. Bot. 11 (1873) 234; KING, J. As. Soc. Beng. 59, ii (1890) 128; Ann. R. Bot. Gard. Calc. 5 (1896) 133, t. 153; KOORD. & VAL. Bijdr. Booms. 5 (1900) 9; KOORD. Exk. Fl. Java 2 (1912) 631; Atlas Baumarten 2 (1914) f. 351; SLOOT. Bijdr. Flac. (1919) 82; BAK. *f.* J. Bot. 62 (1924) Suppl. 6, *incl. var. sumatrana* BAK. *f.*, SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 320; RIDL. Kew Bull. (1925) 77; HEYNE, Nutt. Pl. (1927) 1138.—*Ryparia caesia* BL. *ex* HASSK. Cat. Hort. Bog. (1844) 239; Pl. Jav. Rar. (1848) 267; MIQ. Fl. Ind. Bat. I, 2 (1859) 361; Suppl. (1860) 443.—*Aspidandra fragrans* HASSK. Versl. en Med. Kon. Akad. Wet. Afd. Natuurk. 4 (1856) 141; Flora 40 (1857) 532; Retzia *ed. nov.* (1858) 47; MIQ. Fl. Ind. Bat. I, 2 (1859) 411.

Small tree 5–15 m; bark grey; branchlets terete, striate, with small orbicular or elliptic lenticels, younger parts appressed-rusty-substrigose or -silky, soon glabrescent. *Leaves* elliptic-oblong or oblong, ± long-acuminate and acute at the apex (rarely obtusely acuminate), attenuate at the base, ± firmly chartaceous, dark green, glabrous and shining above, pale, greyish-green and densely appressed-subsericeous or substrigose beneath with ± longish, pale or yellowish hairs specially on midrib and nerves, (10–)15–25 by 4½–7½ (–10) cm; midrib and nerves little prominent above, manifestly so beneath, nerves curved-ascending 5–6 pairs, rather distant, inferior 2–3 excurrent along the margin, upper ones slightly enarching, veins ± transverse, reticulations rather dense and little prominent on both sides; petiole appressed-ferrugineous-hirsute (1–)1½–5 cm, relatively thin, 1–1½ mm diam. *Racemes* slightly supra-axillary, solitary, 5–30 cm, sericeous-rusty-tomentose; rhachis rather slender. Pedicels 2–3 mm. Buds ovate-apiculate. *Calyx* lobes 3(–4), oblong-ovate, acuminate, 3 mm. *Petals* 4–5, elliptic, *c.* 4 mm, greenish-white; scale suborbicular, *c.* 1½ mm. ♂ *Flowers: stamens* mostly connate, but sometimes free, the column respectively filaments glabrous. ♀ *Flowers: staminodes* 5, minute, whether or not with rudimentary anthers. *Ovary* ferrugineous-hirsute; stigmas reniform, slightly emarginate. *Fruit* first rusty-tomentose, later more greyish-tomentose and punctate, when ripe 2–2½(–3) cm across; peduncle 2–3 mm.

Distr. *Malaysia:* Sumatra, Java (W. half).

Ecol. In mixed forests, 400–1600(–2000) m, scattered and not common. *Fl.* July–Nov., March–April, *fr.* July–Oct.

Vern. *Gĕgĕr tako, djĕdjĕr tĕko*, S, *wuru*, J, *kalumpang asoh*, M.

Uses. Fruits said to be edible.

Note. Not known with certainty from Bali, Celebes or New Guinea, as stated in literature.

15. Ryparosa kunstleri King, J. Soc. Beng. 59, ii (1890) 127; Ann. R. Bot. Gard. Calc. 5 (1896) 134, t. 157; Hall. *f.* Med. Rijksherb. Leiden 1 (1910) 3; Sloot. Bijdr. Flac. (1919) 87; Ridl. Fl. Mal. Pen. 1 (1922) 165; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 325; Heyne, Nutt. Pl. (1927) 1138; Burk. Dict. (1935) 1923; Symington, Kew Bull. (1937) 318.—*Xanthophyllum hebecarpum* Chod. Bull. Herb. Boiss. 4 (1896) 263; Ridl. Fl. Mal. Pen. 1 (1922) 149.

Tree 10–25 m, branchlets red-brown when dry, apically appressed-subferrugineous-pubescent, elsewhere glabrous, striate; lenticels oblong, 1–1½ mm; bark grey-brown, mottled with transversely oblong lenticels 3–4 mm. *Leaves* ovate-oblong or obovate-oblong to oblong, shortly and abruptly (1–1½ cm) acuminate, narrowed or rarely rounded at the base, coriaceous, upper surface olivaceous-green when dry, lower surface dull, pale, glabrous or mostly laxly covered with minute, pale-ferrugineous, appressed hairs with some longer bristle-like hairs or numerous shorter, appressed, ferrugineous hairs in the lower part of the midrib beneath, 12–20(–30) by 6–8½(–12) cm; midrib flat or slightly impressed above, very prominent beneath, nerves 5–6(–7) pairs, subarcuate-ascending and slightly raised above, prominent beneath, veins ± transverse, reticulations dense and rather prominent on both sides; petiole 2–3 mm diam., first dark ferrugineous-pubescent, glabrescent, 2–3(–4½) cm. *Racemes* solitary, rarely 2–3 fasciculate, ♂ 15–20 cm, ♀ half as long; rhachis stoutish, 1½ mm diam., subdensely covered with brown, appressed hairs. Pedicels 2½–3½ mm. ♂ *Flowers: calyx* thin, rusty pubescent outside, with 3 ovate lobes 2½ mm. *Petals* 5, oblong-lanceolate, 3 by 2½ mm. Staminal column glabrous. ♀ *Flowers: staminodes* apparently 0. *Ovary* obovoid, attenuate and angular at the base, contracted at the apex, ferrugineous-hirsute. *Fruit* globular, yellowish or dark greenish-brown, first dark velvety-brown, somewhat glabrescent, densely minutely tubercled, *c.* 3 cm diam.; pericarp rather thin, 1 mm diam.; peduncle *c.* 0.8 cm long, 2½ mm thick, glabrous. *Seeds* 5–6, oblong, compressed, striate, 1.8 cm long.

Distr. *Malaysia:* Sumatra, Malay Peninsula (Perak, Pahang, Selangor, Dindings, Kedah).

Ecol. Primary forests, 20–300 m, rarely ascending to 1000 m.

Uses. Wood hard and durable.

Vern. Sumatra: *Kĕpayang rimbu, kalĕt akar mambu, kubang-kubang.* Pahang: *tĕmbasah, kĕlat.*

16. Ryparosa acuminata Merr. Philip. J. Sc. 11 (1916) Bot. 100; En. Born. (1921) 411; Pl. Elm. Born. (1929) 209.

Small tree 8–12 m, rarely a shrub 3 m, innovations dark rusty-brown-appressed-hirsute, lenticels whitish, elongate-elliptic, mostly glabrous, clearly visible; branchlets terete, soon glabrous and covered with a thin whitish cork. *Leaves* oblong, gradually acute-acuminate (1–2 cm), acute at the base, subcoriaceous, upper surface olivaceous, glabrous, shining, lower surface dull, pale, often greyish or yellowish-pruinose when dry, midrib and nerves ± densely to laxly subappressed-hirsute, intervenium itself glabrous, 12–22 by (3½–)4–7 cm; midrib slightly raised above, very prominent beneath, nerves suberect, 4–5(–6) on each side, somewhat prominent above, very distinct so beneath, reticulations rather dense and prominent on both sides; petiole first ferrugineous-hirsute, soon glabrescent, 1½–3(–4) cm. ♂ *Racemes* slender 10–25(–30) cm, the ♀ ones shorter and stouter, all covered with a dark ferrugineous-hirsute tomentum. Pedicels *c.* 2 mm. ♂ *Flowers: calyx* light-green or cream, the 3 lobes ovate-elliptic, *c.* 2½ mm, appressed ferrugineous hirsute outside. Petals 5, rather membranous, oblong-subacuminate, 2½ by 1¼ mm; scale ovate, *c.* 1.2 mm, yellowish-villous. *Stamens* 5, column glabrous, ♀ *Flowers* not yet known. Nearly ripe *fruit* globose, first with a rusty tomentum, which soon peels off, leaving the fruit minutely rugose, glabrous, with white dots; peduncle 2 mm.

Distr. *Malaysia:* Malay Peninsula (Penang, Selangor), Borneo.

Ecol. Dense forests at low altitudes, on Mt Poi (Sarawak) at 1000 m. *Fl.* Sept.–Dec.

Uses. Bark said to have the odour of wintergreen-oil.

Vern. Borneo: *Tampasak burong*, Dusun Kinabat., *giewei*, Sungei.

17. Ryparosa hullettii King, J. As. Soc. Beng. 59, ii (1890) 126; Ridl. Fl. Mal. Pen. 1 (1922) 165; Burk. Dict. (1935) 1923; Airy Shaw, Kew Bull. (1949) 158.—*R. oligophlebia* Merr. Philip. J. Sc. 13 (1918) Bot. 97; En. Born. (1921) 411; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 322; Merr. Philip. J. Sc. 29 (1926) 400.—*R. borneensis* Sloot. Bijdr. Flac. (1919) 88, t. 2; in Fedde, Rep. 29 (1931) 101.—**Fig. 20.**

Slender tree or shrub (2–)5–10(–20) m; bark greyish-brown or brown, smooth, rather flaky; branchlets reddish-brownish when dry, the apical part minutely pubescent, elsewhere quite glabrous, terete, striate, laxly covered with pallid, suborbicular to oblong lenticels. *Leaves* elliptic or obovate-elliptic, sometimes oblong or oblanceolate, firmly membranous, rather abruptly (1–2½ cm) subacute-acuminate, tapering to the petiole, shining and grey-olivaceous on the upper surface, dull, greyish-greenish and pale beneath when dry, glabrous on both sides except the minutely pubescent midrib and occasional short hairs on the nerves beneath, (10–)12–18(–23) by (4–)5–8(–10) cm; midrib and lateral nerves slightly raised above, very prominent beneath, nerves curved-ascending to suberect, upper ones only slightly anastomosing, veins distinctly transverse and somewhat raised on both sides, reticulations rather fine and dense, well visible on both sides; petiole rather slender, minutely pubescent, very soon glabrescent, $(1^1/_2-)2^1/_2-5$ cm long, $1^1/_2$ mm diam. *Racemes* mostly solitary, slender, the ♂ (10–)30–40(–50) cm, the ♀ 4–8 cm; rhachis rather densely greyish- or yellowish-pubescent. Pedicels very slender, 2–3 mm. *Calyx* membranous, with 3, broad, ovate lobes, laxly appressed-pilose outside, 2 mm. *Petals* 5, ovate-oblong, pale-green, usually dark red when dry, $2^1/_2$ mm; scale ovate, 1.2 mm. ♂ *Flowers: stamens* 5; column glabrous or sometimes

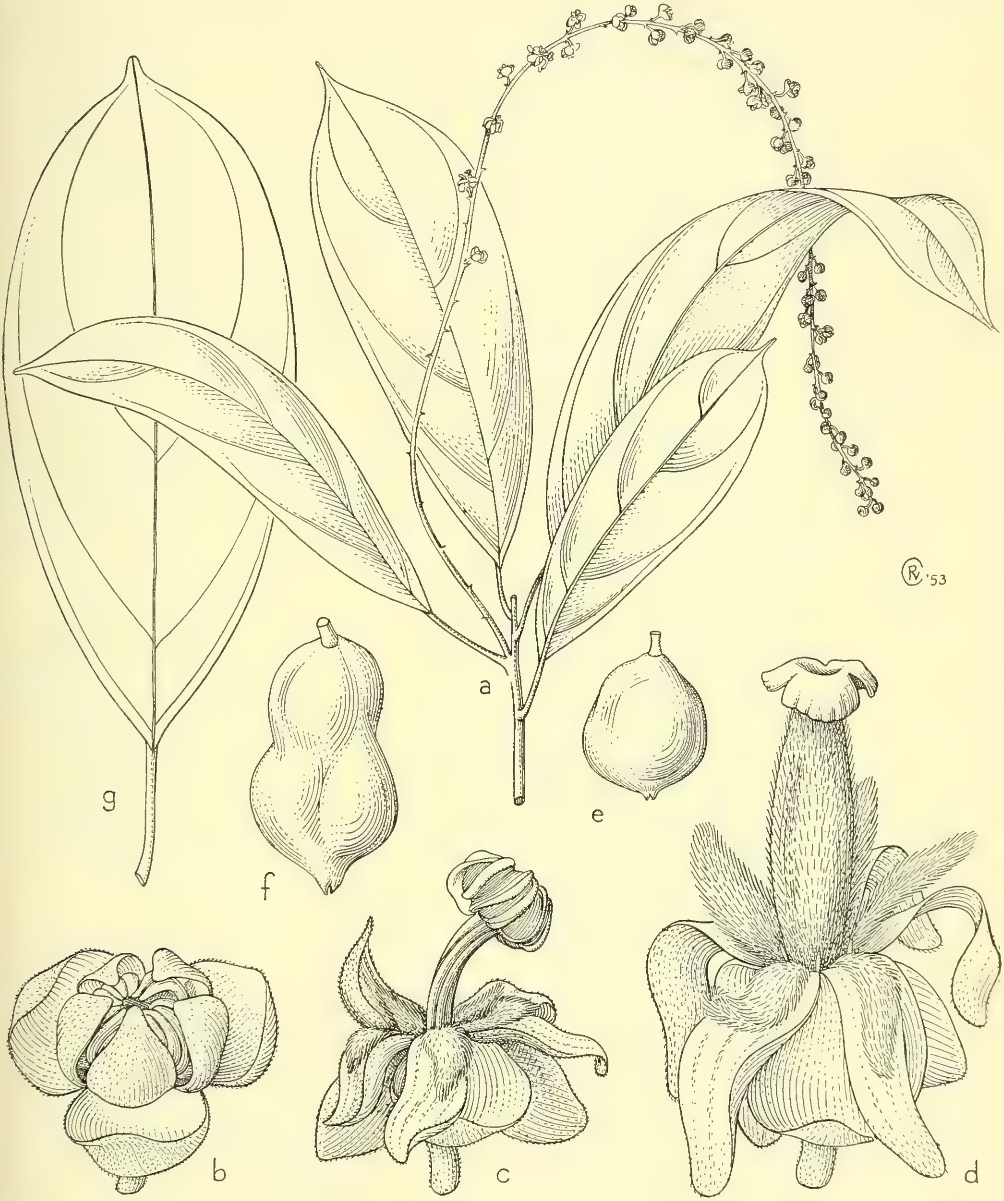

Fig. 20. *Ryparosa hullettii* KING. *a.* Twig with ♂ flowers, × $^2/_3$, *b.* young ♂ flower, × 8, *c.* ♂ flower in full anthesis, × 8, *d.* ♀ flower, × 8, *e.* 2-seeded fruit × $^2/_3$, *f.* 4-seeded fruit, × $^2/_3$, *g.* leaf, × $^2/_3$ (*a–c* after Br. N. Born. For. Dep. A 2297, *d* after KORTHALS, *ex* Borneo, *e* after VILLAMIL 263, *f* after SING. F.N. 29345, *g* after SING. F.N. 35947).

very little pilose immediately below the anthers, 3 mm. ♀ *Flowers: calyx* lobes and petals slightly larger than in the ♂. Staminodes 5, short, glabrous, without anthers. *Ovary* cylindrical, 3–4 mm, somewhat angular, dilutely rusty-hirsute; stigmas large, flat, reflexed, broadly obovate, sessile. *Fruit* fusiform when young, densely covered with minute tubercles, when ripe elliptic-fusiform and narrowed in the middle, when 4–6-seeded (3½–)4–4½(–6) by 2–2½ cm, rarely smaller, obovoid or subglobose, subacuminate, when 2–3-seeded 2½ by 2–2½ cm; pericarp thin, coriaceous, reticulate-pustular, greyish outside, at last nearly glabrous; peduncle 5–8 mm. *Seeds* irregularly compressed, mostly semiglobose, *c.* 1½ by 1 cm.

Distr. *Malaysia:* Malay Peninsula (Singapore, Johore, Trengganu), Borneo.

Ecol. On swampy ground or riversides in primary or secondary rain-forest (Dipterocarpaceous-forest), up to 200 (on Mt Kinabalu up to 550) m. *Fl.* Oct.–May, *fr.* Dec.–July.

Uses. Wood yellowish-white, pale brown or slightly pinkish, said to be soft; bark smelling of wintergreen-oil. Fruit yellow or yellowish-white, said to be edible.

Vern. Borneo: *Pitoling, bubuak, tampasak busong, sireh-sireh* (Sandakan); *piramoh* (Dusun); *impupuak, kayu tahi gagi* (Dusun Kinabat.); *kĕpayang bangai* (P. Laut); *chandar(a)i* (Brunei); *sumpit-sumpit* (SE. Borneo).

Note. A form with more rufous-pubescent leaves rounded at the base but otherwise very similar, was found at the base of Mt Dulit (Sarawak).

Imperfectly known

18. Ryparosa minor RIDL. J. Bot. 74 (1936) 225.

Small tree; branchlets glabrous, soon covered with grey cork. *Leaves* oblong, shortly (1 cm) acute-acuminate, cuneate at the base, coriaceous, glabrous, brownish and shining above, pallid and dull beneath when dry, (8–)9–14 by 4½–6 cm; midrib slightly impressed above, very prominent beneath, nerves ± 5 pairs, curved-ascending, excurrent at the margin or the upper ones very slightly anastomosing, little prominent on both surfaces, veins rather densely reticulate and raised specially beneath; petiole rugose, 1.3–1.8 cm. ♂ *Flowers: racemes* axillary, spike-like, 6–7 cm, grey-puberulous. Pedicels 1 mm. *Calyx* lobes 3, ovate, 1.2 mm. *Petals* 5, oblong-ovate, 2 mm; scales ovate, barbate, 1 mm. Column of filaments glabrous. ♀ *Flowers* and *fruit* not yet known.

Distr. *Malaysia:* Borneo (Sarawak: Kuching), only once found in swampy jungle.

Excluded species

Bergsmia acuminata MIQ. Fl. Ind. Bat. Suppl. (1860) 159, 389 belongs to the *Annonaceae, cf.* KURZ, J. Bot. 11 (1873) 233; HALLIER, Beih. Bot. Centralbl. 39, ii (1923) 160; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 328.

11. ELEUTHERANDRA

SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 328, f. 6–7.

Tree. *Leaves* alternate. Stipules 0. *Racemes* axillary, many-flowered, spike-like, simple or sometimes a little branched at the base. *Flowers* unisexual, 5-merous, the ♂ with rudiment of ovary. *Calyx* lobes valvate, minute, persistent. *Petals* imbricate, fugaceous, with basal scale inside. Disk 0. ♂ *Flowers: stamens* 5, episepalous; connective large. ♀ *Flowers: staminodes* 5, episepalous, subulate. *Ovary* unilocular; placentas 2(–3), each with one ovule. Styles 2 (very rarely 3), very short; stigmas conspicuous, erect, ovate-oblong and flattened, rather thick, together shaped like a deer's footprint. *Fruit* indehiscent, crowned by the style rests, 1–2(–rarely 3)-seeded; pericarp subcoriaceous, rather thin. *Seeds* arillate; testa hard.

Distr. Monotypic, *Malaysia:* S. Sumatra and SE.–NE. Borneo.

1. Eleutherandra pes-cervi SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 329, f. 6–7; HEYNE, Nutt. Pl. (1927) 1138.

Erect, slender tree, 10–35 m, buttressed up to 1 m; bark whitish, peeling; branches ferrugineous-tomentose, glabrescent when old. *Leaves* oblong to elliptic, entire, abruptly (0.5–1.7 cm) constricted at the apex, cuneate at the base, subcoriaceous, glabrous above, laxly pilose beneath, 11–17 by 4–8 cm; nerves 5–7 pairs; petiole stout, 3–6 cm, thickened at the apex. *Racemes* solitary, in the upper leaf-axils of the branchlets (these defoliate or beset with young, brownish-tomentose leaflets), 3–18 cm long. *Flowers* in spaced fascicles. Bracts and pedicels densely rusty-tomentose. *Calyx*-lobes ½ mm, triangular-subulate. *Petals* naviculate, glabrous, caducous, 4 by 1½–2 mm, pale-green, with a linear, inside densely pilose scale 2½ by 1 mm. ♂ *Flowers:* filaments pilose at apex and base only, 3 mm; anthers subcordate. Rudiment of ovary subulate. ♀ *Flowers:* staminodes glabrous, anthers reduced in size. *Ovary* oblong-ovoid, densely rusty-tomentose (white or greenish-white when fresh). Styles 2(–3), very short, tomentose, each with a blackish, *c.* 1 mm long stigma. *Fruit* irregularly globular-trigonous when containing 3 seeds, somewhat flattened when containing 2 seeds, asymmetrically applanate with 1 seed only, rusty-pilose. *Seeds* nearly reniform, 1.2 by 0.8–0.9 cm; testa striate; aril fleshy, 2–3 mm.

Distr. *Malaysia:* S. Sumatra (Palembang), SE. Borneo (Pleihari, Tanahbumbu), NE. Borneo (Berau).

Ecol. Primary dryland forest, probably scattered and rather rare, on sandy soil, 25–150 m. *Fl.* May–Nov., *fr.* July–March.

Vern. *Kĕtjintang, gistang, pĕlupi bara,* Palembang, *manuk-manuk, asahanlandak,* Borneo.

Uses. Sapwood red, heart-wood whitish, hard, occasionally used.

Note. Closely allied to the monotypic genus *Baileyoxylon* C. T. WHITE (J. Arn. Arb. 22, 1941, 143, pl. 1) from NE. Queensland, which differs from *Eleutherandra* only by 3 peltate, irregularly emarginate, foliaceous and shortly stalked stigmas. The fruits of *Baileyoxylon* are not yet known and may offer additional generic differences.

12. HOMALIUM

JACQ. Enum. Pl. Carib. (1760) 5.—**Fig. 21–25.**

Trees or shrubs. *Leaves* alternate (in Mal. *spp.*), penninerved, either with minute, caducous stipules (Mal. *spp.*) or exstipulate, entire or crenate-serrate (teeth obtuse, glandular beneath). *Flowers* bisexual, in axillary racemes (these often spike-like and solitary) or panicles, many-flowered. *Flowers* solitary or fascicled along the rhachis, sessile or pedicelled, subtended by a small, caducous or ± persistent bract. *Calyx*-tube obconical, connate with the ovary; calyx-lobes (sepals) (4–)5–8 (–12), flat, linear or obovate-spathulate, sometimes accrescent, wing-like. *Petals* inserted in the throat of the calyx, similar to the sepals and alternating with them, isomerous, whether or not accrescent, persistent. *Stamens* epipetalous, solitary or in fascicles of 2–8(–12), between the disk-lobes or rarely partly inserted on the base of the petals, very rarely irregularly inserted in the confluent disk-lobes; filaments filiform; anthers small, extrorse, dorsifixed. Disk represented by a (mostly tomentose) gland opposite each sepal. *Ovary* connate with the calyx in the inferior half, unilocular, with 2–6(–8) placentas, each with (1–)3–7 ovules near the apex. Styles 2–5(–7), free or shortly connate at the base; stigmas small or punctate. *Capsule* almost inferior, ± coriaceous, 2–8-valved from the apex, or indehiscent. *Seeds* 1 or few, minute.

Distr. About 180 *spp.* through all tropical countries, in *Malaysia* 23 *spp.*

Ecol. Most species belong to the lowland rain-forest.

Uses. Of several tall species the wood is used.

Note. Among the Malaysian species *23. H. moultonii* shows a remarkable structure of the androecium which does not fit into any of the known sections. To establish its infrageneric status a revision of the genus is necessary; this falls outside the scope of the present work. The species has been arranged here at the end of the genus as anomalous.

KEY TO THE SPECIES

1. Stamens solitary or in twos or in fascicles, strictly before the petals.
2. Stamens solitary before each petal. SECT. PYTHAGOREA.
3. Leaves softly tomentose or villous on the entire undersurface, or at least so on midrib and nerves.
4. Racemes simple or rarely 1–2-partite near the base, elongate, spike-like. Flowers sessile or nearly so. Leaves nearly sessile . . . . **1. H. tomentosum**
4. Racemes panicled, divaricate. Pedicels 1½–2 mm. Leaves 5–7 mm petioled . **2. H. barandae**
3. Leaves glabrous or practically so, sometimes laxly appressed-pilose or puberulous beneath on midrib and nerves only.
5. Flowers (sub)sessile, very small, 3–4 mm diam. . . . . **3. H. acutissimum**
5. Pedicels at least 1 mm.
6. Racemes elongate, spike-like, simple, solitary . . . . **4. H. longifolium**
6. Panicles divaricate, or several spike-like racemes forming a few-branched panicle (single racemes sometimes still with leaflets at their base).
7. Leaves entire or obscurely shallow-crenate, (4–)5–10(–12) by 3–5 cm . . **5. H. panayanum**
7. Leaves manifestly serrate-crenate to crenate.
8. Leaves 6–8 by 3–4½ cm. Nerves 6 pairs. Pedicels very slender . . . **6. H. multiflorum**
8. Leaves (9–)12–17 by 5–8 cm. Nerves 8–10 pairs. Pedicels thicker . . . . **7. H. loheri**
2. Stamens 2 or more before each petal.

9. Stamens inserted only between the disk-glands respectively at the very base of each petal but free from them. Sepals not or slightly accrescent after anthesis. SECT. EUMYRIANTHEIA.

10. Stamens constantly 2 before each petal, one behind the other.

11. Petals conspicuously patently pilose or tomentose, specially at the apex. **8. H. dasyanthum**

11. Petals shortly ± appressedly pilose or tomentose.

12. Leaves rigidly coriaceous, glaucescent-pruinose specially underneath. Bracts ovate or obovate, longer persistent . . . . **9. H. kunstleri**

12. Leaves chartaceous to subcoriaceous. Bracts minute, narrow-lanceolate, early caducous. **10. H. foetidum**

10. Stamens at least partly in fascicles of 3–4(–5–7, very rarely more) in the same specimen.

13. Pedicels up to 1/3 mm.

14. Racemes spike-like, mostly solitary.

15. Sepals and petals triangular-ovate, shorter than the calyx-tube. **11. H. caryophyllaceum**

15. Sepals and petals narrow-linear, as long as the calyx-tube . . . . **12. H. spathulatum**

14. Panicles divaricate . . . . **13. H. oblongifolium**

13. Pedicels at least 1 mm.

16. Racemes spike-like, solitary, simple or rarely 2–3-partite near the base.

17. Calyx-tube narrow-turbinate, about twice as long as the sepals or petals. **11. H. caryophyllaceum**

17. Calyx-tube as long or shorter than the sepals or petals.

18. Sepals and petals with longish, patent hairs.

19. Sepals and petals linear, 0.5–0.6 mm wide, subacute . . . . . . **14. H. samarense**

19. Sepals and petals oblong-spathulate, rounded-obtuse, 1 mm wide. **15. H. villarianum**

18. Sepals and petals ± densely short-pilose or tomentulose.

20. Petals ± as long as or slightly shorter than sepals . . . . **16. H. ramosii**

20. Petals about twice as long as the sepals . . . . **17. H. undulatum**

16. Panicles very much branched, divaricate.

21. Petals and sepals with patent, longish hairs.

22. Petals and sepals oblong-spathulate, rounded-obtuse, 1 mm wide . . **15. H. villarianum**

22. Petals and sepals linear, subacute, *c.* $^1/_2$ mm wide, (3$^1/_2$–)4(–5) mm long. **14. H. samarense**

21. Petals and sepals ± densely or laxly shortly pilose or tomentose.

23. Bracts persistent, ovate, 1–1$^1/_2$ mm long . . . . **18. H. bracteatum**

23. Bracts early caducous . . . . **19. H. celebicum**

9. Stamens partly inserted on the lower part of the petals. Sepals manifestly accrescent after anthesis. SECT. PIERREA.

24. Flowers subsessile to sessile during anthesis; fruit on a 1 mm long pedicel. Inflorescence condensed, densely greyish-yellowish-villous . . . . **20. H. gitingense**

24. Pedicels at least 1 mm during anthesis, in fruit 2–4 mm.

25. Leaves ± broadly elliptic to oblong-elliptic or oblong, rather abruptly acuminate at the apex. **21. H. grandiflorum**

25. Leaves lanceolate- or oblong-ovate, gradually narrowed to the apex, greatest width below the middle . . . . **22. H. minahassae**

1. Stamens *c.* 20, inserted irregularly in the disk formed by the ± fused, tomentose glands. Anomalous species . . . . **23. H. moultonii**

Subgenus Pythagorea

(LOUR.) SLEUM. *stat. nov.*—*Blackwellia* LAMK, Encycl. (1785) 428 (*Blakwellia*); COMM. *ex* JUSS. Gen. (1789) 343, *nec* SCOP. (1777); BL. Mus. Bot. 2 (1852) 25; MIQ. Fl. Ind. Bat. 1, 1 (1855) 714; WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 36, *pro subgen.*—*Pythagorea* LOUR. Fl. Cochinch. (1790) 243.

Stamens solitary before the petals.

Section Pythagorea

(LOUR.) O. KTZE in POST & KUNTZE, Lex. Gen. Phan. (1904) 285.—Sect. *Blackwellia* BENTH. J. Linn. Soc. Bot. 4 (1860) Suppl. 33, *pro parte*.

Sepals and petals ± similar to each other.

1. Homalium tomentosum (VENT.) BENTH. J. Linn. Soc. Bot 4 (1860) 34; KURZ, For. Fl. Br. Burma 1 (1877) 531; J. As. Soc. Beng. 46, ii (1877) 93; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1879) 596; KOORD. & VAL. Bijdr. Booms. 1 (1894) 182; KOORD. Exk. Fl. Java 2 (1912) 632; Atlas Baumarten 2 (1914) f. 340; SLOOT. Bijdr. Flac. (1919) 105; Bull. Jard. Bot. Btzg III, 7 (1925) 348; HEYNE, Nutt. Pl. (1927) 1140; CRAIB, Fl. Siam. En. 1 (1931) 742; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 85, p. 2.—*Blackwellia tomentosa* VENT. Choix (1803) 57, t. 57; BL. Bijdr. 16 (1826) 1115; Mus. Bot. 2 (1856) 26, t. 2; MIQ. Pl. Jungh. (1855) 419; Fl. Ind. Bat. 1 (1857) 714.—*Blackwellia spiralis* WALL. Pl. As. Rar. 13 (1820) 400, tab.—**Fig. 21–22.**

Deciduous tree, (5–)20–30(–40) m, with well-shaped bole; branches horizontal; innovations ± tomentose; bark thin, smooth, green under the thin, whitish or light-grey peeling epidermis; trunk columnar, up to 90 cm diam., buttresses 1 m high, 20 cm broad at the base. *Leaves* broadly obovate to obovate-oblong, subsessile, rounded-obtuse or apiculate, cuneate towards the base, but rounded at the very base, subcoriaceous, shallowly and distantly ± glandular, crenate, ± glabrescent above, ($7^1/_2$–)10–15(–25) by 4–7(–13) cm; nerves strongly parallel, *c.* 12 pairs; petiole stout, 1–3(–5) cm. *Flowers* small, greenish, with a disagreeable smell, 5–6-merous, in 2–3(–5)-flowered glomerules spirally arranged along the stout, yellowish-tomentose, pendulous rhachis 10–35 cm long. *Calyx*-tube conical, tomentose. *Sepals* and *petals* linear-oblong, woolly, *c.* $1^1/_2$ mm. Filaments 2 mm. Styles 2–3, glabrous. *Fruit c.* 3 mm, indehiscent, 1-seeded.

Distr. N. Circars, E. Bengal, Burma, Siam (southwards to 13°), Indo-China, in *Malaysia:* W. Coast of Sumatra (once found), Java (the W. part excepted rather common), Madura, Kangean Arch., Lesser Sunda Islands (Bali, Sumbawa, Flores, Timor). Not in the Malay Peninsula. Fig. 23.

Ecol. In mixed forests as well as in teak-forests (Java), not seldom on calcareous soil and often on periodically dry ground, mostly in localities where the dry monsoon is well-pronounced; sometimes the tree stands leafless for a few months. Not gregarious as a rule, though sometimes locally numerous, mostly at low altitude, from sea-level to 200 (rarely up to 700) m; *fl.* Jan.–Oct.

Uses. After MEIJER DREES (Commun. For. Res. Inst. Btzg *no* 33, 1951, 106) fairly fire-resistant, easily sprouting from stumps, recommended for afforestation and local timber production in not too dry regions; it stands short periods of high groundwater.

Wood brown, hard, heavy, but not durable, used for matches.

Vern. *Ki bodas*, S, *dĕlisĕm*, *dĕlissĕm*, *d(ĕ)lingsĕm*, *g(ĕ)lingsĕm*, *gĕrinsĕng kĕlingsĕm*, *estri*, J, *habu*, Md, *kaladdo*, *kĕleddo*, Flores, *lanung*, Sumbawa, *nèku*, Timor.

2. Homalium barandae VID. *ex* F.-VILL. Nov. App. (1880) 94; Cat. Pl. Prov. Manila (1880) 32; Sin. Atl. (1883) 27, t. 35, f. A; Rev. Pl. Vasc. Filip. (1886) 141; MERR. Philip. J. Sc. 3 (1908) Bot. 245; Sp. Blanc. (1918) 20; En. Philip. 3 (1923) 110.

Tree; young branchlets brownish, ± tomentose, the older ones quickly glabrescent. *Leaves* oblong or elliptic-oblong, abruptly (1 cm) obtuse-acuminate, attenuate into the petiole to ± rounded at the base, somewhat inequilateral, thinly chartaceous, coarsely subserrate-crenate, (6–)7–13(–15)

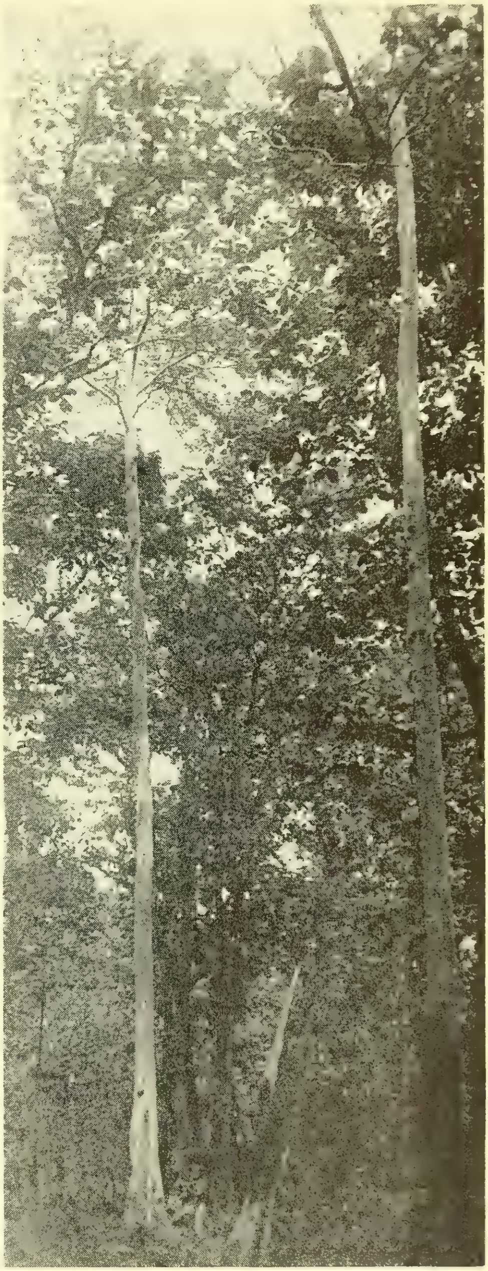

Fig. 21. Two trees of *Homalium tomentosum* (VENT.) BTH., conspicuous by their ivory-white greenish tinged bark, in teak-forest Ngandong (S. Randublatung), E. Java, Dec. 1917 (KALSHOVEN).

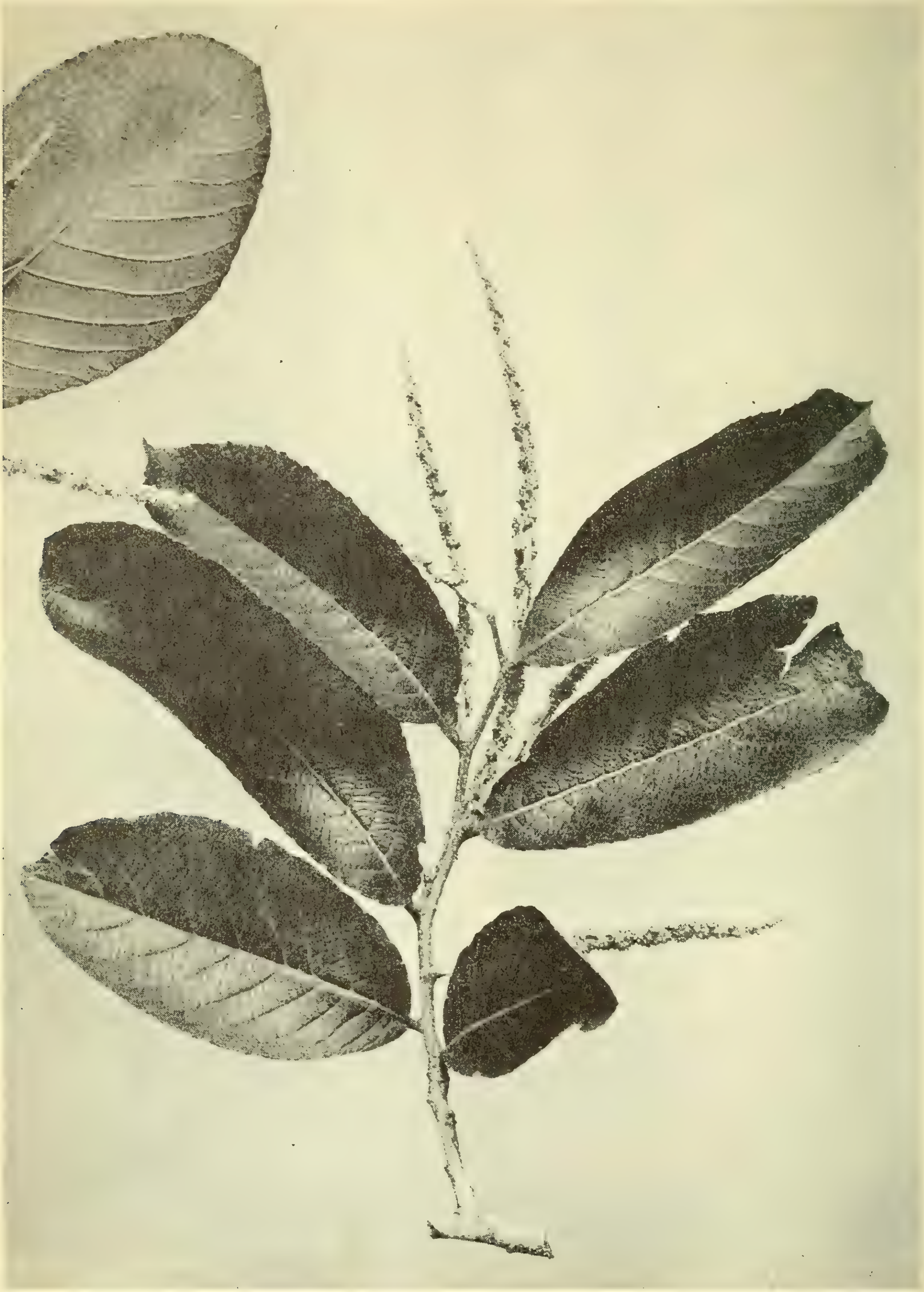

Fig. 22. *Homalium tomentosum* (VENT.) BTH. Flowering twig, above left showing underside of part of a leaf, × 3/5 (C.H.B. IV–F–59).

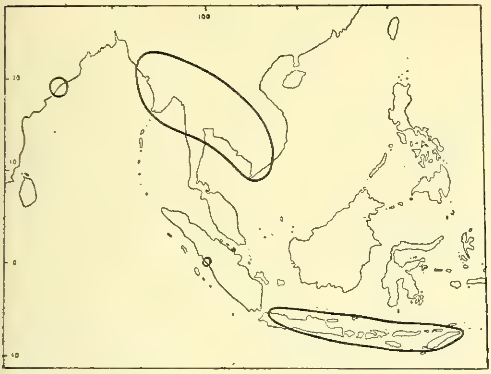

Fig. 23. Distribution of *Homalium tomentosum* (Vent.) Bth. The locality in Sumatra is represented by one collection.

by (4–)5–6½ cm; nerves 6–8 pairs, joined at the margin, veins rather densely reticulate and prominent on both sides; petiole tomentose. *Panicles* ± densely shortly cinereous-pilose, branched from near the base, 15–20 cm long, lower branches up to 10 cm. *Flowers* 7-merous, in fascicles of 4–6(–8) interruptedly disposed on the rhachis. Bracts subulate, ½ mm. Pedicels slender, ± connate at their bases. *Calyx*-tube conical-oblong, 1.8 mm. *Sepals* narrow-spathulate, 1½ by 0.3 mm. *Petals* similar to the sepals, 1½ by ½ mm, slightly accrescent. Styles 7, very short.

Distr. *Malaysia:* Philippines (Luzon: Benguet, Rizal, Batangas).

Ecol. In forests at low and medium altitudes.

Vern. *Laing*, Tag.

Note. Possibly only a tomentose form of *H. loheri.*

3. Homalium acutissimum Gilg, Bot. Jahrb. 55 (1918) 278.

Shrub or tree, glabrous the inflorescences excepted. *Leaves* oblong or oblong-lanceolate, acutely and long-attenuate to caudate at the apex, cuneate or subrotundate at the base, entire or obscurely distantly crenate, firmly chartaceous, shining, 6–11 by 2–4¼ cm; nerves *c.* 10 pairs, prominent on both sides, veins very numerous densely reticulate; petiole 3–4 mm. *Racemes* spike-like, densely pilose, 10–20 cm; pedicels, if any, very short (up to ½ mm). *Flowers* 6-merous; bracts scariose, 1½ mm. *Calyx*-tube obconical, short. *Sepals* and *petals* linear, *c.* 1½ and 2 mm, densely set with rather patent longish hairs.

Distr. *Malaysia:* N. New Guinea (Waria River: Gomadjidji), once found.

Ecol. Rain-forests, 450 m.

4. Homalium longifolium Benth. J. Linn. Soc. Bot. 4 (1860) 35; Clarke in Hook. *f.* Fl. Br. Ind. 2 (1879) 596; King, J. As. Soc. Beng. 67, ii (1898) 20; Ridl. Fl. Mal. Pen. 1 (1922) 834; Craib, Fl. Siam. En. 1 (1931) 741; Burk. Dict. (1935) 1184.—*Blackwellia macrostachya* Turcz. Bull. Soc. Nat. Moscou 36 (1863) 610; (Kew Ind.: *sphalm. monostachya*); Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 355 (*sphalm. macrocarpa*).

Tree 6–10 m, glabrous the inflorescences excepted. *Leaves* lanceolate or oblong-lanceolate, acute or shortly and bluntly acuminate, narrowed at the base, rather coriaceous, shining, entire, sometimes shallow-crenulate, 7–11 by 3½–5 cm; nerves 7–9(–10) pairs, spreading, curved, faint, veins obscure above, somewhat reticulate-prominent beneath; petiole 0.5–0.8(–1) cm. *Racemes* almost slender, solitary, rarely branched near the base, 10–15(–22) cm, covered with a minute, white or pale-yellowish tomentum. *Flowers* 5–6-merous, pale-yellow or greenish, in fascicles of 3–4(–5), rather interruptedly disposed along the rhachis. Pedicels 1–1½ mm, confluent at their bases. *Calyx*-tube turbinate, short. Sepals oblong, 1½–2 mm. *Petals* similar to the sepals, but a little narrower. Disk-glands tomentose, whitish or yellow. Styles 4–5.

Distr. S. Siam (Pattani), in *Malaysia:* Malay Peninsula (Perak, Selangor, Trengganu, Negri Sembilan, Pahang, Penang, Johore, Malacca).

Ecol. In forests, 60–650 m.

Uses. Wood said to be very hard, used in house-construction.

Vern. Siam: *Chen kiang, kamap, panasan, pauh kijang jantan, rukam babi, tias mula*; Selangor: *sangah, pĕtaling gajah, kĕmap, sĕlĕmbar, sĕlĕmbu*; Pahang: *sĕlum(b)ar*; Negri Sembilan: *masikang*; Johore: *slĕmbar.*

5. Homalium panayanum F.-Vill. Nov. App. (1880) 94; Vid. Rev. Pl. Vasc. Filip. (1886) 141, *descr. corr.*; Merr. Philip. J. Sc. 3 (1908) Bot. 246; Sp. Blanc. (1918) 20; En. Philip. 3 (1923) 111.—*H. grandiflorum* (*non* Benth.) Naves in Blanco, Fl. Filip. ed. 3 (1877–83) t. 443.—*H. myrianthum* Baker, Kew Bull. (1896) 23; Merr. En. Born. (1921) 412.—*H. subscandens* Elm. Leafl. Philip. Bot. 4 (1912) 1518.—*H. obovatum* Merr. Philip. J. Sc. 27 (1925) 37; En. Philip. 4 (1926) 253.

Small tree or shrub, glabrous the inflorescences excepted. *Leaves* elliptic-obovate or oblong-obovate, broadly obtusely acuminate or subrotundate, attenuate into the petiole at the base, subcoriaceous, shining above, dull beneath, dark greyish-brownish when dry; nerves 6–7 pairs, distinctly prominent beneath, veins reticulate-prominent beneath only; petiole 3–6(–8) mm. *Panicles* branched from near the base, (4–)5–10(–12) cm long, lower branches 3–4 cm; rhachis and branches rather slender, greyish-ciliate-pubescent. *Flowers* white, 6–7-merous, solitary. Pedicels slender, *c.* 2½ mm. Bract subulate, 1 mm. *Calyx*-tube short, rather narrow, 1.8 mm, ciliate. *Sepals* linear, 1½–1¾ by ½ mm, subacute, densely covered with spreading hairs. *Petals* similar to the sepals but 1 mm wide, both accrescent up to 3 mm. Styles 4, hirsute nearly to their apex.

Distr. *Malaysia:* Br. N. Borneo, Philippines (Luzon, Palawan, Guimaras Isl., Sibuyan).

Ecol. On ridges in forests at low and medium altitudes, ascending to 1400 m.

Vern. Borneo: *Malaban*, Dusun, *kaninium*, D. Tambuwan, *panawan*, Bajan. Philippines: *ampupuyót*, Bis., *kandong*, Ilk., *puyót*, P. Bis.

6. Homalium multiflorum MERR. Philip. J. Sc. 13 (1918) 35; En. Philip. 3 (1923) 111.

Tree, glabrous the inflorescences excepted. *Leaves* elliptic, attenuate at apex and base, subcoriaceous to coriaceous, shining; nerves prominent beneath, veins distinctly reticulate on both sides; petiole 5–7 mm. *Panicles* elongate, composed of several simple racemes from the uppermost axils, sometimes sustained by very reduced leaves, up to 12 cm long, ± densely hirsute-ciliate. *Flowers* 5-merous, white, fasciculate. Pedicels $2^1/_2$ mm. Bracts oblong-ovate, acute, 2 mm. *Calyx*-tube funnel-shaped, 2 mm. Sepals narrow-oblong, ciliate, 2 by $^1/_2$ mm. *Petals* subspathulate, ciliate, 3 mm. Filaments pilose. Styles 4–5.

Distr. *Malaysia:* Philippines (Luzon: Ilocos Norte, Bontoc, Benguet, Rizal, Bataan).

Ecol. In forests up to 1500 m altitude.

Vern. *Tamúyan*, Ibn.

7. Homalium loheri MERR. Philip. J. Sc. 3 (1908) Bot. 245; En. Philip. 3 (1923) 110.

Medium-sized tree, glabrous the inflorescences excepted; branchlets greyish. *Leaves* oblong-elliptic, shortly obtuse-acuminate at the apex, acute at the base, subcoriaceous, shining; nerves prominent, veins distinctly reticulate; petiole *c.* 5 mm. *Panicles* 12–20 cm, with few, elongate branches, densely patent-pilose. *Flowers* fasciculate, 5–6-merous. Pedicels 3–4 mm. Bracts narrow-ovate, minute, caducous. *Calyx*-tube narrow-funnel-shaped, 2 mm. *Sepals* oblong, spreading pilose, 2 mm. *Petals* subspathulate, spreading pilose, $2^1/_2$ mm. *Ovary* villous. Styles 4–5.

Distr. *Malaysia:* Philippines (Luzon: Rizal).

Ecol. In forests at medium altitude.

Vern. *Laing*, *parañgyat*, Tag.

Subgenus Homalium

Homalium subgen. Myriantheia (THOU.) WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 36.—*Myriantheia* THOU. Gen. Nov. Madag. (1806) 21.

Stamens in fascicles of 2 or more.

Section Eumyriantheia

WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 36.—*Cordylanthus* BL. Mus. Bot. 2 (1852) 27, t. 3.

Stamens inserted strictly before the petals.

8. Homalium dasyanthum (TURCZ.) WARB. in E. & P. Pfl. Fam. 3, 6a (1893) 36; CRAIB, Fl. Siam. En. 1 (1931) 739; HENDERS. J. Mal. Br. R. As. Soc. 17 (1939) 46.—*Blackwellia dasyantha* TURCZ. Bull. Soc. Nat. Moscou 36 (1863) 610.—*H. foetidum* (*non Ludia foetida* ROXB.) BENTH. J. Linn. Soc. Bot. 4 (1860) 37, *quoad pl.* GRIFFITH; CLARKE in HOOK. *f.* Fl. Br. Ind 2 (1879) 597.—*H. griffithianum* KURZ, J. As. Soc. Beng. 40, ii (1871) 57 (*cf.* GRIFF. Not. 4, 1854, 584, t. 585 A, f. 10); *l.c.* 46, ii (1877) 93; For. Fl. Br. Burma 1 (1877) 531; CLARKE in HOOK. *f.* Fl. Br. Ind. 2 (1879) 597; KING, J. As. Soc. Beng. 67, ii (1898) 21; RIDL. J. Str. Br. R. As. Soc. *no* 59 (1911) 106; *l.c. no* 61 (1912) 53; J. Fed. Mal. St. Mus. 5 (1915) 161; GAGNEP. Fl. Gén. I.C. 2 (1921) 1009, *incl. var. glabrum* GAGNEP. & *var. cambodianum* GAGNEP. *l.c.* 1011; RIDL. Fl. Mal. Pen. 1 (1922) 835, f. 68; MERR. Lingn. Sc. J. 14 (1935) 40.—**Fig. 25d–e.**

Small tree 4–12 m, trunk 10–20 cm diam., young parts softly tawny-pubescent; outer bark thin, stripping off in bands. *Leaves* ovate- or obovate-oblong, shortly and bluntly acuminate, slightly narrowed to the rounded or subcordate base, sometimes inequilateral, thinly chartaceous, nearly entire to coarsely crenate, younger ones sparsely pubescent on both sides, sometimes more densely pubescent to tomentose specially on midrib and nerves beneath, at maturity ± glabrescent but subpersistently pubescent on midrib and nerves, rarely entirely glabrous, 5–12 by 3–$5^1/_2$ cm; nerves 5–7 pairs, spreading, slightly curved, little prominent beneath, veins rather obscure; petiole tawny-tomentose, 4–5 mm. *Racemes* spiciform, solitary, slender, (6–)8–12 cm long, softly tawny-tomentose at rhachis, pedicels and calyx. *Flowers* (9–)10–12-merous, greenish-yellow or white, in spaced ± whorled 2–4-flowered fascicles along the rhachis. Pedicels 2–3 mm. *Calyx*-tube obconical, nearly 3 mm. Sepals triangular-linear, 2 mm, scarcely 2 mm at the base, subacute. *Petals* oblong-obovate, $2^1/_2$–3 by $1^1/_4$ mm, densely hirsute or covered with tawny spreading hairs. *Ovary* hirsute. Styles *c.* 5.

Distr. Indo-China, Lower Burma, Siam, in *Malaysia:* Malay Peninsula (Perlis, Langkawi, Kedah, Pahang, Johore).

Ecol. Rocky places on limestone, but also in swampy forest (CORNER).

Vern. *Tĕlor buaya*, *ayĕr anjiing*, *lĕnggundi laut*, *mĕsĕrah puteh*, *pĕtaling jantan*, M.

9. Homalium kunstleri KING, J. As. Soc. Beng. 67, ii (1898) 20; RIDL. Fl. Mal. Pen. 1 (1922) 835; HENDERS. J. Mal. Br. R. As. Soc. 17 (1939) 46.

Tree 6–14 m; young branches glabrous, rather slender, smooth, glaucous. *Leaves* subovate-elliptic-oblong, attenuate towards the apex, shortly obtusely acuminate, narrowed or mostly rounded at the base, slightly inequilateral, stiffly coriaceous, glabrous, glossy light-green alive, shining above, dark-brown when dry, dull and glaucous beneath, remotely crenate, 11–18 by 6–8 cm; midrib nearly flat above, very prominent beneath, nerves 8–9 pairs, faint, curving upwards, veins obscure or prominent-reticulate above only; petiole stout, 4–6 mm. *Racemes* solitary, spiciform, rather robust, ± as long as the leaves; rhachis olivaceous-tomentose. *Flowers* pale greenish-yellow, 6-merous, in interrupted, 3–4-flowered fascicles. Pedicels 2 mm. Bracts nearly rounded to ovate, firm, ± persistent, 3 mm diam.. *Calyx*-tube widely funnel-shaped, 2 mm, densely cinereous-tomentose outside as are the sepals and petals. Sepals oblanceolate, obtuse, 2 mm. *Petals* broadly lanceolate, subacute, villous inside, 2 mm. *Ovary* tomentose. Styles 5.

Distr. *Malaysia:* Malay Peninsula (Perak), apparently very rare.

Ecol. Limestone rocks, 150–300 m.

10. Homalium foetidum (Roxb.) Benth. J. Linn. Soc. Bot. 4 (1860) 37, *pro parte, quoad pl.* Roxb.; Koord. Minah. (1898) 473; Val. Bull. Dép. Agric. Ind. Néerl. *no* 10 (1907) 35; Merr. Interpr. Herb. Amb. (1917) 378; Sloot. Bijdr. Flac. (1919) 107; Nova Guinea 14 (1924) 191; Bull. Jard. Bot. Btzg III, 7 (1925) 350; Merr. Philip. J. Sc. 29 (1926) 401; Heyne, Nutt. Pl. (1927) 1139; Merr. Pl. Elm. Born. (1929) 209.—*Metrosideros Molucca Samar mas* Rumph. Herb. Amb. 3 (1750) 25, t. 11.—*Ludia foetida* Roxb. [Hort. Beng. (1814) 38, *nom. nud.*] Fl. Ind. ed. Carey 2 (1832) 508.—*Blackwellia foetida* Wall. [Cat. (1831) 4899, *nom. nud.*] *ex* Delessert, Ic. 3 (1837) 32, t. 53; Bl. Mus. Bot. 2 (1856) 27; Miq. Fl. Ind. Bat. 1 (1857) 714.—*Blackwellia propinqua* Wall. Cat. (1831) 4898, *nom. nud.*—*Blackwellia spiralis* Wall. *l.c.* 4897 *pr.p., nom. nud.*—*Blackwellia moluccana* Bl. Mus. Bot. 2 (1856) 27.—*Scolopia foetida* Clos, Ann. Sc. Nat. IV, 8 (1857) 253.—*Astranthus foetida* Wall. *ex* Clarke in Hook. *f.* Fl. Br. Ind. 2 (1879) 598.—*H. propinquum* Clarke *l.c.* 597; King, J. As. Soc. Beng. 67, ii (1898) 21; Ridl. Fl. Mal. Pen. 1 (1922) 835; Heyne, Nutt. Pl. (1927) 1140; Burk. Dict. (1935) 1184.—*H. luzoniense* F.-Vill. Nov. App. (1880) 94; Vid. Sin. Atl. (1883) 27, t. 53, f. B; Rev. Pl. Vasc. Filip. (1886) 141; Merr. Philip. J. Sc. 1 (1906) Suppl. 99; *ibid.* 3 (1908) Bot. 247; Interpr. Herb. Amb. (1917) 48 (*sphalm. luzonicum*); Sp. Blanc. (1918) 20; En. Philip. 3 (1923) 111.—*H. aranga* Vid. *ex* F.-Vill. Nov. App. (1880) 94, *in syn.*—*H. platyphyllum* Merr. Philip. J. Sc. 13 (1918) 36; En. Philip. 3 (1923) 111.—*H. pachyphyllum* Gilg, Bot. Jahrb. 55 (1918) 276, f. 3; White & Francis, Proc. R. Soc. Queensl. 38 (1927) 248; C. T. White, J. Arn. Arb. 10 (1929) 243.—*H. amplifolium* Gilg, Bot. Jahrb. 55 (1918) 276.—*H. novoguineense* Sloot. Bijdr. Flac. (1919) 109; Nova Guinea 14 (1924) 191; Bull. Jard. Bot. Btzg III, 7 (1925) 353.—**Fig. 24.**

Tree (6–)20–30(–50) m; trunk straight, buttressed to 1.20 m; bark mottled grey to brown-yellow, smooth with transverse fissures; branchlets primarily pilose, soon glabrescent, brownish. *Leaves* oblong or ovate-oblong, rarely ovate or elliptic, mostly rather abruptly acuminate, cuneate or rounded at the base, coriaceous to subcoriaceous, shining above, dull beneath, glabrous (but those of suckers often rather densely tomentose beneath), (juveniles red, mature ones yellowish-green alive), dark red-brownish when dry, mostly coarsely crenate, rarely shallow-crenate only or nearly entire, (10–)12–20(–28) by 5–8(–11) cm; nerves 8–12(–15) pairs, distinctly parallel, very prominent beneath, veins sometimes manifestly, but mostly little reticulate and prominent; petiole stout, rough, (0.7–)1–1.5 cm. *Panicles* ample, composed of several to many spike-like racemes, (7–)10–15(–22) cm long, peduncle 2–3 cm, lower branches (or racemes) 10–15 cm; rhachis as well as pedicels and flowers densely covered with a very short, grey indument. Pedicels 1–2 mm. Bracts linear-subulate, minute, early caducous. *Flowers* 7–8-merous, pale-green or light-yellow, with a repulsive odour, in spaced, whorled fascicles. Calyx-tube obconical, 1 mm. *Sepals* lanceolate, subacute, *c.* $1^{1}/_{2}$ mm. *Petals* oblong-spathulate, $2^{1}/_{2}$–3 mm long, in fruit accrescent up to 4 mm, densely pilose (with hairs a little spreading) at the apex. *Ovary* tomentose. Styles 4.

Distr. Melanesia (New Ireland, New Britain), in *Malaysia:* Sumatra (Tapanuli), Malay Peninsula (Penang, Perak, Kelantan, Pahang, Malacca), Borneo, Philippines (Luzon, Leyte, Cebu, Mindanao), Celebes, Moluccas, New Guinea.

Ecol. In thickets (Philippines) or rain-forest, often along river-banks, on clayey or sandy, often stony, whether or not periodically inundated soil, 20–200(–350) m. Apparently rather common in the eastern part of Malaysia, but specimens scattered. *Fl.* Jan.–Dec.

Uses. Wood yellowish-brown or light reddish-yellow on exposure, blackish in seawater. A hard, dense timber used for house- and bridge-constructions and making combs.

Vern. *Ternataans ijzerhout*, D, *Ayěr anjing, menserah puteh, pantat ulat puteh*, Mal. Pen.. Sumatra: *sarumar, kalět batu, pantat u'lat putih*. Borneo: *takělim*, M, *dijung barak, manuk manuk, hatan sauw, turug pau, katal katal, batu bagalang*; *bo-o*, Suluk, *punit-punit*, Bajan, *kalamis*, Dajak, *takilin*, Sungei, *tělutu*, Dusun, *takabu*, S. Labuk. Philippines: *aráñgan*, Tag., *kamagáhai, kamagáhi'*, Bik., *yagau*, C. Bis.. Celebes: *aliwowos* (t.s.), *kaju běsi, kaju watu* (t.l.), *tohasik*, (ponos.), *watu, momola*; *molaba*, Kolaka, *karondang rante, hija*; *gia*, Buton. Moluccas: *atébe, hatebesi*, Morotai, *mustigawe, bohomangit*, Buru, *samal, s. mérah*, Ceram, *samar, samale, samal batu*, Ambon, *hote besi putih*, Batjan, *hati běsi fina, fatu*, Sulu, *ngersaun, merkai*, Aru, *hate běsi* (*merah*), *horo ma bèka*, Halmah.. New Guinea: *manggusaaipi, ropi*, Japen, *ropir, ropil, kopral, petian, bengeran*, W. Nw G., *ied*, N. Nw G., *tiakaote*, SW. Nw G., *tala*, SE. Nw G., *malasa*, Nakanai, *kavea*, Vailala, *emapu*, Kikoro, Pt Moresby, *manai*, Orokaiva, Mumuni, *lowup*, Rabaul, *malas*, pidgin.

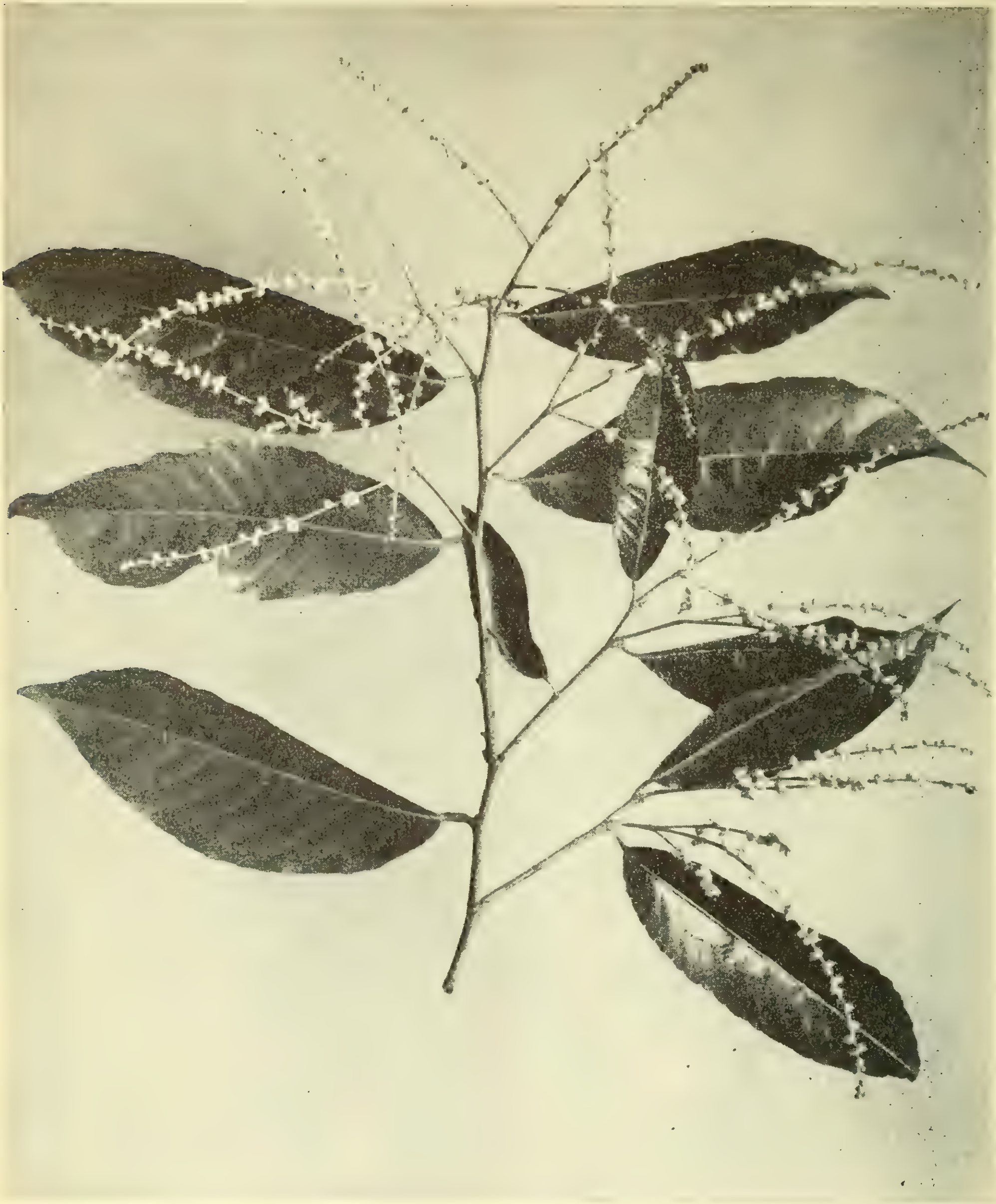

Fig. 24. *Homalium foetidum* (Roxb.) Bth., × 2/7 (C.H.B. IV–F–7).

11. Homalium caryophyllaceum (Z. & M.) Benth. J. Linn. Soc. 4 (1860) 38; Miq. Fl. Ind. Bat. Suppl. (1860) 132, 335; Sloot. Bijdr. Flac. (1919) 110; Gagnep. Fl. Gén. I.C. 2 (1921) 1012; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 335; Heyne, Nutt. Pl. (1927) 1139; Merr. Pl. Elm. Born. (1929) 209; Craib, Fl. Siam. En. 1 (1931) 738; Fischer, Kew Bull. (1932) 180; Burk. Dict. (1935) 1183; Ridl. Kew Bull. (1938) 111; Back. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 85, p. 2.—*Blackwellia caryophyllacea* Z. & M. in Mor. Syst. Verz. (1846) 33; Zoll. Nat. & Geneesk. Arch. 4 (1847) 31; Miq. Pl. Junghuhn. (1855) 400; Fl. Ind. Bat. 1 (1857) 715.—*Blackwellia longiflora* Miq. *l.c.*—*Cordylanthus frutescens* Bl. Mus. Bot. 2 (1856) 28, t. 3.—*H. cordylanthus* Benth. J. Linn. Soc. Bot. 4

(1860) 38.—*H. sumatranum* Miq. Fl. Ind. Bat. Suppl. (1860) 132, 334; Sloot. Bijdr. Flac. (1919) 112; Bull. Jard. Bot. Btzg III, 7 (1925) 356.—*H. obovale* Miq. Fl. Ind. Bat. Suppl. (1860) 132, 334. —*H. frutescens* Warb. in E. & P. Pfl. Fam. 3, 6a (1893) 36; King, J. As. Soc. Beng. 67, ii (1898) 22; Ridl. Fl. Mal. Pen. 1 (1922) 836.—*H. longiflorum* Benth. *ex* Koord. Exk. Fl. Java 2 (1912) 633.—*H. hosei* Merr. Philip. J. Sc. 11 (1916) Bot. 98; En. Born. (1921) 411.—**Fig. 25a–c.**

Small tree 4–10(–15) m, or shrub; young branchlets slender, glabrous, angular, striate, pallid; bark smooth. *Leaves* elliptic-oblong to elliptic, rarely ovate-oblong, shortly obtusely acuminate, broadly cuneate at the base to nearly rounded, coriaceous, shining, brownish when dry, entire or slightly to coarsely crenate-serrate, glabrous or sparsely pubescent beneath (very rare more densely pilose underneath), 7–16(–19) by (3–)4–7(–10) cm; nerves 7–8 pairs, prominent beneath, curved, ascending, anastomosing, reticulations distinct, specially beneath; petiole 2–3(–5) mm. *Racemes* rather stiff, simple or rarely 2–3-branched above the base, ± sparsely pubescent, 7–8(–10) (very rarely up to 15) cm. *Flowers* 5–6-merous, subsessile, white, solitary or in pairs, not rarely in fascicles of 3–5 and then 1 mm peduncled. Bracts ovate, subacute, 1 mm, subpersistent. *Calyx*-tube elongate, (4–) 5–6 mm, ± densely pilose to glabrescent, red-brown when dry, manifestly sulcate. *Sepals* coriaceous, oblong-ovate, subacute, *c.* $2^1/_2$ mm, erect. *Petals* white, similar to the sepals, but slightly longer and more densely greyish-appressed-tomentose on both sides, somewhat stellate-patent. Glands yellow. Stamens in fascicles of 3–4, exceeding the petals a little in length; filaments glabrous. *Ovary* elongate-conical, tomentose. Styles 4–5(–7), cylindric, erect, exserted.

Distr. Indo-China, S. Siam, in *Malaysia:* Malay Peninsula (Johore, Pahang, Selangor, Perak), Sumatra (East Coast and S. Sumatra), Banka, W. Java, Borneo, and Central to S. Celebes.

Ecol. Humid forest or in brushwood vegetation on level or hilly land, usually along river-sides or in humid soil periodically inundated during the wet monsoon, also on sandy loam, up to 150 m, *fl.* Jan.–Dec.

Uses. Wood light-brown, rather hard and heavy, possibly useful for house-construction. Used in Java as a hedge plant.

Vern. *Kaju bĕras*, M, *k. palis*, *k. polis*, *k. tulang*, Lampongs, *anjing ayĕr*, *pĕtaling ayĕr*, *dada ruan*, Mal. Pen., *mĕdang*, Pahang; Banka: *mĕntulang kĕrak*, *kaju rĕtjah piengan*, *rukĕm paja;* Borneo: *tangan mungit*, *malinein*, *kamuning*, Mal., *kamandjar*, Sampit, *kaju laras*, S. Borneo, *pintik*, Lower Dyak, *tulang ular*, *tambalinoh*, Kuala-Kapuas, *kaju keras*, W. Borneo, *bulalang*, *basing*, *malinoin*, Sungei, *kulahit hitam*, *kutang*, Dusun Kinab.; S. Celebes: *tenau*, *warra*.

Note. *H. sumatranum* Miq. (*H. obovale* Miq.) is merely a local, hairy variety, once found in S. Sumatra (Lampongs).

12. Homalium spathulatum Ridl. J. As. Soc. Str. Br. *no* 75 (1917) 35; Fl. Mal. Pen. 1 (1922) 835.

Glabrous tree. *Leaves* elliptic, obtusely acuminate, narrowed at the base, thinly coriaceous, shining, entire or undulate, 9–11 by 3–4 cm; nerves *c.* 7 pairs, very fine and rather obscure as are the reticulations; petiole 4–5 mm. *Racemes* slender, tomentose, *c.* 7–8 cm. *Flowers* 10-merous, subsessile. Pedicel up to 0.3 mm. *Calyx*-tube tomentose, $2^1/_2$ mm. *Sepals* narrow-linear, rather densely patent-hairy, *c.* $2^1/_2$ mm. *Petals* linear-spathulate, *c.* 3 by $^1/_2$ mm, with spreading hairs as the sepals. Stamens mostly 3 (rarely also 2 in the same flower), opposite each petal. Disk-glands rounded, rather flat, densely pubescent. Styles 3, glabrous.

Distr. *Malaysia:* Malay Peninsula (Dindings: Pangkor), once found.

13. Homalium oblongifolium Merr. Philip. J. Sc. 10 (1915) Bot. 326; En. Philip. 3 (1923) 111.

Tree *c.* 35 m, glabrous the inflorescences excepted. *Leaves* oblong, shortly acuminate, acute at the base, entire, coriaceous, shining on both sides, more pallid beneath when dry, entire or obscurely undulate, 20–30 by 7–11 cm; nerves 15 pairs, distinct, veins manifestly reticulate-elevated on both sides; petiole thick ($2^1/_2$ mm diam.), *c.* $1^1/_2$–2 cm. *Panicles* branched from the base, 20–30 cm, rather densely shortly yellowish-greyish-hirsute, lower branches up to 25 cm. *Flowers* sessile, 7-merous. Bracts narrow-subulate, $1^1/_2$ mm, very early caducous. *Calyx*-tube funnel-shaped, 3–4 mm. *Sepals* oblong-lanceolate, 4–5 by 1.8 mm, subacute. *Petals* oblong, 4 mm. Stamens in fascicles of 3; filaments sparsely pilose. Ovary hirsute.

Distr. *Malaysia:* Philippines (Mindanao: Zamboanga), once found.

Ecol. Primary forest at low altitude.

14. Homalium samarense Merr. Philip. J. Sc. 11 (1916) 199; En. Philip. 3 (1923) 111.—*H. villosum* Merr. Philip. J. Sc. 13 (1918) 37; En. Philip. 3 (1923) 112.—*H. polillense* Merr. Philip. J. Sc. 27 (1925) 38; En. Philip. 4 (1926) 253.

Tree about 10–15 m; branchlets grey-villous when young, rather soon glabrescent. *Leaves* elliptic or oblong-elliptic, obtusely acuminate, rounded to acute at the base, subcoriaceous, rather shining and brownish-olivaceous when dry, distantly and ± distinctly crenate-serrate, glabrous above but ± pilose at midrib, sparsely to densely pilose beneath when young, but ± glabrescent when adult the midrib and nerves excepted, 7–9(–10) by ($2^1/_2$–)$3^1/_2$–5 cm; nerves 6 pairs, prominent beneath, anastomosing, veins manifestly reticulate but little elevated on both sides; petiole 4–8 mm, ± villous. *Racemes* solitary or mostly several arranged in sometimes much-branched panicles up to 15 cm long, mostly provided with reduced, subpersistent leaflets, with soft long, spreading, pale hairs. *Flowers* 6–7-merous, white, scattered along the rhachis. Pedicels 2–3 mm. Bracts ovate to lanceolate,

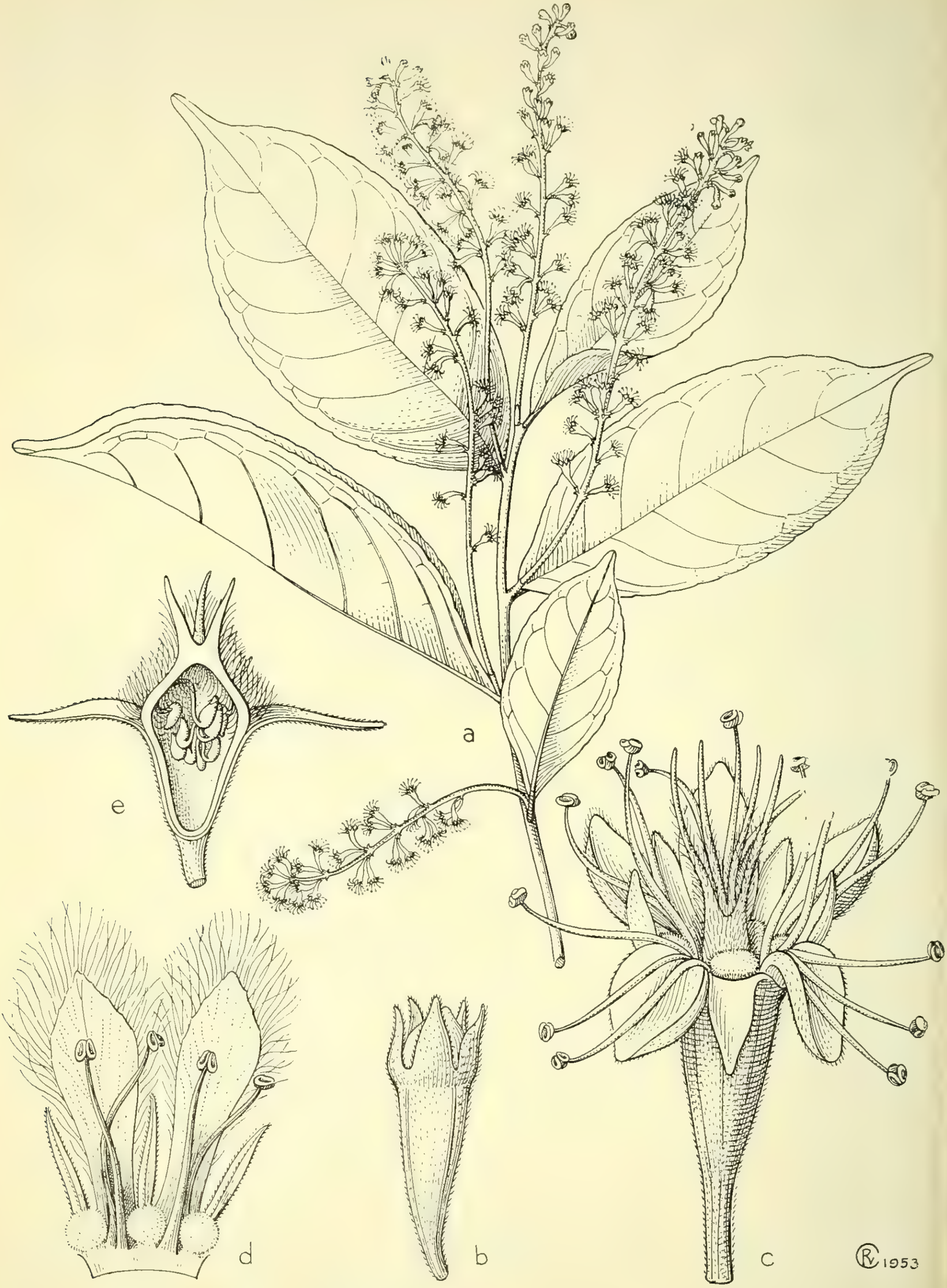

Fig. 25. *Homalium caryophyllaceum* (Z. & M.) BTH. *a*. Flowering twig, × ²/₃, *b*. bud, × 10, *c*. flower, × 10.—*Homalium dasyanthum* (TURCZ.) WARB. *d*. part of flower, × 7, *e*. longitudinal section, × 7 (*a–c* after KORTHALS from Borneo, *d–e* after KUNSTLER 1393).

membranous, 2½–4 mm. *Calyx*-tube funnel-shaped, *c.* 2–3 mm. *Sepals* linear to oblanceolate, subacute, densely set with patent hairs. *Petals* narrow-spathulate, similar to the sepals and equally long. Stamens 3 opposite each petal; filaments 5 mm, in the lower half with spreading hairs. *Ovary* ± villous. Styles 5–6, patent-hairy in the lower half, 2–3 mm.

Distr. *Malaysia:* Philippines (Luzon, Samar, Polillo, Mindanao).

Ecol. Primary forests at low altitude.

Vern. *Bato-bato*, S.L.Bis.

Note. *H. polillense* and *H. villosum* represent the juvenile state of *H. samarense* with not yet fully developed flowers.

15. Homalium villarianum VID. Rev. Pl. Vasc. Filip. (1886) 142; MERR. Philip. Bur. For. Bull. 1 (1903) 41; Philip. J. Sc. 3 (1908) Bot. 247; En. Philip. 3 (1923) 111.—*H. sorsogonense* ELM. Leafl. Philip. Bot. 1 (1908) 325.

Tree up to 8 m. *Leaves* elliptic, broadly attenuate or nearly rounded at the apex but rather abruptly extended into a short (1 cm) blunt acumen, cuneate to nearly rounded at the base, subcoriaceous, usually glabrous, distantly serrate-crenate, (6–)7–12(–18) by 4–7 cm; nerves 5–6 pairs, specially prominent beneath, veins rather densely reticulate-elevated on both sides; petiole 3–6 mm. *Panicles* rather slender, (10–)12–20 cm, in all parts rather densely greyish patent-pilose. *Flowers* 5–6-merous, whitish, in spaced 2–3-flowered fascicles. Pedicels 2–3 mm. Bracts narrow-oblong, subacute, 2 by 1 mm, subpersistent. *Calyx*-tube turbinate, sulcate, shortly but distinctly stipitate at the base. *Sepals* [illegible]late, nerved, 4 by 1 mm, rather dense[illegible]h spreading hairs. *Petals* very similar to the [illegible] sometimes a little smaller. Stamens normally in fascicles of 3, sometimes of 2 and 3 in the same flower or specimen; filaments pilose at the base only, 2 mm. *Ovary* villous. Styles 4–5.

Distr. *Malaysia:* Philippines (Luzon, Leyte, Mindanao); said to occur also in Panay and Samar.

Ecol. Forests, up to 400 m.

Vern. *Adáñga*, Bik., *aráñgan*, *kamagahai*, Tag., *matobato*, S.L.Bis.

Note. This species is in habit similar to *H. bracteatum*.

16. Homalium ramosii MERR. Philip. J. Sc. 14 (1919) 423; En. Philip. 3 (1923) 111.

Small tree, glabrous the inflorescences excepted. *Leaves* oblong to oblong-elliptic, gradually attenuate at the apex and the base, subcoriaceous, entire or obscurely crenate, shining, 6–8(–10) by 3–4½ cm; nerves 6–7 pairs, anastomosing, curved, prominent beneath, veins rather densely reticulate-elevated on both sides; petiole 5–8 mm. *Racemes* solitary or mostly several from the axils of the uppermost decrescent and rather soon caducous leaves forming a lax, depauperate, ± densely grey-pubescent panicle, up to 10 cm. *Flowers* 5-merous, white, 6–7 mm in diam., in fascicles of 2–3 along the rhachis. Pedicels slender, 3–4 mm. Bracts narrowly oblong-obovate or oblong, more distinctly pubescent inside, *c.* 2½ mm. Stamens in fascicles of 3; filaments glabrous, 2 mm. *Ovary* very densely pubescent. Styles 4–5, glabrous towards the apex.

Distr. *Malaysia:* Philippines (Luzon: Ilocos Norte), once found.

Ecol. Forested slope, *c.* 450 m.

17. Homalium undulatum KING, J. As. Soc. Beng. 67, ii (1898) 23; RIDL. Fl. Mal. Pen. 1 (1922) 837; HENDERS. J. Mal. Br. R. As. Soc. 17 (1939) 46.—*H. verruculosum* CRAIB, Kew Bull. (1928) 239; Fl. Siam. En. 1 (1931) 742.

Tree 10–20 m, glabrous the inflorescences excepted; young branches slender, pale brown. *Leaves* elliptic to oblong-elliptic, rarely oblanceolate, shortly and bluntly acuminate, narrowed and sometimes unequal at the base, subcoriaceous, yellowish-green, grey-green when dry, shining above, dull beneath, shallowly crenate, (6–)7–10½ by (2½–)4½–5 cm; nerves 8–10 pairs, little prominent, veins minutely reticulated when dry; petiole (3–)4–5(–7) mm. *Panicle* 7–10 cm, composed of several racemes, the lower ones from the uppermost leaf-axils; rhachis slender, sparsely tomentose. *Flowers* 5–6-merous, greenish-yellow with a silvery tinge, tomentose, laxly arranged along the rhachis. Pedicels slender, 4–5(–8) mm. Bracts ovate-acuminate, minute, very early caducous. *Calyx*-tube infundibuliform, *c.* 2 mm, minutely grey-tomentose. *Sepals* lanceolate, obtuse, 4 by 1½ mm, grey-tomentulose on both sides. *Petals* obovate, clawed at the base, 5 by 3 mm, reticulate, tomentose, somewhat accrescent after anthesis. Stamens 4–5 at the base of each petal. Filaments glabrous, 2 mm. *Ovary* tomentose. Styles 3, glabrous upwards.

Distr. S. Siam, in *Malaysia:* Malay Peninsula (Perak, Langkawi).

Ecol. Evergreen forest, on rocky limestone hills up to 300 m.

18. Homalium bracteatum BENTH. J. Linn. Soc. Bot. 4 (1860) 37; ROLFE, J. Bot. 23 (1885) 213; VID. Phan. Cuming. Philip. (1885) 115; Rev. Pl. Vasc. Filip. (1886) 142; MERR. Philip. J. Sc. 3 (1908) Bot. 246; En. Philip. 3 (1923) 110.—*H. curranii* MERR. Philip. J. Sc. 4 (1909) Bot. 297; En. Philip. 3 (1923) 110.

Tree, glabrous the inflorescences excepted. *Leaves* ovate or mostly elliptic-oblong, gradually attenuate to the apex, obtuse, cuneate to nearly rounded at the base, coriaceous, shining on both sides when dry, manifestly and rather coarsely crenate, 15–20 by 5–8 cm; midrib very prominent beneath, nerves 5–6 pairs, elongate-curved and ascending, veins rather densely reticulate-elevated on both sides; petiole stoutish, rugose, 7–10 mm. *Panicles* thyrsoid, 10–14(–18) cm, grey- or yellowish-tomentose, lower branches 4–7 cm. *Flowers* 5-merous, single or rarely in pairs along the rhachis. Pedicels 1 mm. *Calyx*-tube turbinate, 3 mm, a little stipitate. *Sepals* narrow-oblong, obtuse, 3 by 1 mm. *Petals* oblong-spathulate, nerved, 4 by 1½ mm, somewhat accrescent, like the sepals and calyx grey-hirsutulous. Stamens in fascicles of 3.

Filaments pilose above the base, $2^{1}/_{2}$ mm. *Ovary* hirsute. Styles 4–5, *c.* 2 mm.

Distr. *Malaysia:* Philippines (Luzon).

Ecol. In primary forests at low altitude.

Vern. *Aráñga(n)*, Tag., Bik., *arangan-babai*, Bik., *boñguas*, *pañginahauan*, S.L.Bis., *ubiön*, *matambokal*, Ilk., *malakamáñga*, Tag.

19. Homalium celebicum Koord. Minah. (1898) 473, 623; Sloot. Bijdr. Flac. (1919) 116; Bull. Jard. Bot. Btzg III, 7 (1925) 353.

Tree 20–?50 m; bark reddish, scaling; branchlets glabrous. *Leaves* elliptic to ovate-elliptic, sometimes nearly ovate, obtusely acuminate, attenuate at the base, subcoriaceous to coriaceous, glabrous, shining on both sides, distantly subserrate-crenate, 7–12(–17) by (4–)5–7(–10) cm; nerves 7–8(–9) pairs, little prominent on both sides, reticulations dense and conspicuously raised specially beneath; petiole 4–5 mm. *Panicles* divaricate, up to 20 cm, lower branches up to 12 cm; rhachis finely greyish-pubescent. *Flowers* 5-merous, in fascicles of 2–3, rarely solitary. Pedicels $1^{1}/_{2}$–3 mm. *Calyx*-tube $2^{1}/_{2}$ mm, greyish-tomentulose as are the sepals and petals. *Sepals* oblong, $3^{1}/_{2}$ by 1 mm, whitish. *Petals* spathulate, rounded at the apex, 3 by $1^{1}/_{2}$ mm, later accrescent up to 6 mm. Stamens in fascicles of 3; filaments 3 mm, pilose at the base only. Disk-glands red. *Ovary* outside laxly, inside densely pilose. Styles 4–5, pilose at the base.

Distr. *Malaysia:* Celebes (Minahasa and S. Celebes), Buton Isl.

Ecol. Primary mixed forests on hills, on stony clay or limestone rock, 30–550 m.

Uses. Wood excellent for house-building.

Vern. *Karingis*, *karikis*, *k. rintek*, *k. meha*, *k. makaänak*, *togo ulu*, Manado, *kombolili*, Buton.

Section Pierrea

(Hance) Warb. in E. & P. Pfl. Fam. 3, 6a (1893) 36.—*Pierrea* Hance, J. Bot. 15 (1877) 339.

Stamens inserted both before and on the petals.

20. Homalium gitingense Elm. Leafl. Philip. Bot. 4 (1912) 1513.

Small to large spreading tree; branchlets grey to brown, glabrous. *Leaves* ovate-elliptic to broadly subovate-oblong, shortly and abruptly obtusely acuminate, ± rounded at the base, subcoriaceous to coriaceous, glabrous, entire, shining on both sides, (7–)10–15 by (4–)5–7(–8) cm; nerves 8–9 pairs, elevated on both sides, veins rather densely reticulate and prominent on both faces; petiole stout, 1–$1^{1}/_{2}$ cm. *Panicles* suberect, 5–8 cm, usually 3-branched from the base, the central and longest spike occasionally short-rebranched; rhachis stout, sulphur- or creamy-woolly. *Flowers* 6-merous, light-green, crowded. Bracts broadly ovate, rounded at the apex, $2^{1}/_{2}$–3 mm diam., caducous. *Calyx*-tube turbinate, 3–4 mm, villous. *Sepals* lanceolate, subacute, accrescent, finally 7–8 by 2 mm, rather densely pilose. *Petals* similar to the sepals, but only half their length. Stamens 5–6 before each petal, *viz* 1 between the disk-glands, 4–5 inserted on the basal part of the petals; filaments filiform, glabrous, 2–3 mm. Disk-glands villous, nearly round. *Ovary* tomentose. Styles 5.

Distr. *Malaysia:* Philippines (Sibuyan: Capiz; Mindanao: Surigao; Luzon: Albay), apparently rare.

Ecol. Forests along streams, on reddish soil with a gravelly subsoil, 150 m.

Vern. *Camagalial*, Luzon.

21. Homalium grandiflorum Benth. J. Linn. Soc. Bot. 4 (1860) 36; Miq. Fl. Ind. Bat. Suppl. 1 (1860) 132; Clarke, in Hook. *f.* Fl. Br. Ind. 2 (1879) 598; King, J. As. Soc. Beng. 67, ii (1898) 23; Sloot. Bijdr. Flac. (1919) 113; Gagnep. Fl. Gén. I.C. 2 (1921) 1012; Ridl. Fl. Mal. Pen. 1 (1922) 837; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 360, *excl. pl. javan.*; Heyne, Nutt. Pl. (1927) 1139; Merr. Pl. Elm. Born. (1929) 210; Craib, Fl. Siam. En. 1 (1931) 741; Burk. Dict. (1935) 1184; Holttum, Gard. Bull. Str. Settl. 11 (1940) 145.—*H. grandiflorum var. heptagynum* Miq. Fl. Ind. Bat. Suppl. (1860) 334.—*H. parvifolium* Hook. *f.* *ex* Benth. J. Linn. Soc. Bot. 4 (1860) 37; Merr. En. Born. (1921) 412.—*H. damrongianum* Craib, Kew Bull. (1915) 429; Fl. Siam. En. 1 (1931) 739.—*H. fallax* Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 356, f. 10.—*H. crassipes* Sloot. *ibid.* 362, f. 11.—*H. calciphilum* Ridl. Kew Bull. (1928) 112.

var. **grandiflorum.**

Buttressed tree, 10–30 m, glabrous the inflorescences excepted. *Leaves* ovate-elliptic to elliptic-oblong, shortly rather abruptly obtusely acuminate at the apex, broadly narrowed into the petiole or rounded at the base, (light-green when alive, red when young), greyish-olivaceous when dry, ± coriaceous, shining, entire or nearly so, (7–)10–15(–26, very rarely up to 37) by (3–)4–7(–10, sometimes up to 15) cm; nerves (7–)9–12(–14) pairs, veins distinctly reticulated on both sides; petiole stout, grooved, 4–6 (–15) mm. *Racemes* simple or sometimes short-branched, 5–10(–15, very rarely up to 22) cm, with scattered flowers along the rather thin rhachis 1 mm diam.. *Flowers* all or for the greater part solitary, (5–)6–8(–9)-merous. Bracts lanceolate-oblong, 4–5 mm, glabrescent, caducous. *Calyx*-tube short, 3 mm, turbinate, tomentose, accrescent in fruit to 6 mm. *Sepals* oblong, subacute, in anthesis 5–6 mm long and reflexed, later on stellate and accrescent up to 10–16 by 4 mm, nerved and glabrescent. *Petals* triangular-oblong, 3–4 mm, otherwise similar to the sepals, accrescent up to 8 mm, ± curved over the ovary. Stamens (4–)6–12 before each petal, *viz* 1–3 between the disk-glands, the rest in pairs (one above the other) inserted on the basal part of the petals; filaments pilose. Disk-glands slightly lobed, tomentose. *Ovary* 5–8-ridged, tomentose. Styles 5–8, rather short. *Fruit* spindle-shaped, 5–8-valved.

Distr. Cochin-China, Siam, Lower Burma (Tenasserim), in *Malaysia:* Sumatra, Malay Peninsula (Pahang, Selangor, Kedah, Negri Sembilan, Malacca, Singapore), Borneo.

Ecol. Lowland forests (rarely up to 600 m), on never inundated, hilly ground and sandy soil. According to RIDLEY and HOLTTUM this tree flowers very rarely, probably once in 25 years, with the new leaves. *Fl.* Nov.–Jan.

Uses. Wood hard, difficult to work, used for house-construction.

Vern. *Kaju batu, k. b. kuning, k. b. arèng, kaju manau, manu, bias, kĕrbok, pau rusah, petjah pinggan, tutur batu,* Sumatra; *bajud,* Borneo.

Note. *H. parvifolium* HOOK. *f. ex* BENTH. is a small-leafed form.

var. **javanicum** (K. & V.) SLEUM. *stat. nov.—H. javanicum* KOORD. & VAL. Bull. Inst. Bot. Btzg *no* 2 (1899) 11; Ic. Bog. 1 (1901) 69, t. 100; KOORD. Exk. Fl. 2 (1912) 633; Atlas Baumarten 2 (1914) t. 341; SLOOT. Bijdr. Flac. (1919) 144.—*H. grandiflorum* (*non* BENTH.) SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 360, *pro pl. javan.*; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 85, p. 2.

Differing from the type-variety by its nearly woolly, longer (18–26 cm), more laxly flowered inflorescence.

Distr. *Malaysia:* Java (Banjumas & Pekalongan).

Ecol. Mixed rain-forest up to 200 m.

Vern. *Uru watu, langit, l. lawé,* J.

22. Homalium minahassae KOORD. Minah. (1898) 474, 624; SLOOT. Bijdr. Flac. (1919) 116; KOORD. Fl. N.O. Celeb. Suppl. pt 2 (1922) t. 92; *ibid.* pt 3 (1922) 45; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 359; HEYNE, Nutt. Pl. (1927) 1139.

Tree up to 35 m; branches glabrous. *Leaves* oblong- or ovate-lanceolate, gradually narrowed to the subacute apex, attenuate into the petiole to nearly rounded, sometimes a little inequilateral, coriaceous, glabrous, shining, entire, (10–)15–20 by 4–5(–6, rarely up to 8) cm; nerves 9–11(–12) pairs, veins distinctly reticulate and prominent on both sides; petiole stout, 1.2–1.5 cm. *Racemes* slender, in the upper axils on the young shoots, simple or branched, lax, grey-tomentose, 10–15 (–30) cm. *Flowers* whitish-greenish, fragrant, 6–7-merous. Pedicels 2–3 mm, in fruit up to 8 mm. Bracts ovate-oblong, subacute, 3–5 mm, glabrescent, caducous. *Calyx*-tube narrow-obconic, grey-tomentose, 3 mm. *Sepals* oblong, subacuminate, *c.* 4 by 1$^1/_2$ mm, stellate-patent, nerved, glabrescent. *Petals* similar to the sepals, but remaining shorter in fruit and inflexed above the ovary. Stamens in fascicles of 6–7(–8) before each petal, one stamen between the disk-glands, the others inserted on the base of the petal. *Ovary* tomentose. Styles 6–7.

Distr. *Malaysia:* Celebes (Manado), Moluccas (Key and Tenimber Isl.).

Ecol. In primary forest on level, never inundated ground on sandy clay, up to 100 m.

Uses. Timber used for house-construction.

Vern. Moluccas: *Lagumuté, kationgar;* Minahasa: *karikis sèla* (t.l.).

Anomalous species

23. Homalium moultonii MERR. Philip. J. Sc. 11 (1916) Bot. 97; En. Born. (1921) 411.

Small tree, glabrous inflorescences excepted; young branchlets soon covered with reddish-brown, rough, splitting bark. *Leaves* ovate- or elliptic-oblong, gradually attenuate and subacute, cuneate into the petiole to nearly rounded at the base, coriaceous, olivaceous when dry, shining, entire or obscurely and distantly denticulate, (7–)8–12 by (3–)4–5$^1/_2$ cm; midrib prominent beneath, nerves 7–8 pairs, curved, prominent on both sides as are the densely reticulate veins; petiole rugose, 5–7 mm. *Racemes* solitary, slender, curved, 10–18 cm, yellowish- or grey-appressed-pilose. *Flowers* solitary, 10-merous, laxly arranged. Pedicel $^1/_2$ mm. Bract very small, persistent. *Calyx*-tube narrow-funnel-shaped, grey-pubescent, nearly 5 mm. *Sepals* linear, acute, pubescent in anthesis *c.* 2 by 0.3 mm. *Petals* very similar to the sepals, slightly wider below, some of them up to 3 mm. Disk-glands fused, nearly covering the apex of the ovary. Filaments *c.* 1 mm, glabrous. Ovary conical, short, tomentose. Styles 3–4, short, glabrous.

Distr. *Malaysia:* Borneo (Sarawak), apparently rare.

Excluded species

Homalium gilgianum LAUT. Nachtr. Fl. Deut. Schutzgeb. Südsee (1905) 320 = *Lophopyxis maingayi* HOOK. *f.* (*Euphorbiaceae*). *Cf.* HALLIER *f.* Med. Rijksherb. *no* 1 (1910) 9; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 364.

13. BENNETTIODENDRON

MERRILL, J. Arn. Arb. 8 (1927) 10.—*Bennettia* MIQ. Fl. Ind. Bat. 1, 2 (1859) 105, *non* S. F. GRAY (1821), *nec* R. BROWN (1852).

Dioecious tree or shrub. Young shoots terminating with a perular bud; perular bracts persistent. *Leaves* spirally arranged, the uppermost ones crowded, sometimes subopposite, penninerved, ± coarsely glandular-serrate; petiole mostly elongate, very variable in length, in the upper leaves generally much shorter, mostly with a distinct axillary bud. Stipules 0. *Panicles* axillary or terminal, often much-branched. *Flowers* small, mostly umbellate at the apex of the stalks of the inflorescence. Bracts minute, lanceolate, caducous. *Sepals* 3(–4, rarely 5), small, imbricate, ciliate, caducous. *Petals* 0. ♂ *Flowers:* stamens indefinite, with numerous, short, fleshy, glabrous disk-glands between them; filaments filiform, woolly to their middle; anthers very small, dorsifixed. Rudiment of ovary minute, with 3 short styles. ♀ *Flowers:* staminodes indefinite like the stamens, but sterile; filaments less than half as long as in the ♂ flowers, densely pilose at the base; disk-glands numerous, truncate. *Ovary* incompletely 3-locular, each placenta with 2 (or 3) ovules. Styles 3, divergent, caducous; stigmas shortly 2-lobed. *Berry* small, rather dry, globose, usually 1–(rarely 2–4)-seeded; pericarp thin, fragile. *Seeds* blackish, shining; testa minutely reticulate.

Distr. Two or 3 *spp.* in Assam, Burma, Tonkin, and S. China, one of them in *W. Malaysia* (Sumatra and Java).

1. Bennettiodendron leprosipes (CLOS) MERR. J. Arn. Arb. 8 (1927) 11; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 84, p. 8.—*Xylosma leprosipes* CLOS, Ann. Sc. Nat. IV, 8 (1857) 230; MIQ. Fl. Ind. Bat. 1, 2 (1859) 106.—*Bennettia horsfieldii* MIQ. Fl. Ind. Bat. 1, 2 (1859) 105; KOORD. & VAL. Bijdr. Booms. 5 (1900) 29; Ic. Bog. 2 (1904) 133, t. 126.—*Bennettia longipes* OLIV. in HOOK. Ic. Pl. 16 (1887) t. 1596.—*Myroxylon leprosipes* O. KTZE, Rev. Gen. Pl. 1 (1891) 44.—*Bennettia leprosipes* KOORD. Med. Kon. Akad. Wet. 18 (1909) 49; BACK. Schoolfl. Java (1911) 71; KOORD. Exk. Fl. Java 2 (1912) 635; Atlas Baumarten 2 (1914) t. 337–338; SLOOT. Bijdr. Flac. (1919) 135; RIDL. J. Mal. Br. R. As. Soc. *no* 87 (1923) 53; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 382.—*B. longipes* MERR. J. Arn. Arb. 8 (1927) 11.—*B. brevipes* MERR. *ibid.* 10.

Shrub or small tree, 3–6(–15) m, glabrescent; bark, grey, fetid. *Leaves* arranged in distant groups, obovate-oblong or oblong-elliptic, obtusely acuminate, ± attenuate at the base, subcoriaceous, shining above, coarsely and ± irregularly glandular-serrate, (8$^{1}/_{2}$–)10–18 (rarely up to 35) by (3$^{1}/_{2}$–)4–7$^{1}/_{2}$(–14) cm; tripli- to nearly quinquenerved from the base, with *c.* 5 pairs of additional lateral nerves, veins finely reticulated on both sides; petioles (0.4–)1.5–4(–6, rarely up to 8) cm, glabrescent, whether or not with 2 glands at the apex. *Panicles* ± densely puberulent, finally glabrous, (5–)10–20 cm. *Flowers* dirty white or greenish-yellow, scented. Pedicels 3–4(–5) mm, thickened under the fruit, as the rhachis, petioles and young twigs ± densely set with thick, scale-like, nearly triangular or oblong, tubercled lenticels. ♂ *Flowers:* sepals rotundate-ovate, 3–4 mm. Stamens light-yellow, somewhat exserted. Disk-lobes purple. ♀ *Flowers:* sepals and staminodes nearly half as long as in the ♂ flowers. *Ovary* trigonous, glabrous, yellowish-green to orange. Styles dirty white as are the stigmas. *Berry* red to yellowish-red when ripe, shining, 6–9 mm diam. *Seeds* globose (or semiglobose, when 2 seeds are developed), 3–4 mm diam.

Distr. Assam, Burma, and S. China (Yunnan, Kwangtung, Hunan, Hainan), in *Malaysia:* Sumatra and Java. Fig. 26.

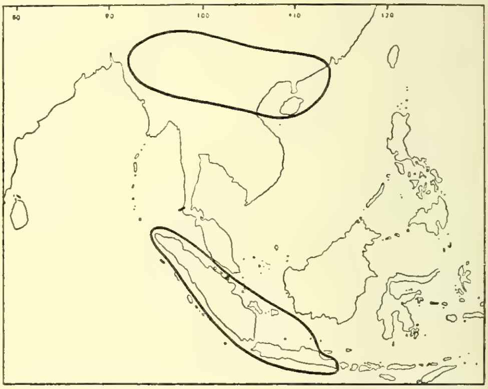

Fig. 26. Distribution of *Bennettiodendron leprosipes* (CLOS) MERR.

Ecol. Mixed forests or brush-woods, locally apparently rare, (15–)200–1450 m, in Java mostly above 1000 m, in the Padang Uplands once collected at 2400 m. Specimens with ♂ flowers seem to be rather rare. *Fl. fr.* Jan.–Dec.

Vern. *Ki hiur, andĕm ati,* S, *lumut, golèk laban, kulik* (*labang*), *lortĕloran, tutup labang, katjĕngal, tangkil, bĕrassan, rasbĕrasan,* J.

Note. The leaves and berries have an intensely bitter taste.

Doubtful or excluded species

Bennettia trinervia (LAUT. & K. SCH.) GILG *ex* DIELS, Bot. Jahrb. 57 (1922) 430; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 381.—*Terminalia trinervia* LAUT. & K. SCH. Fl. Deut. Schutzgeb. (1901) 466.

DIELS transferred this to *Bennettia* apparently on authority of GILG, in 1922. In 1925 VAN SLOOTEN noted that, according to DIELS (*in sched.*), the type (LAUTERBACH 1123, from Astrolabe Bay, Gogol River) was absent from Berlin. The description generally agrees to *Bennettiodendron*, but I hesitate to refer it definitely to this genus, as there are some discrepancies in the inadequate diagnosis; *e.g.* the leaf-margin was apparently entire, a character unknown in the genus.

Bennettiodendron papuanum (GILG) MERR. J. Arn. Arb. 8 (1927) 10.—*Bennettia papuana* GILG, Bot. Jahrb. 55 (1918) 283, f. 6; in E. & P. ed. 2, 21 (1925) 443, f. 205 = *Pimeleodendron papuanum* WARB. (*Euphorbiaceae*).

14. HEMISCOLOPIA

SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 342, f. 9.

Dioecious tree. *Leaves* alternate, large, oblong, penninerved; petiole short. Stipules 0. *Inflorescence* short, cluster-like, axillary, on leafy or defoliate branchlets. *Perianth* segments little distinct between each other, in 2 whorls of 3, persistent. ♂ *Flowers:* stamens numerous, inserted inside the lobes of a rather narrow disk; anthers with a thick, apiculate connective. Rudiment of the ovary present. ♀ *Flowers:* antherless staminodes 1-seriate between the ovary and disk-lobes. *Ovary* unilocular, with 3–4, prominent, few-ovuled placentas. Style simple, shortish, thick; stigma large, somewhat oblique and recurved at the margin, obscurely 3-lobed. *Berry* rather large, many-seeded, crowned by the persistent style and stigma; pericarp coriaceous. *Seeds* exarillate, with thick albumen.

Distr. Monotypic, in Indo-China and *Malaysia* (Sumatra, Banka, and Java).

Ecol. In mixed rain-forests, mostly at low altitudes.

1. Hemiscolopia trimera (BOERL.) SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 343, f. 9.—*Scolopia trimera* BOERL. Cat. Hort. Bot. Bog. 1 (1899) 53; KOORD. Exk. Fl. Java 2 (1912) 632; SLOOT. Bijdr. Flac. (1919) 102.—? *Flacourtia kelampagine* VAN EEDEN, Houtsoort. Ned. Oost-Ind. ed. 3 (1905) 12, *nom. nud.*—*Xylosma macrocarpum* PIERRE *ex* GAGNEP. Bull. Soc. Bot. Fr. 55 (1908) 527; Fl. Gén. I.C. 1 (1909) 232, f. 22, 7–13; *ibid.* Suppl. 1 (1939) 210.

Glabrous tree, 2–5(–12) m, normally unarmed but occasionally with simple spines 2½–3½ cm, buttressed when old. *Leaves* oblong, large, shortly attenuate at the apex, rounded or subtruncate at the base, coriaceous, shining on both sides (young ones purplish alive), (10–)16–32 by (5–)6–12 cm, distantly glandular-subserrate-crenate (1 mm deep) with 2 or 4 basal glands near the apex of the petiole; nerves curved-ascending, (7–)8–10(–12, rarely 14) pairs, prominent beneath, veins numerous, ± transversal and little prominent; petiole stout, rugose, ½–1 cm. *Flowers* (3–)4–8 in compact, axillary, fascicle-like racemes, sordid-white, inside red; peduncle very short, woody, with minute bracts at the base. Pedicels 2–5 mm. ♂ *Flowers:* perianth segments (4–)6, ovate to nearly orbicular, ciliate, further glabrous, concave, many-nerved, the outer ones firm, the inner ones somewhat smaller and thinner, (3–)4–5 by 3½–5 mm. Disk fleshy, consisting of many short, red lobes coherent at the base. Filaments filiform, glabrous; appendage-like connective glabrous. Rudiment of ovary minute, glabrous. ♀ *Flowers:* perianth segments and disk similar to those in the ♂ flowers, the first a little smaller. Staminodes glabrous. *Ovary* ovoid, glabrous, attenuate at the apex into a 3–4 mm long style. *Berry* green, ovoid or obpyriform, rather abruptly attenuate at the apex, somewhat 3–5-sulcate, crowned by the persistent style and stigma, glabrous, 2–2½ by 1½ cm. *Seeds* 10–15(–20), oblong, irregularly angular, shining, 6–8 mm.

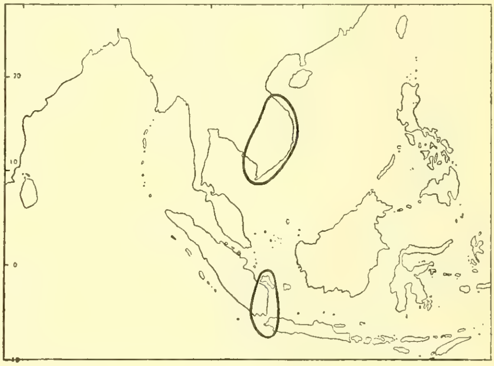

Fig. 27. Distribution of *Hemiscolopia trimera* (BOERL.) SLOOT.

Distr. Indo-China (Cochin-China, Annam), in *Malaysia:* S. Sumatra (Ranau Lake), Banka, and W. Java (Banten, Preanger, Djakarta). Fig. 27.

Ecol. In rain-forest, both on limestone rock or sandy soil, 20–300, in S. Sumatra up to 700 m, everywhere rare.

Uses. Fruit said to be edible; wood not used.

Vern. *Rukĕm gunung*, *ki kĕmandĕn*, S, *kĕlampa laut*, *k. gine*, M (Banka).

15. XYLOSMA

G. FORST. Prod. (1786) 72, *nom. conserv.*—*Myroxylon* J. R. & G. FORST. Char. Gen. (1776) 125, t. 63, *nec* L. *f.* (1781).—*Hisingera* HELLEN. Vet. Akad. Handl. Stockh. (1792) 32, t. 2.—**Fig. 28–29.**

Dioecious trees or shrubs, often with axillary, simple spines on branches and branchlets, sometimes with (simple or compound) thorns on trunk. *Leaves* spirally arranged, ± coriaceous, mostly subglandular-serrate or -crenate, more rarely entire, penninerved, mostly with a short petiole. Stipules 0. *Flowers* small, in short, axillary, few-flowered, mostly solitary racemes. Bracts small, subpersistent. Pedicels articulated immediately above their insertion or a little higher up. *Perianth* segments (sepals) 4–6(rarely up to 8), slightly connate at the base, imbricate. Petals 0. Disk fleshy, mostly ± regularly 4–8-lobed, more rarely entire, extrastaminal. ♂ *Flowers:* stamens very numerous, mostly exserted; filaments filiform; anthers subglobose, basifixed, ± gibbous. Rudiment of ovary 0. ♀ *Flowers:* ovary sessile, with 2(–3, rarely up to 6), few-ovuled placentas; stigmas 2 (or 3), somewhat bilobed, sessile or on a (sometimes very) short, cylindrical style. *Berry* rather dry; pericarp mostly thinly leathery. *Seeds* mostly few, ± obovoid by mutual pressure, with a thin aril.

Distr. About 104 *spp.* throughout the tropics Africa excepted, the bulk (*c.* 68 *spp.*) in Central and South America, *c.* 7 in Polynesia, *c.* 15 in New Caledonia, 3 in Australia, 1 in the New Hebrides, 1 in Micronesia (Guam), 4 in *Malaysia* and 5 in SE. Asia.

Ecol. In *Malaysia* in rain-forests, sometimes in the montane zone.

Note. The specific delimitation in this rather large genus is very difficult as neither the flowers nor the fruits yield good or distinctive characters. However, the differences, though small, or even minute, seem to hold.

KEY TO THE SPECIES

1. Leaves entire or nearly so.
  2. Leaves ± coriaceous, rather laxly reticulate. Nerves (4–)5–7 pairs, distant and prominent on both sides . . . . **1. X. papuanum**
  2. Leaves ± subcoriaceous, finely and densely reticulate. Nerves 8–10 pairs, rather close and little prominent on both sides . . . . **2. X. suluense**
1. Leaves at least in the upper half manifestly serrate or crenate.
  3. Leaves rather coarsely and irregularly crenate, densely reticulate . . . . . . **3. X. luzonense**
  3. Leaves ± sharply and regularly crenate-serrate, little and ± laxly reticulate. **4. X. sumatranum**

1. Xylosma papuanum GILG, Bot. Jahrb. 55 (1918) 280, f. 4; SLEUM. Notizbl. Berl.-Dahlem 14 (1938) 296.—*Flacourtia papuana* PULLE, Nova Guinea 8 (1912) 672; SLOOT. Bijdr. Flac. (1919) 131.—*X. pullei* SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 379; Nova Guinea 14 (1924) 192.

Small or medium-sized tree up to 6 m. *Leaves* ovate to ovate-oblong, acutely acuminate, subrotundate at the base, shining above, 7–15 by $3^1/_2$–$5^1/_2$(–7) cm; nerves rising strongly from or somewhat above the base, veins prominent; petiole thickened (0.6–)1–$1^1/_2$ cm. *Racemes* mostly solitary, 10–12-flowered, ($1^1/_2$–)$2^1/_2$–4 cm long; rhachis densely pilose. Sepals 4–6, 1–$1^1/_2$ mm, ovate, ciliate further glabrous. Disk thick, irregularly 5-lobed or crenulate. ♂ *Flowers:* stamens *c.* 15; filaments glabrous, 2–3 mm. ♀ *Flowers:* ovary ovoid, glabrous. Style very short; stigmas 2, applanate. *Berry* globose, red, *c.* 6 mm.

Distr. Solomon Isl. (Guadalcanal), in *Malaysia:* Moluccas (Ternate), New Guinea.

Ecol. Scattered in forest, 400–1600 m.

Uses. Wood very tough, used in the Solomon Isl. by the natives for making tool-handles.

2. Xylosma suluense MERR. Philip. J. Sc. 9 (1914) Bot. 324; En. Philip. 3 (1923) 112; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 379; SLEUM. Notizbl. Berl.-Dahlem 14 (1938) 296.—**Fig. 28.**

Shrub or little tree 3–5 m, glabrous; branches and branchlets slender, very pale, with scattered lenticels. *Leaves* oblong-ovate, flexile, shining, glabrous, brownish when dry, gradually acuminate from the middle to the apex, attenuate at the base, not rarely with one or 2 little glands at the very base respectively the apex of the petiole, (7–)9–18 by (3–)$3^1/_2$–5(–6) cm; petiole 0.6–0.8(–1) cm. *Racemes* minutely pubescent, *c.* $1^1/_2$ cm long, few-flowered. Pedicels glabrous, 3–5 mm, with two minute pubescent bracteoles at the base. Perianth segments 4–6, minute, ovate-acuminate, 0.8 mm, nearly glabrous; disk-lobes *c.* 8, truncate or clavate, as long as the sepals. ♂ *Flowers:* stamens *c.* 20–25; filaments 2 mm, glabrous. ♀ *Flowers:* ovary

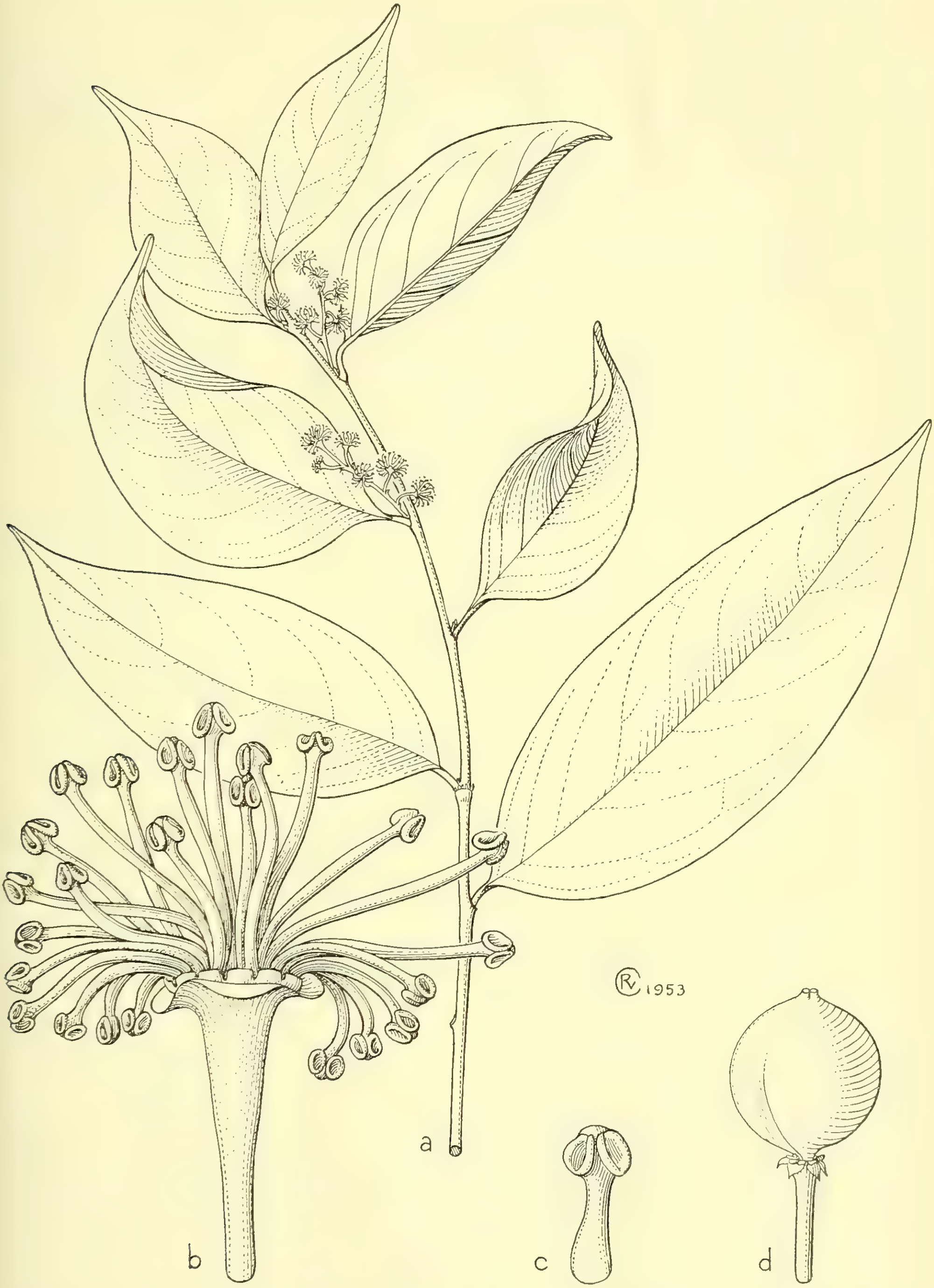

Fig. 28. *Xylosma suluense* MERR. *a.* Twig with ♂ flowers, × 3/4, *b.* ♂ flower, × 12, *c.* exterior stamen, × 18, *d.* fruit, × 3 (*a–c* after MERRILL 7174, *d* after MERRILL 11623).

oblong, with 2 nearly sessile, subreniform stigmas. *Berry* globose, 6–8 mm diam., green. *Seeds* 3–4, blackish, 3–4 mm.

Distr. *Malaysia:* Br. N. Borneo (Balabac Isl.), Philippines (Guimaras Isl.; Mindanao: Cotabato, Zamboanga; Basilan; Sulu Arch.: Bongao, Ubian, Cavilli, Tawi-Tawi); Moluccas (Sula: Taliabu).

Ecol. Thickets back of the beach (Merrill) and low limestone region on rocks, from sea-level up to 200 m (Guimaras Isl.).

3. Xylosma luzonense (Presl) Clos, Ann. Sc. Nat. IV, 8 (1857) 229, *in clavi*, 273; Merr. Philip. J. Sc. 9 (1914) Bot. 323; En. Philip. 3 (1923) 112.—*Prockia luzonensis* Presl, Rel. Haenk. 2 (1835) 94.—*Flacourtia amara* Span. Linnaea 15 (1841) 166.—*X. fragrans* Forst. *ex* Decaisne, Voy. Vénus, Atlas (1846) t. 25, Bot. 5 (1864) 31; Clos, Ann. Sc. Nat. IV, 8 (1857) 232; Miq. Fl. Ind. Bat. I, 2 (1858) 106.—*X. cumingii* Clos, Ann. Sc. Nat. IV, 8 (1857) 231; Miq. Fl. Ind. Bat. I, 2 (1858) 106; F.-Vill. Nov. App. (1880) 13; Vid. Phan. Cuming. Philip. (1885) 94; Rev. Pl. Vasc. Filip. (1886) 49.—*Myroxylon cumingii* O. Ktze, Rev. Gen. Pl. 1 (1891) 44.—*Myroxylon fragrans* O. Ktze *l.c.*—*Myroxylon amarum* Warb. in E. & P. Pfl. Fam. 3, 6a (1893) 41.—*X. amarum* Koord. Versl. Kon. Akad. Wet. A'dam 18 (1909) 51; Exk. Fl. Java 2 (1912) 633; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 377.—*Flacourtia lanceolata* Merr. Philip. J. Sc. 9 (1914) Bot. 455; En. Philip. 3 (1923) 113; Meijer Drees, Comm. For. Res. Inst. 33 (1951) 59.—*X. fragrans* Decne & Clos *ex* Sloot. Bijdr. Flac. (1919) 132.

Large shrub or tree up to 10 m, glabrous, occasionally with spines on the trunk; branchlets unarmed or with simple, axillary, slender spines, ½–1 cm. *Leaves* rather variable in shape and size, ovate-oblong to oblong-lanceolate, rarely ovate or elliptic, ± acuminate, but obtuse at the extreme apex, attenuate at the base, 6–10(–14) by (1½–) 2–3(–4–5, rarely up to 6) cm, mostly subentire towards the base, ± distinctly obtusely serrate, at least above the middle, ± chartaceous to subcoriaceous, mostly shining above, dull beneath; petiole almost rather slender, ½–1 cm. *Racemes* usually solitary, puberulous, the ♂ 1–2½(–4) cm long and 8–10(–15)-flowered, the ♀ ½–1½ cm long and 3–5-flowered. *Flowers* small, yellowish green or whitish. Pedicels minutely puberulous, 2–3 mm. Perianth segments 4–6, ovate, ciliate, otherwise glabrous, 0.5–0.8 mm. Disk shortly 6–8-lobed, as long as the sepals. ♂ *Flowers:* stamens *c.* 40, exserted; filaments unequal, glabrous, 2 mm. ♀ *Flowers:* ovary ovoid, attenuate at the apex, glabrous; stigmas 2, nearly sessile. *Berry* globose, (4–)5–6 mm diam., glabrous, blackish when dry, apiculate by the very short, persistent style. *Seeds* 1–2(–4), lenticular-compressed, 2–3 mm.

Distr. *Malaysia:* Philippines (Babuyan Isl., Luzon), S. Celebes and Buton Isl., Lesser Sunda Islands (Timor: P. Lamaan; Wetar, Flores), Moluccas (Key Isl.).

Ecol. Mostly rare and scattered in primary and secondary forest on never inundated hilly or level, clayey or stony ground, from the sea-shore up to 1200 m.

Vern. Philippines: *Amaet*, Bis., *babaliuayin, mambuk*, Sbl., *digek, palútan*, Ilk., *kuliága, mangkíl, mamangkíl, suliak-dagá*, Tag.; *kaju ulĕr, hauw sisi, sisi moné hau, lianfui*, Timor, *kĕsuja, laihéha*, Wetar.

4. Xylosma sumatranum Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 379, f. 12; Merr. Contr. Arn. Arb. 8 1934) 109; Sleum. Notizbl. Berl.-Dahlem 14 (1938) 295.—**Fig. 29.**

Shrub or tree, 3–15 (rarely up to 25) m; bark greenish-brown or light-greyish; branches mostly unarmed, but sometimes with simple or branched spines up to 2 cm; branchlets glabrous. *Leaves* shortly acuminate, cuneate at the base, chartaceous, glabrous, (pale green, but reddish when young), brown when dry, oblong-lanceolate to oblong-elliptic, 5–9(–11–13) by 2½–4(–5–6) cm; nerves (4–)5–7 pairs, distant and ± prominent specially beneath; petiole rather stout, red when fresh, (3–)5–10(–12) mm. *Racemes* 1–2 (rarely up to 4) cm, 4–8-flowered, puberulous on the rhachis and pedicels. Bracts small, narrow-ovate, acute, ciliate. Pedicels 2–3 mm (in the ♂ flowers somewhat longer and more slender), thickened and corky in fruit. Perianth segments 6–8, unequal (4 mostly bigger in size), white or greenish, ovate or nearly rounded, ciliate, glabrous outside, pilose inside, 1–1½ mm. Disk-lobes 6–8, truncate, very short. ♂ *Flowers:* stamens *c.* 30; filaments glabrous; anthers creamy. ♀ *Flowers:* ovary elongate-ovoid, bottle-like thickened at the apex, little exserted; stigmas 2, minute. *Berry* subglobose, blackish and shining when dry, 4 mm diam.; pericarp rather dry, red. Style subcylindric, ½ mm, subpersistent. *Seeds* 2–3, subrotundate-trigonous, *c.* 3 mm.

Distr. *Malaysia:* Sumatra (Atjeh, East Coast), E. Java (Besuki: Idjen Plateau), Borneo (Br. N. Borneo and Sarawak), Lesser Sunda Islands (Bali, Lombok), New Guinea.

Ecol. Rain-forest, apparently scattered, 1070–2200 m.

Uses. Wood whitish, not used.

Vern. *Tata-tata*, Sum. E.C., *taeni, talini*, Gajo. Br. N. Borneo: *rukam*, Kedayan. New Guinea: *mikeia*, Anona.

Note. *Rottlera zollingeriana* Miq. Fl. Ind. Bat. 1, 2 (1859) 394; M.A. in DC. Prod. 15, 2 (1866) 983; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 381, *nota*.

Java: Zollinger 3174, probably on the Idjen plateau in extreme E. Java.

Only known by a single collection with ♂ flowers which do not allow to decide, if the species belongs either to *Flacourtia* or *Xylosma*. Not identical with any so far known species of these genera, but rather similar in leaf-characters to *X. sumatranum*, differing by its quite glabrous inflorescence.

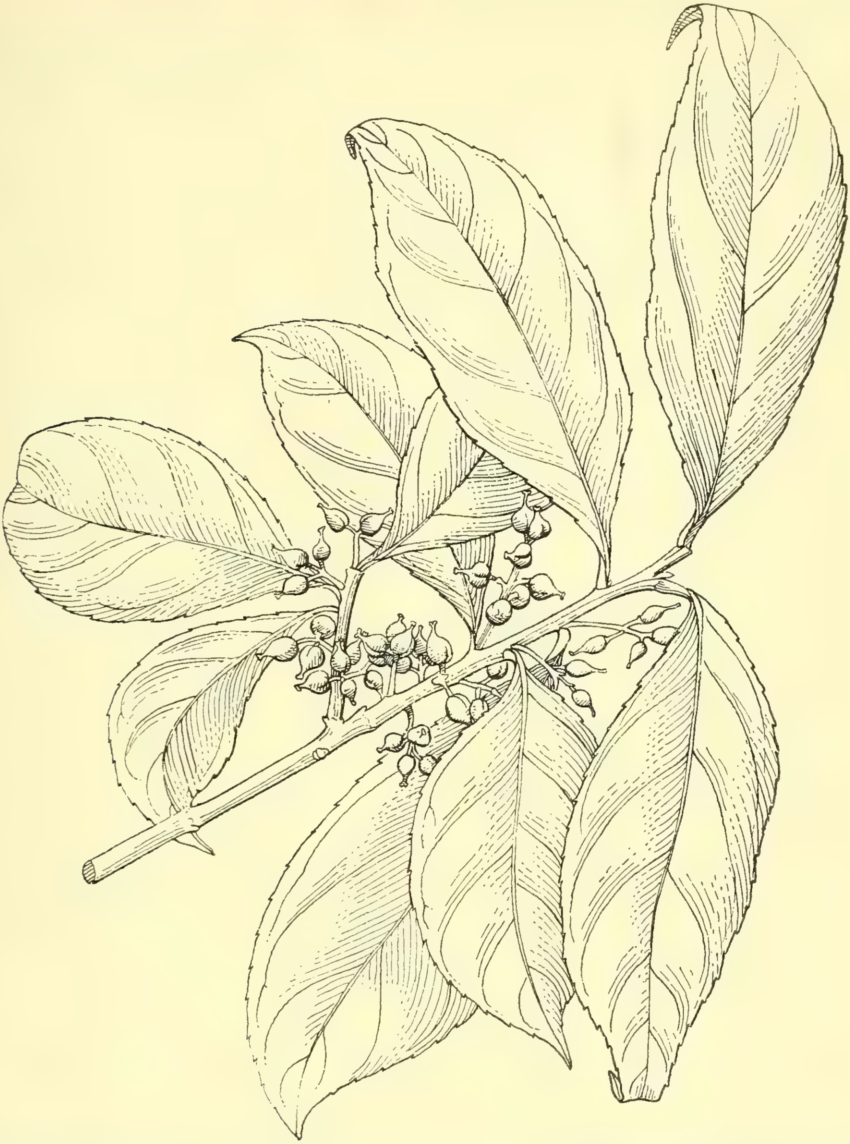

Fig. 29. *Xylosma sumatranum* SLOOT. After a ♀ living twig from Mt Idjen, E. Java (VAN STEENIS 12059).

16. FLACOURTIA

L'HÉRITIER, Stirp. Nov. 3 (1785) 59, t. 30, 31; JUSS. Gen. (1789) 291 (*Flacurtia*).—*Satania* NOR. Verh. Bat. Gen. 5 (1790) ed. 1, Art. IV, 3, *nom. nud.*—*Stigmarota* LOUR. Fl. Cochinch. (1790) 633; HOOK. *f.* & TH. Fl. Br. Ind. 1 (1872) 193 (*sphalm. Stigmarosa*).—*Rhamnopsis* RCHB. Consp. (1828) 188.—**Fig. 30–33.**

Trees or erect shrubs; trunk thorny or not; branches often with axillary spines when young, unarmed when old. *Leaves* spirally arranged, shortly petioled, ± 3–5-nerved at the base, otherwise penninerved, mostly crenate. Stipules 0. *Flowers* unisexual, rarely hermaphrodite, small, in short, axillary racemes. Perianth segments (sepals)

4–6(–7), slightly connate at the base, imbricate, green, subpersistent. Disk extrastaminal, entire or crenulate (mostly so in ♀ flowers), or broken up into free glands inserted mostly in twos more or less before each sepal (mostly so in ♂ flowers). ♂ *Flowers:* stamens 15-∞, free, with ellipsoid, extrorse, dorsifixed, ± versatile, ± gibbous anthers; rudiment of ovary 0. ♀ *Flowers:* ovary incompletely (2–)4–6(–10)-celled by false septa. Ovules 2 per cell. Styles as many as cells, free or ± connate; stigmas notched or shortly 2-lobed. *Fruit* a berry-like, fleshy, indehiscent drupe; pyrenes twice the number of styles, (1–)2-seeded, in the latter case the seeds superposed. *Seeds* obovoid; testa thinly crustaceous; cotyledons orbicular.

Distr. About 15 *spp.* in the warmer parts of Africa and Asia to Polynesia, in *Malaysia* 7 *spp.*, one of them introduced.

KEY TO THE SPECIES

1. Flowers always bisexual. Stamens ± persistent at the base of the fruit.
  2. Leaves, branchlets, and petioles wholly glabrous. Blade subacute. Styles central, somewhat connate at the base . . . . **1. F. zippelii**
  2. Leaves, branchlets, and petioles ± densely pubescent beneath along the midrib and nerves. Blade mostly obtuse at the apex. Styles central, entirely free, sometimes very short . . **2. F. inermis**
1. Flowers unisexual (dioecious trees or shrubs, exceptionally in *F. rukam* a few ± ⚥ flowers on otherwise ♂ specimens).
  3. Leaves softly-tomentose throughout the undersurface, cordate at the base. Nerves (8–)10–12 pairs. **3. F. tomentella**
  3. Leaves glabrous or pubescent beneath along midrib and nerves, not cordate at the base.
    4. Styles entirely connate into a distinct column, both on the ovary and fruit; stigmas very short and spreading, ± applanate. Leaves ovate-oblong to ovate-lanceolate, mostly membranous, glabrous, shining, the petiole slender . . . . **4. F. jangomas**
    4. Styles entirely free or practically so.
      5. Styles 6–7(–8), elongate-filiform free from each other, erect, inserted in a circle on the flat top of the fruit, distinctly spaced. Leaves ± elliptic-oblong, mostly coarsely but regularly crenate, firmly chartaceous, lateral nerves subparallel and not rarely impressed above when dry. **5. F. rukam**
      5. Styles 4–6(–7), central or nearly so, spreading and ± reflexed both in ovary and fruit, sometimes somewhat united at the base (apex of the fruit tapering into a connate portion).
        6. Leaves oblong- or lanceolate-ovate, manifestly and narrowly reticulated at both sides, with 6–8(–9) pairs of lateral nerves, (10–)14–17 by (4–)5–6 cm . . . . . **6. F. kinabaluensis**
        6. Leaves smaller, occasionally up to 9 by 4 cm, very variable in shape, with 3–6 pairs of lateral nerves . . . . **7. F. indica**

1. Flacourtia zippelii SLOOT. Bijdr. Flac. (1919) 128; Bull. Jard. Bot. Btzg III, 7 (1925) 372; Nova Guinea 14 (1924) 192.—*F. cerasifera* ZIPP. Bijdr. Nat. Wet. 5 (1830) 179, *nomen.*—*F. inermis var. glabra* BOERL. Cat. Hort. Bog. (1899) 51.—*F. inermis* (*non* ROXB.) MERR. Philip. J. Sc. 1 (1906) Suppl. 99.

Unarmed, slender tree, 5–10(–25) m high, rarely a shrub, tall specimens sometimes buttressed; branches mottled-brown and green, the young ones including the tips entirely glabrous and often shining (vernicose), striate, brownish; lenticels rather sparse, pallid, oblong-elliptic; bark thin, brown. *Leaves* ovate-oblong, rarely ovate-elliptic or lanceolate-ovate, gradually acuminate, broadly attenuate to nearly rotundate at the base, shining specially above, coriaceous to subcoriaceous, coarsely crenate to subentire, entirely glabrous, (7–)12–20 by (3–)5–7(–9) cm; midrib little prominent above, distinctly so beneath, 2 pairs of lateral nerves rising from or near the base, 3–4 pairs ascending from the midrib, all distinctly prominent beneath, veins numerous, transverse and slightly prominent as are the rather dense reticulations; petiole rather stout, 1½–2 mm, rugose, 0.6–1 cm. *Racemes* abbreviate, few-flowered, shortly, laxly, yellowish-pubescent. Pedicels 4–6 mm. *Sepals* 4–5, ovate, subacute, outside laxly, inside densely pilose. Disk shortly 4–5-lobed. Stamens *c.* 15 (the anthers sometimes not well developed); filaments normally *c.* 2½ mm, glabrous. *Ovary* ovoid; styles 4–5, radiate, 1 mm long and connate at the base, forming a very short column. *Fruit* depressed-globose, *c.* 1½–2 cm diam., first pale green, dark red when ripe or dry, mostly surrounded at the base by the ± persistent sepals and stamens or their rests, crowned by 4–5 short, radiate styles and not rarely a little apiculate giving the impression of the presence of a short style-column.

Distr. Melanesia (Solomon Isl. and New Britain) and *Malaysia:* Philippines (Luzon, Mindanao, Mindoro, Dinagat, Polillo), Celebes, Moluccas (Key, Banda, Morotai), New Guinea.

Ecol. Primary or secondary rain-forest on level or hilly moist ground and clayey soil, scattered, at low altitude, up to 1200 m.

Uses. Wood very tough, used by the people of the Solomon Islands for making handles of tools.

Vern. *Rukam manis, maraijo, mokoronda,* Malili, *karondang pangala,* Palopo; *lati,* Guadalcanal.

2. Flacourtia inermis ROXB. Pl. Corom. 3 (1811) 16, t. 222; Hort. Beng. (1814) 73; JACK, Mal. Misc. 1 (1820) 25; ROXB. Fl. Ind. ed. 2 (1832) 833; JACK, Calc. J. Nat. Hist. 4 (1843) 230; CLOS, Ann. Sc. Nat. IV, 8 (1857) 216; MIQ. Fl. Ind. Bat. I, 2 (1859) 103; HOOK. *f.* & TH. Fl. Br. Ind. 1 (1872) 192; KURZ, For. Fl. Br. Burma 1 (1877) 74; KOORD. Minah. (1898) 472; KOORD. & VAL. Bijdr. Booms. 5 (1900) 25; K. SCHUM. & LAUT. Fl. Deut. Schutzgeb. Südsee (1901) 454; BACK. Fl. Bat. 1 (1907) 68; Voorl. Schoolfl. Java (1908) 15; Schoolfl. Java (1911) 70; KOORD. Exk. Fl. Java 2 (1912) 634; Atlas Baumarten 2 (1914) t. 335; MERR. Philip. J. Sc. 11 (1916) Bot. 293; GILG, Bot. Jahrb. 55 (1918) 282; SLOOT. Bijdr. Flac. (1919) 127; Nova Guinea 14 (1924) 192; Bull. Jard. Bot. Btzg III, 7 (1925) 373; HEYNE, Nutt. Pl. (1927) 1140; OCHSE & BAKH. V. D. BR. Vruchten en Vruchtenteelt N.I. (1931) 47, pl. 18; BURK. Dict. (1935) 1022; KANEH. & HATUS. Bot. Mag. Tokyo 52 (1938) 416; CORNER, Ways. Trees (1940) 307; BACK. Bekn. Fl. Java (em. ed.) 4 A (1942) fam. 84, p. 7; MERR. J. Arn. Arb. 33 (1952) 225.—*F. sapida* (*non* ROXB.) TEYSM. & BINN. Cat. Bog. (1866) 185, *nom. nud.*—**Fig. 30e–g.**

KEY TO THE VARIETIES

1. Leaves ovate or ovate-oblong, 10–20 by (4–) 5–8(–12) cm . . . . *var.* **inermis**
1. Leaves oblong to oblong-lanceolate, 3–5 cm wide.
    2. Leaves 12–18 cm long, attenuate-cuneate at the base . . . . *var.* **rindjanica**
    2. Leaves 5–8(–11) cm long, broadly cuneate at the base, the base itself rounded or truncate. *var.* **moluccana**

var. **inermis.**

Unarmed tree, (3–)5–15 m; trunk usually crooked, gnarled and furrowed, up to 35 cm; bark brown or grey, rather smooth; young branchlets pubescent to nearly tomentose, brownish, laxly beset with pallid subrotundate lenticels. *Leaves* ovate-oblong to ovate-elliptic, attenuate-acuminate, broadly cuneate or rarely rounded at the base, firmly chartaceous, glabrous but always puberulous at the midrib on both surfaces, olivaceous to brown when dry, coarsely to slightly crenate, 8–14(–20) by (4–)5–8(–12) cm; midrib little prominent above, distinctly so beneath, nerves 5–6(–7) pairs, curved-ascending, but not interarching, little prominent above, distinctly so beneath, veins transverse and distinct, reticulations rather dense, well visible but little prominent; petiole stoutish, 8–10(–12) mm, manifestly pubescent. *Racemes* short, sometimes nearly reduced to fascicles, 1–1½ cm, puberulous, with several small bracts at the base. Pedicels slender, 4–10 mm, finely pubescent. *Sepals* (3–)4–5, ovate, obtuse, nearly glabrous or little pubescent outside, densely pilose inside, *c.* 2½ mm. Stamens 15–25, sometimes not fully developed; filaments glabrous, 2½ mm. Disk ± manifestly 6–8-lobed. *Ovary* ovoid, contracted apically; styles 4–5, slightly reflexed and enlarged into disciform or cuneate, bilobed stigmas. *Fruit* globose, pink to red, *c.* 2–2½ cm diam., adstringent, crowned by the compact styles or their rests, usually with remains of stamens or filaments at the base; pyrenes 8–10.

Distr. Only known in a cultivated or semi-cultivated state in the tropics in the vicinity of human habitations, widely spread from India (Silhet) over *Malaysia:* Sumatra, Malay Peninsula, Java, Borneo, Celebes, Moluccas and New Guinea to New Britain.

Ecol. Cultivated as a fruit tree up to 1300 m; grows also near the sea on sandy soil. *Fl.* Jan.–Febr.; *fr.* May–July.

Uses. The bright, cherry-red ripe fruit, the varieties with sweet fruits excepted, is too acid and adstringent to be eaten when fresh, but very good for making jams, syrup and preserves.

Vern. *Lobi-lobi, l.l. asĕm, rukĕm, rukam,* M, J, S, *saradan kaju,* S; *rukĕm bĕlanda,* Lingga; *tomi-tomi* Manado; *tomè-tomè,* Ternate; *tomo-tomo,* S. Ceram, *tombi-tombi,* S. Halmah., *kamondju, mĕngkorondo,* Barèe dial., *kĕnilango,* Buol; *lubi-lubi,* Minangk., Bugin.; *kegboi,* Manokwari.

Note. ROXBURGH founded this species on a specimen introduced from the Moluccas into the Botanic Garden at Calcutta. In many botanical works *F. inermis* has been cited as a native of the Moluccas, where it is nowadays widely distributed, but apparently it was not present there in the days of RUMPHIUS († 1702), who does not mention this very popular fruit tree. *Cf. var. moluccana.*

var. **rindjanica** (SLOOT.) SLEUM. *stat. nov.*—*F. rindjanica* SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 372; MALM in FEDDE, Rep. 34 (1934) 281. —*F. lanceolata* SLOOT. Bijdr. Flac. (1919) 129, *nec* MERR. 1914.

Differs from *var. inermis* by the lanceolate, attenuate leaves, 12–18 by 3–5 cm, attenuate-cuneate at the base.

Distr. *Malaysia:* Lesser Sunda Islands (Lombok, Sumba).

Ecol. Monsoon forests, on clayey soil, 750–950 m.

Vern. *Lobah,* Sumba.

var. **moluccana** SLEUM. Blumea 7 (1954) 493.—*F. cataphracta* (*non* ROXB.) SCHEFF. Ann. Jard. Bot. Btzg 1 (1876) 6.

Differs from *var. inermis* by smaller leaves, 5–8 (–11) cm long, with a characteristically truncate, nearly rounded, base. Fruit said to be green or red.

Distr. *Malaysia:* Moluccas (Halmaheira, Morotai), New Guinea (McCluer Gulf, Wissel Lake Region, Andai).

Ecol. In primary forests on coralline limestone (Halmaheira), up to 150 m (Morotai); *fr.* Jan.–April.

Uses. Used for timber in Halmaheira.

Vern. *Halimaditoko,* Tobelo, Halmaheira.

Note. The material of this variety has apparently been collected from indigenous specimens, and *var. moluccana* may represent the ancestral form from which the cultigens of *var. inermis* originated.

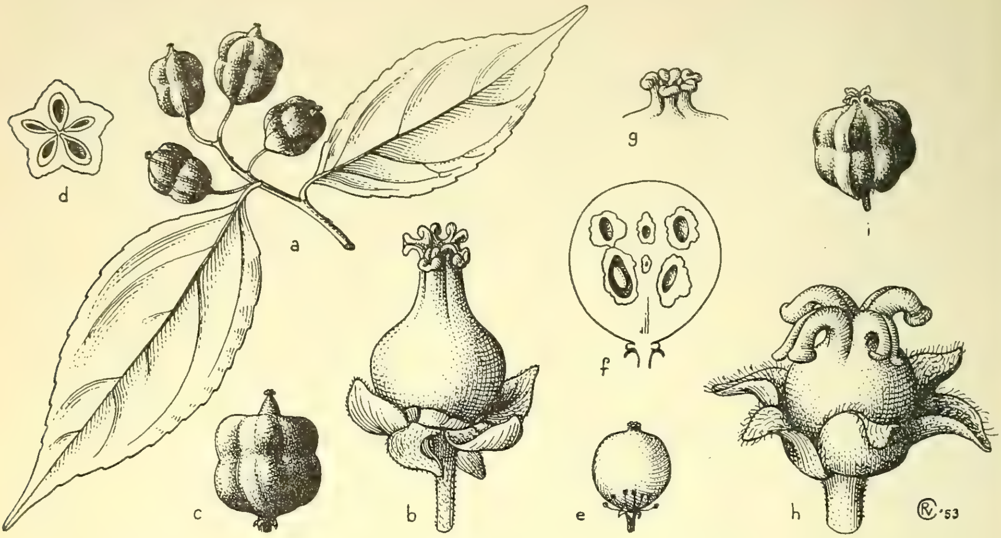

Fig. 30. *Flacourtia jangomas* (Lour.) Raeusch. *a*. Twig with fruits, × 2/3, *b*. ♀ flower, × 9, *c*. fruit, × 2/3, *d*. fruit, cross-section, × 2/3.—*Flacourtia inermis* Roxb. *e*. fruit, × 2/3, *f*. fruit, cross-section, × 1 1/3, *g*. stigma, × 7.—*Flacourtia indica* (Burm. *f*.) Merr., *h*. ♀ flower, × 9, *i*. fruit, × 1 1/3 (*h–i* after Coert 1558).

3. Flacourtia tomentella Miq. Fl. Ind. Bat. Suppl. (1860) 387; Sloot. Bijdr. Flac. (1919) 125; Bull. Jard. Bot. Btzg III, 7 (1925) 372; Ridl. J. Bot. 74 (1936) 222.—*F. sumatrana* Planch. *msc. ex* Hook. *f.* & Th. Fl. Br. Ind. 1 (1872) 192 *excl. pl.* Helfer; Gagnep. in Morot, J. de Bot. 21 (1908) 172; Sloot. Bijdr. Flac. (1919) 130; Bull. Jard. Bot. Btzg III, 7 (1925) 365.

Unarmed tree; branchlets dilute-ferrugineous-pubescent apically, soon covered with whitish or greyish cork. *Leaves* oblong-elliptic, obtuse-acuminate, inequilateral and distinctly cordate at the base, firmly chartaceous, coarsely crenate, shining and glabrous on the upper surface except the pubescent midrib and the nerves, dull beneath and laxly covered with short, subferrugineous hairs, more densely so on midrib and nerves, 9–25 (–30) by 4–10 cm; midrib slightly prominent, sometimes somewhat impressed above, very prominent beneath, nerves (8–)10–12 pairs, the inferior 3–4 rising from the leaf-base, the others suberect from the midrib, all slightly prominent above, distinctly so beneath, veins transverse, numerous, only little prominent on both sides as are the rather dense reticulations; petiole thick, densely pubescent 5–7(–10) mm. *Racemes* axillary, few-flowered, 1–1 1/2 cm, rather densely rufous-pubescent. Pedicels rather slender, 4 mm. Bracts ovate-rotundate, 1 mm. *Sepals* 4, ovate, densely hairy on both sides, *c.* 1 1/2 mm. Disk undulate. ♂ *Flowers:* stamens *c.* 15; filaments pubescent, 2 mm. ♀ *Flowers:* not seen. *Fruit* subglobose, *c.* 1 1/2 cm diam., crowned by 4–5(–7), ± reflexed, shortly bilobed, *c.* 1 mm long styles radiating from the very apex of the fruit.

Distr. *Malaysia:* W. Sumatra (Padang Lowlands); only 2 gatherings are known, both collected a century ago.

4. Flacourtia jangomas (Lour.) Raeusch. Nomencl. Bot. ed. 3 (1797) 290; Gmel. *ex* Steud. Nomencl. (1821) 343; Miq. Fl. Ind. Bat. 1, 2 (1859) 105; Merr. En. Born. (1921) 412; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 375; Heyne, Nutt. Pl. (1927) 1140; Burk. Dict. (1935) 1023; Merr. Comm. Lour. (1935) 274: Ridl. J. Bot. 74 (1936) 224; Henders. J. Mal. Br. R. As. Soc. 17 (1939) 36; Corner, Wayside Trees 1 (1940) 307, p. 64, f. 99; Back. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 84, p. 8.—*Stigmarota jangomas* Lour. Fl. Cochinch. 2 (1790) 634; ed. Willd. (1793) 779.—*F. cataphracta* Roxb. *ex* Willd. Sp. Pl. 4 (1806) 830; Roxb. Pl. Corom. 3 (1811) t. 222; Bl. Bijdr. 1 (1825) 55; Roxb. Fl. Ind. ed. Carey 3 (1832) 834; Kurz, Nat. Tijd. Ned. Ind. 27 (1864) 177; Tul. Ann. Sc. Nat. V, 9 (1868) 340; Hook. *f.* & Th. Fl. Br. Ind. 1 (1872) 193; Scheff. Ann. Jard. Bot. Btzg 1 (1876) 6; Kurz, For. Fl. Burma 1 (1877) 74; King, J. As. Soc. Beng. 59, ii (1890) 117; Koord. & Val. Bijdr. Booms. 5 (1900) 26; Gagnep. in Morot, J. de Bot. 21 (1908) 172; Fl. Gén. I.C. 1 (1909) 233; Back. Schoolfl. Java (1911) 71; Koord. Atlas Baumarten 2 (1914) f. 334; Ridl. Fl. Mal. Pen. 1 (1922) 158; Craib, Fl. Siam. En. 1 (1925) 94.—*Roumea jangomas* Spr. Syst. Veg. 2 (1825) 632.—*Xylosma borneense* Ridl. J. Bot. 74 (1936) 224.—**Fig. 30a–d.**

Small, deciduous tree, 6–10(–14) m; trunk and branches commonly thornless in old trees, ± densely beset with simple or branched, woody thorns when younger; bark light-brown to copper-red or pinkish-buff, flaky into thin lamels; young branches white-dotted by numerous suborbicular lenticels, puberulous or mostly glabrous. *Leaves* ± narrow-ovate to ovate-oblong, rarely ovate-lanceolate, long-obtuse-acuminate, broadly cuneate to rounded at the base, membranous to thinly chartaceous (pinkish or light cinnamon-brown when young in a fresh state), glabrous, shining above, mostly dull beneath, subserrate-crenate, (5–)7–10(–11) ny (2–)3–4(–$5^{1}/_{2}$) cm; petiole puberulous or glabrescent, 6–8 mm. *Racemes* axillary, subcorymbose, glabrous, few-flowered, the ♂ $1^{1}/_{2}$–3, the ♀ 1–$1^{1}/_{2}$ cm long. *Flowers* fragrant of honey, before or with the young foliage. Pedicels very slender, $^{1}/_{2}$–1(–$1^{1}/_{2}$) cm. *Sepals* 4(–5), ovate, obtuse, greenish, ± pubescent on both sides, 2 mm. Disk fleshy, entire or slightly lobed, white or yellow (orange). ♂ *Flowers:* filaments glabrous. ♀ *Flowers:* Ovary first flask-shaped, soon subglobular, with 4–6 styles connate into a distinct, 1 mm high column, not or slightly free at their apices, each bearing a ± dilatate, bilobed, recurved stigma. *Fruit* subglobose, $1^{1}/_{2}$–$2^{1}/_{2}$ cm diam., dull-brownish red or purple, then blackish, with greenish-yellow pulp, enclosing 4–5(–10) flat seeds, tipped with the single, short style-column with 4–6 minute stigma-points.

Distr. Cultivated around villages throughout tropical countries, specially in E. Africa, India, SE. Asia, in *Malaysia* in the Malay Peninsula (Penang, Kedah, Perlis, Trengganu, Kelantan, Perak), occasionally in Sumatra, E. Java, Borneo, P. Kangean, and Luzon.

Not known in wild state, but possibly originated in India (E. Bengal – Assam – Upper Burma). LOUREIRO based *Stigmarota jangomas* on a specimen cultivated in Cochin-China. Already mentioned as cultivated in Bombay by GARCIA DEL HUERTO, Hist. Arom. lib. 2 cap. 5 (1563) 185; he calls the plant *Jamgomas* or *Jangomas*, modifications of the Bombay native name *Jangama*.

Ecol. Cultivated in lowland countries up to 600 m as a fruit tree. *Fl.* March–Oct.

Uses. Fruit with firm, fairly juicy flesh, rather tart when fresh, but making a good marmelade. Leaves and roots, prescribed for diarrhoea, contain tannin. Wood hard, red or orange-red in colour, brittle, capable of receiving a good polish.

Vern. *Indian plum*, E, *kĕrukup*, Palembang, *situ*, Atjeh, *rukĕm*, J. Malay Peninsula: Greater *k(ĕ)rekup* or *kĕlukub*, *k. bakon*, *kurkup*, *okum*, *akar pulasan*, *a. tĕmbĕrak*. Borneo: *katong*, Bajan, *lahu kakang*, Dusun.

5. Flacourtia rukam ZOLL. & MOR. in MOR. Syst. Verz. (1846) 33; MIQ. Pl. Jungh. (1855) 400; CLOS, Ann. Sc. Nat. IV, 8 (1857) 216; MIQ. Fl. Ind. Bat. 1, 2 (1859) 104; HOOK. *f.* & TH. Fl. Br. Ind. 1 (1872) 192; F.-VILL. Nov. App. (1880) 112; BISSCHOP GREVELINK, Pl. Ned. Ind. (1883) 302; VID. Phan. Cuming. Philip. (1885) 94; Rev. Pl. Vasc. Filip. (1886) 49; KING, J. As. Soc. Beng. 59, ii (1890) 117; KOORD. & VAL. Bijdr. Booms. Java 5 (1900) 22; K. SCHUM. & LAUT. Fl. Deut. Schutzgeb. Südsee (1901) 454; RIDL. Agric. Bull. Str. Fed. Mal. St. 5 (1906) 199; VAL. Bull. Dép. Agric. Ind. Néerl. 10 (1907) 34; BACK. Fl. Bat. 1 (1907) 67; Voorl. Schoolfl. Java (1908) 15; GAGNEP. in MOROT, J. de Bot. 21 (1908) 172; Fl. Gén. I.C. 1 (1909) 234; BACK. Schoolfl. Java (1911) 71; KOORD. Exk. Fl. Java 2 (1912) 634; Atlas Baumarten 2 (1914) t. 336; MERR. Philip. J. Sc. 11 (1916) Bot. 97; GILG, Bot. Jahrb. 55 (1918) 282; SLOOT. Bijdr. Flac. (1919) 119; MERR. En. Born. Pl. (1921) 412; BROWN, Min. Prod. Philip. For. 2 (1921) 348, f. 68; RIDL. Fl. Mal. Pen. 1 (1922) 157; KOORD. Fl. Tjibodas 2 (1923) 192; MERR. En. Philip. 3 (1923) 113; SLOOT. Nova Guinea 14 (1924) 191; Bull. Jard. Bot. Btzg III, 7 (1925) 365; DOCTERS V. LEEUWEN, Zoocec. Ned. Ind. (1926) 394; MERR. Philip. J. Sc. 29 (1926) 401; HEYNE, Nutt. Pl. (1927) 1140; GIMLETTE & BURK. Gard. Bull. Str. S. 6 (1930) 366; BURK. & HANIFF, *ibid.* 173; OCHSE & BAKH. V. D. BR. Ind. Groenten (1931) 293, f. 187; Vruchten & Vruchtenteelt (1931) 49, pl. 19; FISCHER, Kew Bull. (1932) 176; BURK. Dict. (1935) 1024; CORNER, Wayside Trees (1940) 307, f. 99, 100; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 84, p. 8; BROWN, Useful Pl. Philip. 2 (1950) 504, f. 236; QUIS. Med. Pl. Philip. (1951) 627.—*F. rukam var. domestica* & *var. erythrocarpa* RIDL. Fl. Mal. Pen. 1 (1922) 158.—*F. rukam var. myriantha* MERR. Philip. J. Sc. 30 (1926) 411.—*F. cataphracta* (*non* ROXB.) BL. Bijdr. (1825) 55.—*F. edulis* GRIFF. Not. 4 (1854) 612.—*Hisingera grandifolia* TURCZ. Bull. Soc. Nat. Moscou 27 (1854) 332; *ibid.* 36 (1863) 554, *in obs.*—*F. inermis* (*non* ROXB.) MERR. Philip. J. Sc. 1 (1906) Suppl. 99.—*F. euphlebia* MERR. *ibid.* 9 (1914) 324; BROWN, Minor Prod. Philip. For. 2 (1921) 346; MERR. En. Philip. 3 (1923) 112; BROWN, Useful Pl. Philip. 2 (1950) 502.—*F. sulcata* ELM. Leafl. Philip. Bot. 7 (1915) 2653.—*F. megaphylla* RIDL. J. Bot. 74 (1936) 223.—*F. peninsula* ELM. Leafl. Philip. Bot. 10 (1939) 3808.—**Fig. 31–33.**

Small tree, 5–15(–20) m; trunk and old branches usually crooked, gnarled and furrowed, branched near the base; when young with strong woody simple or branched thorns, up to 10 cm, on trunk and branches, but occasionally (cultivated forms) thornless, specially when old; bark brown to greyish, smooth, not flaky; ultimate branchlets shortly (hispid-)pilose, with numerous warty, rounded or broad-elliptic lenticels. *Leaves* ovate-oblong or elliptic to oblong-lanceolate, gradually tapered to the long, obtuse tip, rather broadly cuneate to rounded at the base, mostly puberulous at both sides on midrib and nerves, or entirely glabrous, mostly shining above, or dull on both sides, mature ones dark green above, pale green below, young ones shining rose-red or brown, flaccid, drooping, always brown when dry, bitter, rather coarsely toothed, ($6^{1}/_{2}$–)10–15(–18) by (3–)4–7(–9) cm; midrib and nerves little prominent, but sometimes markedly impressed above, prominent beneath, nerves 5–7(–8–10–12) pairs, curved-ascending, little or distinctly anastomosing, veins ± transverse and distinct, reticulations rather

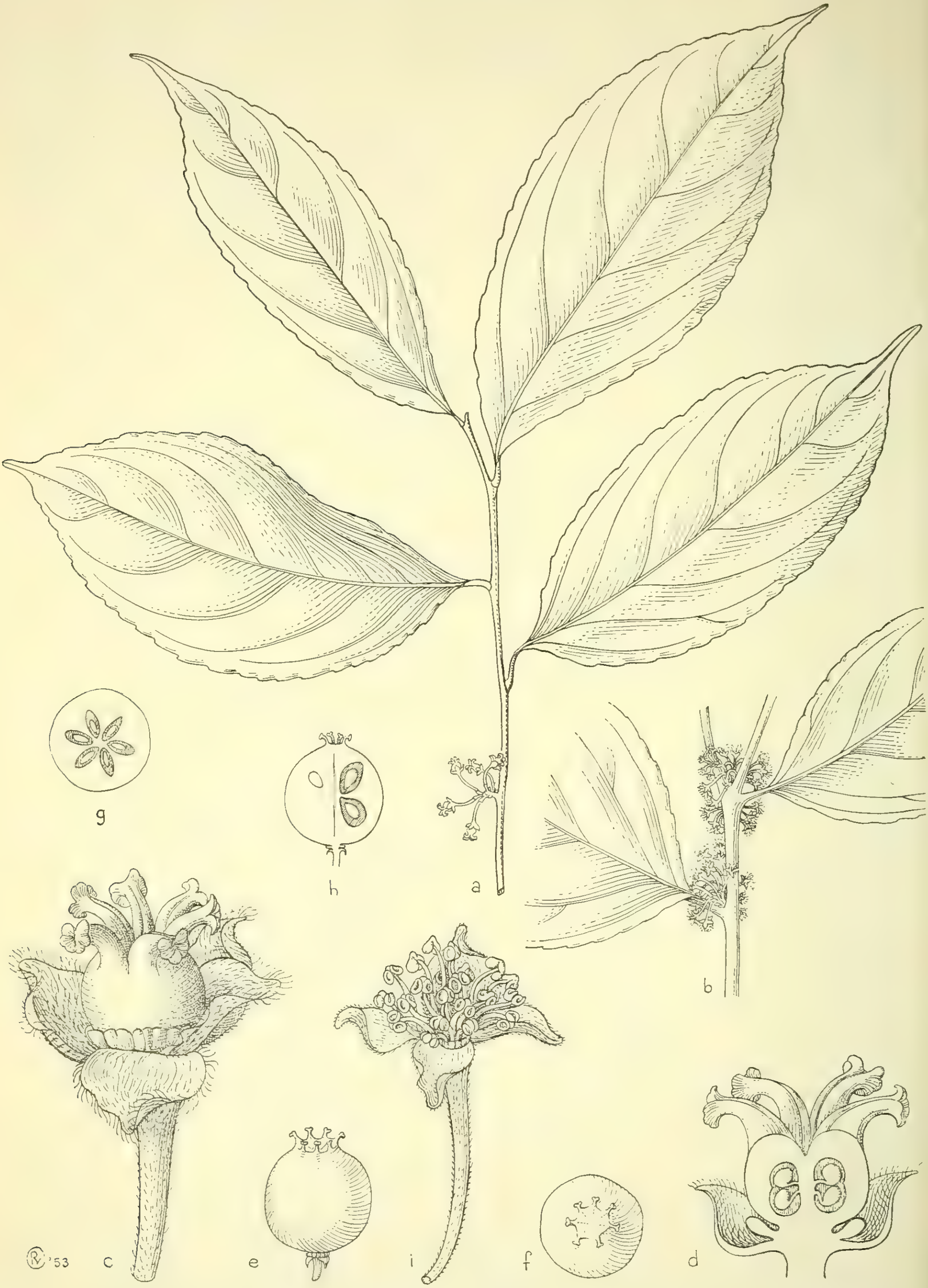

Fig. 31. *Flacourtia rukam* Z. & M. *a.* Twig with ♀ flowers, × $^2/_3$, *b.* part of twig with ♂ inflorescences, × $^2/_3$, *c.* ♀ flower, × $7^1/_2$, *d.* ♀ flower, longitudinal section, × $7^1/_2$, *e.* fruit, × $^2/_3$, *f.* fruit, seen from top, × $^2/_3$, *g.* fruit, cross-section, × $^2/_3$, *h.* fruit, longitudinal section, × $^2/_3$, *i.* ♂ flower, × $7^1/_2$ (*a*, *c–d* after BECCARI 671, *b*, *i* after BUWALDA 6974).

dense and mostly somewhat elevated; petiole 5–8 mm, glabrous or mostly subferrugineous-puberulous. *Flowers* greenish-yellow, scentless, in few-flowered, short, axillary, finely pubescent racemes. Bracts oblong-ovate, 1 mm. Pedicels 3–4 mm. *Sepals* (3–)4(–6), ovate-acuminate, 2 mm diam., laxly pubescent on both surfaces. ♂ *Flowers:* disk-lobes 8, fleshy, orange to yellow-white; stamens numerous; filaments glabrous 3–4 mm; anthers very small, yellow. ♀ *Flowers:* stamens mostly none, but sometimes present, then mostly reduced in size (staminodes), very rarely normally developed. *Ovary* flask-shaped, with 4–6(–8) free, suberect styles with a small, indistinctly bilobed stigma. *Fruit* globose to depressed-globose or a little obovate, 2–2½ cm diam., 4–7-sulcate or -angular when dry, 5–8 mm peduncled, light-green to pink or purplish-green to dark-red, with whitish pulp, crowned by the 4–6(–8), small, peg-like spaced styles set in a circle.

Distr. Widely distributed but scattered, both cultivated and wild all over *Malaysia*, apparently rare in the Moluccas and New Guinea, also introduced (?) in Samoa. Neither native in Indo-China nor in Siam or Hainan, as accepted by various authors.

Ecol. Evergreen, primary or secondary forest, also in teak-forests, often along rivers, from the lowland up to *c.* 2100 m in a wild state. *Fl.* June–August, *fr.* Sept.–Nov.

Uses. Cultivated for its edible fruits, good for making jams and pies. The fruit is rather variable in shape, size, and colour. The ripe fruit from cultivated specimens is acid and adstringent, but rubbing it between the hands bruises the flesh and causes a chemical change to take place, which renders it sweet and palatable. Wild forms have smaller, very sour and bitterly tasting fruits. Propagated by root-suckers which are abundantly produced.

In the Philippines the roots are medicinal, and their decoction is given internally to women after childbirth. The adstringent juice of the young fruit is given for diarrhoea and dysentery, also for dysmenorrhoea. The juice of the leaves is applied to inflamed eye-lids.

The wood is very hard, occasionally (Philippines) made into pestles or shafts.

Vern. *Rukĕm, rukam, r. gajah, rasak manggis, kaju piu*, M, *piu tangulan*, Asahan, *mĕdang munungan*, Palemb., *tĕnonosih*, Mentawei, *tonggolen*, Karo-Batak, *tangkulung*, Mentawei, *kupa landak, rukĕm*, S, *(ganda) rukĕm, saradan, djĕnggatan*, J, *landak*, Md, *klang tatah kutang*, Borneo. Philippines: *Salabagin, agasas, banauo*, C. Bis., *amaiit, bitóñgol*, Tag., *kalamasáti, lalamasali*, Sbl., *kalominga, kaluñga*, Ig., *obieng*, Ilk., *lanagon*, Buk., *tangkanyan*, Ina, *balalauan, nuginagin*, Bag., *nanagan*, Sub., *oropag*, Mbo.

Note. The species varies much both in the amount of pubescence and in the shape and size of its leaves. I consider neither the big-leaved forms described as *F. megaphylla* and *F. euphlebia* nor the narrow-leafed forms (*F. peninsula*) to represent distinct species. Sometimes dried material shows strongly impressed nerves (*F. sulcata*), which I suppose due to quick drying of rather young, not yet fully developed leaves.

6. Flacourtia kinabaluensis SLEUM. Blumea 7 (1954) 493.

Slender tree or shrub, 5–6 m, recumbent; young twigs copper-red, glabrous, dull or shining, specially towards the tips covered with varnish. *Leaves* ± tapering into an elongate obtuse acumen, sometimes nearly caudate, rounded at the base, coriaceous, glabrous, shining on both sides; midrib prominent, the two lower pairs of the nerves rising from or nearly from the base, but curved-ascending as are the superior ones and equally prominent on both sides. *Flowers* in axillary, very short, few-flowered racemes, mostly reduced to 2–3-flowered fascicles on tubercled nodes. Pedicels laxly pilose, 4–5 mm. *Sepals* 4(–5) ovate, obtuse, laxly pilose outside, rather densely so inside, 2 mm. ♂ *Flowers* cream. Stamens *c.* 15; filaments glabrous 2 mm. Disk-lobes 8, free, fleshy, truncate. ♀ *Flowers* not seen; developed ovary surrounded at the base by 4 sepals similar to those of the ♂ flowers, globose,

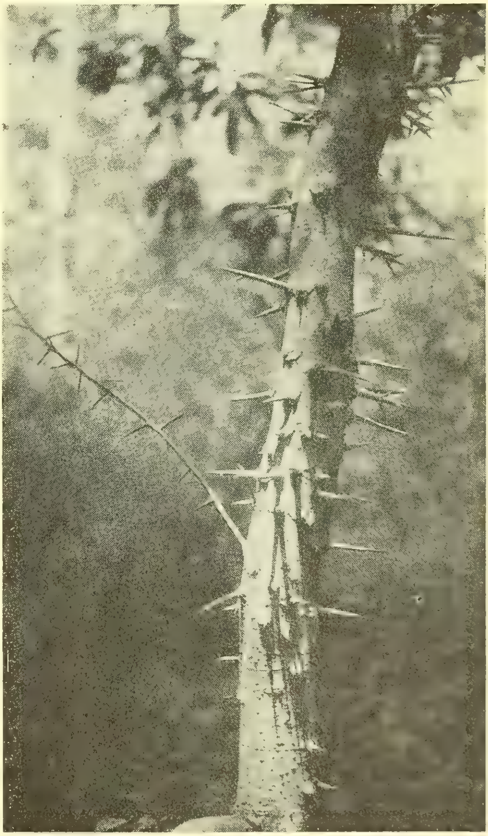

Fig. 32. Spiny stem of *Flacourtia rukam* Z. & M. Rawah Bodjong, W. Java (VAN STEENIS, Oct. 1941

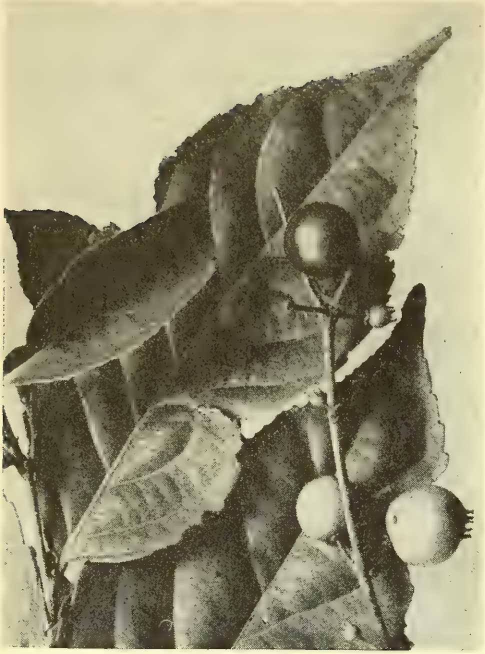

Fig. 33. *Flacourtia rukam* Z. & M. Leaves and fruits, × 4/5 (C.H.B. IV–F–115).

with 4(–5), central, 1 mm long styles, radiating and reflexed from the apex. *Fruit* subglobose, 6–8 mm diam., red, with 6–8 flat seeds, each 4 mm diam.

Distr. *Malaysia:* Br. N. Borneo (Kinabalu: Penibukan).

Ecol. Jungle ridge, 1300–1650 m.

7. Flacourtia indica (Burm. *f.*) Merr. Interpr. Rumph. Herb. Amb. (1917) 377; Sp. Blanc. (1918) 274; Philip. J. Sc. 19 (1921) 367; Brown, Min. Prod. Philip. For. 2 (1921) 348, f. 69; Merr. En. Philip. 3 (1923) 112; Hall. *f.* Beih. Bot. Centralbl. 39, ii (1923) 161; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 368; Merr. J. Arn. Arb. 6 (1925) 137; Heyne, Nutt. Pl. (1927) 1140; Merr. & Chun, Sunyatsenia 1 (1930) 73; Back. Onkruidfl. Jav. Suiker. (1930) 455; Burk. Dict. (1935) 1022; Merr. Comm. Lour. (1935) 274; J. Arn. Arb. 19 (1938) 356; Back. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 84, p. 7; Masam. Fl. Kainant. (1943) 214; Brown, Useful Pl. Philip. 2 (1950) 502, f. 234; Quis. Med. Pl. Philip. (1951) 626.—*Spina spinarum I mas* Rumph. Herb. Amb. Auct. (1755) 36, t. 19, f. 1–2.—*Spina spinarum II femina* Rumph. *l.c.* 37.—*Gmelina indica* Burm. *f.* Fl. Ind. (1768) 132, t. 39, f. 5; Houtt. Nat. Hist. II, 3 (1774) 122.—*Gmelina javanica* Christm. Pflanzensyst. 2 (1777) 134.—*F. ramontchi* Hérit. Stirp. Nov. 3 (1785) 59, t. 30, 30 B; F.-Vill. Nov. App. (1880) 12; Koord. & Val. Bijdr. Booms. 5 (1900) 19; Back. Fl. Bat. (1907) 66; Voorl. Schoolfl. Java (1908) 15; Schoolfl. Java (1911) 71; Koord. Exk. Fl. Java 2 (1912) 634; Hall. *f.* Med. Rijksherb. *no* 12 (1912) 25; Koord. Atlas Baumarten (1914) t. 333; Sloot. Bijdr. Flac. (1919) 123; Brown, Useful Pl. Philip. 2 (1950) 504, f. 235; Meijer Drees, Comm. For. Res. Inst. 33 (1951) 59.—*Stigmarota africana* Lour. Fl. Cochinch. 2 (1790) 634.— *F. sepiaria* Roxb. Pl. Corom. 1 (1796) 48, t. 68; Fl. Ind. ed. Carey 3 (1832) 835; Miq. Fl. Ind. Bat. 1, 2 (1859) 104; Hook *f.* & Th. Fl. Br. Ind. 1 (1872) 194; Kurz, For. Fl. Br. Burma 1 (1877) 75; F.-Vill. Nov. App. (1880) 12; Vid. Sin. Atl. (1883) 13, t. 7, f. c; Rev. Pl. Vasc. Filip. (1886) 49; Gagnep. in Morot, J. de Bot. 21 (1908) 172; Fl. Gén. I.C. 1 (1909) 236; Merr. Fl. Manila (1912) 334; Ridl. Fl. Mal. Pen. 1 (1922) 158; Craib, Fl. Siam. En. 1 (1925) 94; Gagnep. Fl. Gén. I.C. Suppl. (1939) 212.—*F. sepiaria var. frondosa & var. leucophloea* Clos, Ann. Sc. Nat. IV, 8 (1857) 217.— *F. sapida* Roxb. Pl. Corom. 1 (1795) 49, t. 69; Bl. Bijdr. (1825) 55; Roxb. Fl. Ind. ed. Carey 3 (1832) 835; Miq. Fl. Ind. Bat. 1, 2 (1859) 104; Kurz, For. Fl. Br. Burma 1 (1877) 75.—*Sideroxylon spinosum* Willd. Sp. Pl. 1 (1797) 1091.—*Rhamnopsis sepiaria* Rchb. Consp. (1828) 188.—*F. obcordata* Roxb. Fl. Ind. ed. Carey 3 (1832) 835.—*F. rotundifolia* Roxb. *l.c.* 173, *nomen.*—*Myroxylon decline* Blanco, Fl. Filip. (1837) 813.—*Stigmarota edulis* Blanco, Fl. Filip. ed. 2 (1845) 560; *op. cit.* ed. 3 (1879) 221.—*F. heterophylla* Turcz. Bull. Soc. Nat. Moscou 27 (1854) 331; *ibid.* 36 (1863) 554.—*Mespilus silvestris* Burm. Ind. Univ. Herb. Amb. (1855) 18, *nec* Burm. *l.c.* 14.—*F. rotundifolia* Clos, Ann. Sc. Nat. IV, 8 (1857) 218; Miq. Fl. Ind. Bat. 1, 2 (1859) 104; Kurz, For. Fl. Br. Burma 1 (1877) 75.—*F. perrottetiana* Clos, *l.c.* 218.—*F. frondosa* Clos, *l.c.* 217.—*F. cataphracta* (*non* Roxb.) Rolfe, J. Bot. 23 (1885) 210; Vid. Rev. Pl. Vasc. Filip. (1886) 49.—*F. balansae* Gagnep. Bull. Soc. Bot. Fr. 55 (1908) 521; Fl. Gén. I.C. 1 (1909) 235, f. 23; *ibid.* Suppl. 1 (1939) 212.—*F. thorelii* Gagnep. Bull. Soc. Bot. Fr. 55 (1908) 522; Fl. Gén. I.C. 1 (1909) 236; Craib, Fl. Siam. En. 1 (1925) 95; Gagnep. Fl. Gén. I.C. Suppl. 1 (1939) 212.—*F. lenis* Craib, Kew Bull. (1916) 259; Fl. Siam. En. 1 (1925) 94; Gagnep. Fl. Gén. I.C. Suppl. 1 (1939) 212.—*F. parvifolia* Merr. Lingn. Sc. J. 6 (1930) 328.—**Fig. 30h–i.**

Deciduous, polymorphous bush or small tree up to 15 m; trunk and big branches set with branched thorns, but older branches often unarmed; younger branches with axillary, simple thorns, decrescent in size apically; bark greyish-buff, rather fissured and flaky; crown bushy, spreading, with many arching branches with drooping ends and set with tufts of erect twigs, these glabrous or pubescent, laxly set with elliptic lenticels when young, soon covered with grey bark. *Leaves* rather small, variable in form, size, texture and indument, mostly narrow and obovate, blunt, cuneate to the base, coarsely and ± regularly crenate specially towards the apex and set in clusters on the branches of the previous year, others larger, deeply notched and elliptic to heartshaped, spaced along the vigorous young shoots and mostly with thorns in their axils, membranous to coriaceous, glabrous to softly tomentose on both sides, rose-red when young, 2–4(–7–8½) by 1½–3(–4–5) cm; (red) midrib and 4–6 pairs of nerves little prominent on both sides, reticulations slight, mostly distinct; petiole red, mostly slender and puberulous, 3–5(–11) mm. *Racemes* short, puberulous, few-flowered, axillary or terminating short, lateral, 3–4-leaved twigs (these sometimes reduced to very short leafless shoots bearing several lanceolate bracts at their base, or transformed into woody thorns). Pedicels puberulous, 3–5(–7) mm. *Sepals* (4–)5–6(–7), ovate, obtuse, mostly nearly glabrous on their back, ± densely hairy at the margin and inside, 1½ mm. ♂ *Flowers:* disk slightly lobulate or crenate. Filaments 2–2½ mm, hairy only at the base. ♀ *Flowers:* disk entire or nearly so. *Ovary* globular, somewhat attenuate at the apex, with 5–6(–7), radiate, thickly, terete, 1 mm long styles each with a slightly bilobed stigma, not or little connate at the base. *Fruit* rather small, globose to ellipsoid, solitary or in small clusters on the short lateral, leafy twigs, *c.* 0.8–1(–1.3) cm diam., ripening dull to blackish red, rather translucent, with 5–6(–7), short styles radiating from a ± short, rather thickened common stalk-like basis. *Seeds* 5–8.

Distr. Widespread and cultivated in tropical and subtropical countries in Africa, India, SE. Asia, and Polynesia, in *Malaysia* in the Malay Peninsula (up to date only known from Kedah and Perlis), frequent in Java, Madura and Luzon, apparently scattered or rare in Banka, Bali, S. Celebes, Timor (Leti Isl.) and Mindoro. No material seen from Sumatra.

Ecol. From the plains near the sea up to 700 m, in mixed forests, teak-forests, brushwood, forest-borders, thickets, along riversides, but mostly in seasonally dry, open, barren places, on limestone, clayey, or sandy soil. *Fl. fr.* Jan.–Dec.

Uses. Frequently cultivated in villages for the edible, but rather adstringent fruit; also medicinal as adstringent. Wood hard, but not used being too small.

Vern. *Madagascar plum, Mauritius plum*, E, *lesser krĕkup*, Mal. Pen., *duri rukam, daun lalambaran*, S, *bogo, baga, rukĕm, rir, ri sisir, saradan*, J, *kĕm*, Bali. Philippines: *bitángol*, Sbl., *bitóngol, bolóng*, Tag., *palútan*, Ibn., *serali, saua-saua*, Bis.

Notes. *F. indica* is accepted here in a wide sense, including *F. ramontchi* HÉRIT. and *F. sepiaria* ROXB., both treated as separate species up to 1917, when MERRILL united them under the name *F. indica*. COOKE (Fl. Bombay 1901, 55) and after him BLATTER (J. Bomb. Nat. Hist. Soc. 31, 1927, 912) and RAIZADA (Ind. For. 79, 1953, 503) insist to distinguish these species as follows:

F. ramontchi: thorns not bearing flowers and fruits.

F. sepiaria: thorns (RAIZADA: usually) with flowers and fruits.

This distinction does not hold, as the small-leaved, deciduous forms usually designed as *F. sepiaria* can bear the inflorescences in the axils of the leaves, at the very base of the thorns, or on the thorns themselves. After having seen a rather large assemblage of Indian and Malaysian material of the so-called *F. sepiaria*, I feel that 'inflorescences on the thorns' are rather an exception than the rule; moreover, thorns (*i.e.* reduced lateral twigs) are not always represented. I cannot find any constant character neither in leaves nor flowers or fruits, which would allow to segregate two species in the *F. indica*-complex, and I am certain that the greater part of the African '*ramontchi*' should also be included in *F. indica.*

It seems that *F. indica* (*F. sepiaria*) prefers rather dry, open places, thickets or scrub-forest, whilst *F. ramontchi* seems to be more frequently attached to evergreen respectively rain-forest-vegetation, but also this may not hold, as RAIZADA states, that *F. ramontchi* occurs 'in Burma in indaing and in dry forests'.

The sterile type-specimen of BURMAN's *Gmelina indica* conserved at Geneva agrees in leaf-characters with *F. sepiaria*. The type material of *F. sepiaria* ROXB. in the Brit. Museum consists of 2 specimens, one of them with thorns and the inflorescence at the base of them, the other without thorns.

Excluded

Flacourtia campbelliana ROXB. Hort. Beng. (1814) 73, *nom. nud.*; VOIGT, Hort. Suburb. Calc. (1845) 84, *nom. nud.*? Sumatra.

Flacourtia camptoceras MIQ. Fl. Ind. Bat. Suppl. (1860) 388.—*Roucheria griffithiana* PLANCH. *cf.* BOERL. Ic. Bog. 1 (1897) 25, t. 7 = *Indorouchera sp.*, *cf.* HALL. *f.* Med. Rijksherb. *no* 35 (1918) 16; Beih. Bot. Centralbl. 39, ii (1923) 50 (*Linaceae*).

Flacourtia magallanensis ELM. Leafl. Philip. Bot. 4 (1912) 1519 = *Worcesterianthus magallanensis* (ELM.) MERR. Philip. J. Sc. 10 (1915) Bot. 270; En. Philip. 2 (1923) 117 (*prob. Icacinaceae*).

17. OSMELIA

THWAITES, En. Pl. Zeyl. (1858) 20.—*Stachycrater* TURCZ. Bull. Soc. Nat. Moscou 31 (1858) 464.—**Fig. 35a–g.**

Dioecious trees. *Leaves* spiral, mostly seemingly distichous, ovate to oblong-lanceolate, mostly entire and abruptly acuminate, triplinerved from the base, penninerved above, the veins not rarely ± cancellate. Stipules mostly minute, linear, caducous, rarely leafy and subpersistent. *Flowers* small, almost sessile, numerous, in long, terminal or axillary, simple or mostly panicled, ± interrupted, drooping, spike-like racemes, surrounded at the base by a persistent cup formed by a bract and 2 bracteoles. *Calyx*-tube very short, with 4(–5), distinctly imbricate lobes (sepals). Petals 0. ♂ *Flowers:* stamens 8(–10), ± exserted, 4(–5) distinctly alternating with the sepals, the other 4(–5) episepalous and inserted at the inner base of the staminodes; anthers minute, ovate-globose, dorsifix. Staminodes episepalous, scale-like, ± flattened, deeply bifid, hairy. Rudiment of the ovary villous, with 3 short styles. ♀ *Flowers:* similar to the ♂ flowers, but stamens only half the size of the normal ones, not exserted, the anthers without pollen. *Ovary* ovoid or oblong, sessile, densely hairy, with 3 few-ovuled placentas. Styles 3, short, curved, glabrous; stigmas capitellate or mostly reniform-applanate, ± distinctly bilobed. *Capsule* 1 mm pedicelled, subglobose to oblong-trigonous, tomentose, 3-valved, with 1–3(–4) seeds; pericarp subcoriaceous. *Seeds* ellipsoid to subglobose, with a red or yellow, fleshy aril and membranous testa.

Distr. Four *spp.*, 3 of which throughout *Malaysia*, one in Ceylon. Fig. 34.

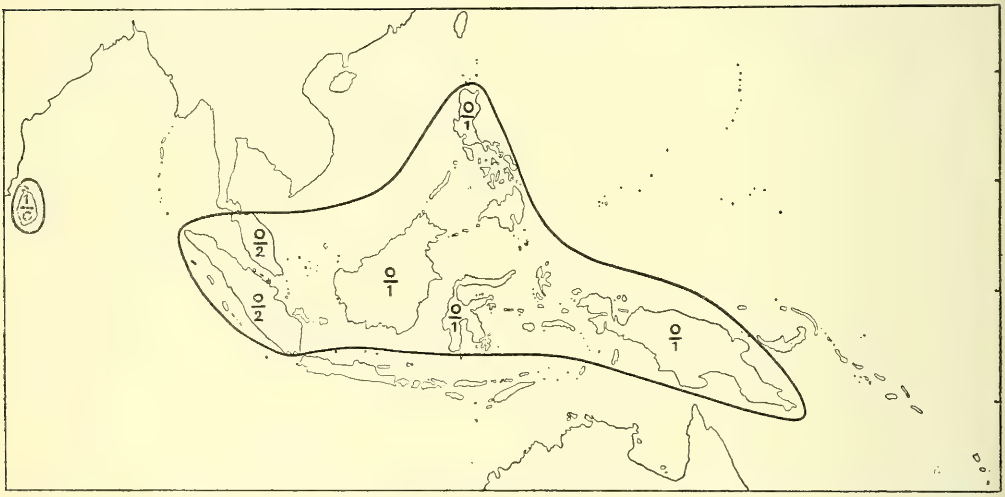

Fig. 34. Distribution of *Osmelia*. The number above the hyphen indicates the number of endemic species in the island, the figure below the hyphen the number of non-endemic species.

KEY TO THE SPECIES

1. Stipules small, mostly linear, early caducous.
   2. Leaves usually olivaceous–tomentose beneath, very rarely ± glabrescent . . . **1. O. maingayi**
   2. Leaves usually glabrous, rarely and apparently not persistently pubescent on midrib and nerves beneath . . . . **2. O. philippina**
1. Stipules ± foliaceous, 2–3, sometimes up to 5 cm long and up to 1½ cm wide, longer persistent. Leaves practically glabrous . . . . **3. O. grandistipulata**

1. Osmelia maingayi KING, J. As. Soc. Beng. 67, ii (1898) 19; SLOOT. Bijdr. Flac. (1919) 138; RIDL. Fl. Mal. Pen. 1 (1922) 834; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 387; BURK. Dict. (1935) 1610.

Tree 6–20 m; branchlets slender, minutely tawny-tomentose. *Leaves* oblong or elliptic-oblong, shortly ± abruptly acuminate, cuneate to subrotundate at the base, membranaceous, entire or obscurely crenulate, light-green, upper surface glabrous except the ± pilose midrib, lower surface ± densely covered with spreading, yellowish or olivaceous hairs especially on nerves and midrib, the latter still pubescent in old elsewhere glabrescent leaves, 10–20(–25) by (4½–)5½–8 cm; nerves (6–)8–10 pairs, ± mostly suberect and rather close to each other, prominent beneath, veins ± transverse, reticulate but little prominent; petiole (0.6–)1–1.8 cm, rather densely ferrugineous-pilose. *Panicles* terminal (mostly the ♂ ones), these usually longer than the leaves, *c.* 7–15 (rarely up to 40) cm, or axillary (mostly the ♀ ones, these shorter than the leaves), all slender and spiciform. Flowers ± spaced, small, yellowish-rose. *Calyx*-lobes nearly rounded, pubescent on the back, 1.2 mm long, in the ♀ flowers somewhat smaller. ♂ *Flowers:* stamens 8 in two rows; staminodes broad, yellowish. ♀ *Flowers:* stamens shorter than calyx-lobes. *Ovary* oblong, 2 mm, densely yellowish-tomentose. *Capsule* oblong, narrowed at the apex and base, manifestly 3-ridged, densely yellowish-tomentose when dry, said to be velvety-red and corrugated when fresh, with silvery tinge, (1.2–) 1.5–2 cm long. *Seeds* ellipsoid, 7–8 mm long.

Distr. S. Siam (Chawng), in *Malaysia:* Malay Peninsula (Kedah, Pahang, Selangor, Negri Sembilan, Malacca, Singapore, apparently frequent in Perak), Sumatra (East Coast, Padang), Br. N. Borneo (Sandakan).

Ecol. In dense forests from the lowland up to *c.* 360 m.

Uses. Wood reddish, durable, heavier than water, used for making chairs and house-posts.

Vern. *Bĕrunai ayĕr*, *mĕdang kĕmantau*, Mal. Pen., *akar laka*, Pahang, *bangas mèrah*, *chindarong bukit*, *rambai burong*, Selangor, *mata kanan*, Sandakan.

Note. As more material is coming in, the variation of both *O. maingayi* and *O. philippina* seems to increase, and it is quite possible that in future they cannot be kept separate.

2. Osmelia philippina (Turcz.) Benth. (*sphalm. philippinensis*) J. Linn. Soc. Bot. 5 (1861) Suppl. 2, 89; F.-Vill. Nov. App. (1880) 93; Vid. Phan. Cuming. (1885) 115; Rev. Pl. Vasc. Filip. (1886) 141; Pulle, Nova Guinea 8 (1911) 672; Gilg, Bot. Jahrb. 55 (1918) 284; Sloot. Bijdr. Flac. (1919) 141; Merr. En. Philip. 3 (1923) 114; Sloot. Nova Guinea 14 (1924) 193; Bull. Jard. Bot. Btzg III, 7 (1925) 391.—*Stachycrater philippinus* Turcz. Bull. Soc. Nat. Moscou 31 (1858) 465.—*O. conferta* Benth. J. Linn. Soc. Bot. 5 (1861) Suppl. 2, 89; Rolfe, J. Bot. 23 (1885) 213; Vid. Phan. Cuming. (1885) 115; Rev. Pl. Vasc. Filip. (1886) 141; Merr. En. Philip. 3 (1923) 113.—*O. celebica* Koord. Minah. (1898) 474, 624; Hall. *f.* Med. Rijksherb. 1 (1910) 3; Sloot. Bijdr. Flac. (1919) 140; Merr. En. Philip. 3 (1923) 113; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 391; Heyne, Nutt. Pl. (1927) 1141.—*Dichapetalum spicatum* Elm. Leafl. Philip. Bot. 1 (1908) 299.—*O. euspicata* Elm. Leafl. Philip. Bot. 7 (1915) 2653.—*O. subrotundifolia* Elm. *l.c.* 2655; Merr. En. Philip. 3 (1923) 114.—*O. borneensis* Merr. Philip. J. Sc. 11 (1916) Bot. 98; Sloot. Bijdr. Flac. (1919) 139; Merr. En. Born. (1921) 412; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 390.—*O. bartlettii* Merr. Philip. J. Sc. 14 (1919) 246; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 388; Bartlett, Pap. Mich. Acad. Sc. Arts & Lett. 6 (1926) 31.—**Fig. 35a–g.**

Shrub or mostly tree 5–8 m; bark yellowish-grey, peeling-off in plates; branches usually pale grey, glabrous except the young slender cinereous-pubescent innovations. *Leaves* oblong to oblong-elliptic, ± abruptly acuminate, base acute to subrotundate, entire or obscurely crenulate, membranous or mostly chartaceous (rarely subcoriaceous), both surfaces quite glabrous, or sometimes the midrib and the nerves minutely appressed-pilose beneath, 7–15(–17) by ($3^1/_2$–)4–7(–10) cm; green to brownish and slightly shining when dry, nerves (4–)5–7(–8) pairs, prominent, curved, anastomosing, rather distant from each other, veins mostly little reticulate; petiole ± pubescent, 0.6–1 cm. Stipules linear or acicular, densely pubescent, 3–4 mm, early caducous. Staminate and pistillate *racemes* in the uppermost axil (seemingly terminal) or sometimes in the lower axils, spike-like, simple or panicled, many-flowered, pubescent by appressed, pale hairs, 10–20(–30) cm. *Flowers* greenish. *Calyx*-lobes membranous, glabrous or minutely pilose outside, *c.* $2^1/_2$ mm. ♂ *Flowers:* stamens 8 (–10); filaments *c.* 3 mm; staminodes 1–$1^1/_2$ mm. ♀ *Flowers:* calyx-lobes 2 mm. *Ovary* oblong-elliptic, densely yellowish-tomentose; ovules 2–4. *Capsule* oblong-subglobose, with 3 rounded angles, attenuate at apex and base, 1–$1^1/_2$ cm long, densely covered with grey to yellowish hairs when dry, said to be purpurascent or rich velvety red when fresh; pedicel *c.* 2 mm. *Seeds* 1–2 (sometimes more), ellipsoid, *c.* 5 mm, with fleshy lemon-yellowish aril.

Distr. *Malaysia:* Sumatra (East Coast Res.), Malay Peninsula (Dindings, Singapore), Borneo, Philippines (Luzon, Mindanao, Mindoro, Catanduanes, Leyte, Samar, Tablas, Panay, Surigao, Bohol, Dinagat, Negros), N. & Central Celebes, Moluccas (Aru Isl.: Kobroör), N. & SE. New Guinea.

Ecol. Primary forests, ascending to 500 m.

Uses. Wood pale or yellowish-white, quite hard, odourless and tasteless, used in N. Celebes for house-construction.

Vern. *Kaju si basaon*, Sumatra, *k. goi*, Asahan, *antjerina*, W. Borneo. Philippines: *bariñgorus*, *maguntáp(a)i*, Bag., *lubí-lubí*, *tagupala*, C. Bis., *bantulinai*, Sul., *gauai-gauai*, *apadgag*, Mbo., *malakamáñga*, *oonog*, Tag., *malatayótes*, S.L.Bis., *sumate*, P. Bis.; *kajuwatu*, Celebes, *madausiep*, Manado, *siwiakuni*, *karonda kuni*, Malili, *kuwa*, Vailala River, *boh*, Sorong.

Notes. Between the specimens of the above mentioned localities there are slight differences in the tomentum, size of the capsule, leaf-texture and number of nerves, which are not constant and not sufficient for specific distinction.

3. Osmelia grandistipulata Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 388, f. 13; Heyne, Nutt. Pl. (1927) 1141.

Tree 10–24 m, buttresses 40–60 cm; branchlets appressed-pilose, soon glabrescent; innovations densely ferrugineous-tomentose. *Leaves* oblong- to ovate-elliptic, abruptly short-acuminate, ± rounded to acute at the base, entire or shallow-crenulate, glabrous or laxly appressed-pilose beneath on midrib and nerves, shining above, dull beneath, brownish when dry, 15–33 by 5–10 cm;

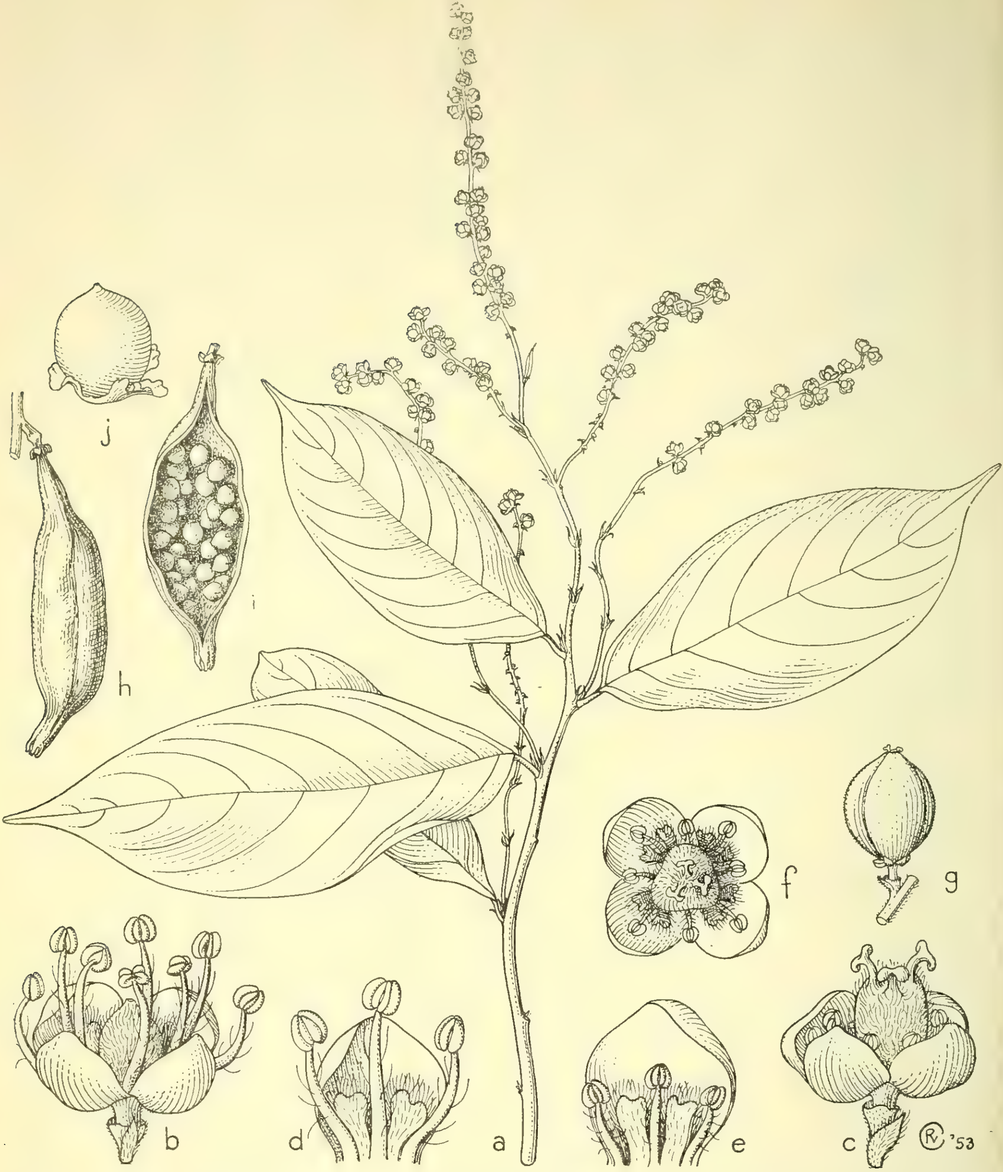

Fig. 35. *Osmelia philippina* (TURCZ.) BTH. *a.* Twig with ♀ flowers, × ²/₃, *b.* ♀ flower, × 7, *c.* ♀ flower, × 7, *d.* ♂ flower in section, × 10, *e.* ♀ flower in section, × 10, *f.* ♀ flower from top, × 7, *g.* fruit, × 1¹/₂.—*Pseudosmelia moluccana* SLEUM. *h.* fruit, × ²/₃, *i.* fruit split lengthwise, showing seeds, × ²/₃, *j.* seed with aril, × 3 (*a, c, e, f* after WENZEL B.S. 1912, *b, d* after KRUKOFF 4003, *g* after RAMOS, B.S. 24536, *h–j* after the type, KOSTERMANS 1045).

petiole ± pilose, 1¹/₂–2 cm. *Panicles* lax, composed of spike-like racemes of spaced flowers; rhachis ± densely dilutely ferrugineous- or grey-tomentose, 15–25 cm. Pedicels *c.* 1 mm. *Calyx*-lobes elliptic, 2 by 1¹/₂ mm, nearly glabrous outside, white to greenish-white. ♂ *Flowers:* stamens 8; filaments of the longer ones *c.* 2.7 mm. ♀ *Flowers:* ovary oblong, densely subferrugineous-tomentose. *Capsule* nearly trigonous when young, later oblong to subglobose, attenuate at the base and the apex, densely subferrugineous-tomentose, green to greyish-purplish when fresh, 0.8–1 by ¹/₂ cm, 1–(rarely 2)-

seeded, very shortly peduncled. *Seed* 6–7 mm long.

Distr. *Malaysia:* Sumatra (Tapanuli, Palembang), Simalur Isl., Lingga Archip.

Ecol. Scattered in mixed forests, at low altitudes, rarely up to 600 m.

Uses. Wood hard, used only for raw posts.

Vern. *Awa saré saré, anang, a. uding, a. pajo, a. ètĕm, a. balah, a. sĕbĕl fulung, sosotmanu balah, tulian balah*, Simalur.

18. PSEUDOSMELIA

SLEUM. Blumea 7 (1954) 494.—**Fig. 35h–j.**

Shrub or treelet, probably dioecious. *Leaves* alternate, ± distichous, penninerved. Stipules subulate, mostly early caducous. *Flowers* arranged in long, slender, axillary or subterminal or cauline, interrupted spikes, surrounded at the base by a persistent cup formed by a bract and 2 bracteoles as in *Osmelia.* Calyx-tube very short, with 4 distinctly imbricate lobes (sepals). ♂ *Flowers* (seen in bud only): stamens apparently 8, 4 of them slightly longer. Staminodes and rudiment of the ovary apparently present. ♀ *Flowers:* stamens 8, reduced as in *Osmelia.* Staminodes 4, episepalous, scale-like, thick-fleshy, subquadrate, irregularly erose at the top, deeply bifid, hairy. *Ovary* nearly cylindrical, sessile, hairy, with 3 many-ovuled placentas. Styles 3, divergent, each bearing a large, bilobed stigma. *Capsule* fusiform, with 3 short, thick styles, each with a sessile, obscurely bilobed stigma, subtended at the base by 4 subpersistent sepals; pericarp coriaceous; peduncle very short. *Seeds* numerous; testa smooth, thin; aril membranous. Endosperm abundant, albuminous-oily; cotyledons flat, cordate.

Distr. Monotypic, *Malaysia* (N. Moluccas).

1. Pseudosmelia moluccana SLEUM. Blumea 7 (1954) 495.—**Fig. 35h–j.**

Shrub or treelet 2½–3 m; branchlets slender, terete, first laxly appressed-pilose, soon glabrous and covered with a thin greyish cork. *Leaves* elliptic-oblong, shortly (1–1½ cm) cuspidate-caudate and falcate at the apex, cuneate at the base, thinly chartaceous, ± olivaceous to brownish and little shining when dry, paler beneath, entire, glabrous the midrib finely pubescent beneath excepted, 10–16 by 4–6½ cm; midrib impressed above, very prominent beneath, nerves 7–8 pairs, curved-ascending (the lowest pair coming from the leaf-base, the upper 3–4 pairs only anastomosing), obscure above, prominent beneath, veins transverse, reticulations little but distinctly prominent on both sides; petiole slender, ± densely appressed-pubescent, 6–10 mm. Stipules subulate, pilose, 3–4 mm, mostly early caducous. ♂ *Flowers* seen only in bud. ♀ *Flowers:* calyx-lobes 4, broadly ovate, cup-shaped, yellow, 2 mm. Stamens not exserted, with minute, cordate, empty anthers on top of cylindrical, rather thick filaments. Staminodes 2 mm. *Ovary* cylindrical, somewhat inflated in the middle, hairy, (beyond anthesis) 7 by 2 mm. Styles 1 mm. *Fruits* 1 or 2, near or on the top of a 15–20 cm long, slender rhachis markedly thickened towards its apex and densely appressed-pubescent. *Capsule* rather narrow-fusiform, somewhat inflated in the middle, green when fresh, ± glabrous, 5–9 by 1¼–2 cm, rather abruptly contracted at both ends, crowned by 3 thick, *c.* 2–3 mm long styles incurved towards each other in the dry state, each with a minute, thick, ± bilobed stigma; pedicel 1–2 by 1–2 mm. *Seeds* 25–30, ± ovoid, 4–5 by *c.* 3 mm, smooth.

Distr. *Malaysia:* N. Moluccas (Morotai, Halmaheira).

Ecol. Apparently common, in forests, 200–800 m, *fl. fr.* May, June, Sept.

Vern. *Mutingut*, Morotai.

19. CASEARIA

JACQ. En. Pl. Carib. (1760) 4.—**Fig. 36–37.**

Shrubs or mostly small trees. *Leaves* alternate, manifestly distichous, entire, crenate or serrate, often pellucid-punctate and/or -striate. Stipules mostly very small and early caducous, sometimes ± persistent, subulate or lanceolate, or reniform and ± amplectant. *Flowers* axillary, bisexual, small, mostly clustered in ± dense-flowered fascicles or glomerules (these sometimes reduced to a solitary flower), or very rarely clustered on top of a short peduncle, the latter naked or densely covered by ± imbricate bracts. Pedicels articulated above their base and surrounded there by many, often scale-like bracts, the latter mostly forming a cushion. *Calyx* semi-perigynous, ± deeply 5-lobed; lobes imbricate, persistent, mostly erect-patent, rarely reflexed at or after anthesis. *Petals* 0. *Stamens* (5–)8–10 (–12); filaments whether or not alternately unequal in length. *Staminodes* same in number as the stamens, usually well developed as clavate or flat appendages, mostly hairy, specially on top, alternating with the stamens (in Mal. *spp.*) and united with them at the base in a ± perigynous tube. *Ovary* free, ovoid to columnar; style 0 or very short; stigma capitate (in Mal. *spp.*). *Ovules* few to many. *Capsule* succulent to coriaceous or hard, globose or ovoid or oblong, 3-angled when fresh, mostly 6-ribbed when dry, (2–)3-valved. *Seeds* few to numerous, ovoid or obovoid, angular by mutual pressure, enveloped by a membranous, usually coloured, soft, fimbriate aril; testa ± crustaceous; albumen fleshy; cotyledons flat.

Distr. About 160 *spp.* in tropical and subtropical America, Africa, Asia, Australia, and the Pacific, in *Malaysia* 60 *spp.*. All Malaysian *spp.* belong to the *sect. Pitumba* (AUBL.) BENTH. wich comprises besides the African, Australian and Pacific species the greater part of the American ones.

Ecol. Mostly in lowland rain-forests, also in mountain forests (mossy scrub), always scattered. A few species are apparently rather indifferent to climate and occur both in the everwet and seasonal forest, *e.g. 28. C. grewiaefolia* VENT. and *22. C. velutina* BL.

Wood anat. DEN BERGER, Bull. Jard. Bot. Btzg III, 9 (1927) 243 (hand lens); MOLL & JANSSONIUS, Mikr. Holzes 3 (1918) 613. See also under family characters.

Uses. The wood of some species is used locally. The bark and fruits of the Javanese species are reported to possess a bitter taste and the fruits are described to be acrid. This seems to hold also for some other species.

Note. As the flowers in *Casearia* are small and the differences in the floral organs are usually minute and often difficult to recognize, and as, moreover, fruits are in many cases unknown, the distinction of the species has been based mainly upon vegetative characters. Lack of sufficient, adequate materials in the herbarium and of field-knowledge make it up till now very difficult to appreciate the amount of variability of these vegetative characters which had to be used in framing the key to the species. I am not wholly convinced that all local-endemic species will stand the test of time.

Many so-called species are known up to date from single collections only and seem to prove a high percentage of endemism. On the other hand, one widely distributed Malaysian species, *C. grewiaefolia* VENT., although varying in the density of the indument and minor leaf-characters, can be recognized; consequently this species possesses an appreciable number of synonyms.

In the descriptions the tufts of hairs found in the axils of the primary nerves at the undersurface in several species are here called *domatia*; apparently they represent a species character.

Almost all species seem to possess pellucid dots in the leaves. However, in some species they are obscured by the thick texture and appear to be absent or very indistinct; in these cases they have been described as 'absent'.

KEY TO THE SPECIES

1. Stipules considerable in size, very conspicuous and at least present at the uppermost 3 or 4 nodes.
2. Stipules reniform, ± amplectant.
3. Leaves lanceolate, attenuate at both ends, subentire, 8–11 by 1.7–2½(–2.8) cm . **1. C. auriculata**
3. Leaves elliptic-oblong to oblong, subcaudate-acuminate at the apex, nearly rounded at the base, obtusely crenate-serrate, 9–15 by 4½–5½ cm . . . . **2. C. amplectens**
2. Stipules subulate to lanceolate, not amplectant.
4. Stipules 3–4 mm wide at the base.
5. Stipules 5–6 mm long. Leaves entire or nearly so, glabrous . . . . . . **3. C. macrantha**
5. Stipules 7–15 mm. Leaves serrate, ± densely soft-brownish-tomentose beneath. **4. C. rhynchophylla**
4. Stipules ½–2 mm wide at the base, (3–)4–8 mm long.
6. Leaves entire or nearly so, *i.e.* very minutely serrulate.
7. Leaves not or very minutely pellucid-punctate. Fruit *c.* 8 mm long . . . **5. C. microcarpa**
7. Leaves distinctly pellucid-punctate and -lineate. Fruit 16–20 mm long.
8. Stipules lanceolate, 2 mm wide at the base. Fruit glabrous . . . . . . **6. C. erythrocarpa**
8. Stipules subulate, ½–1 mm wide at base. Ovary and fruit laxly short-pilose. **7. C. rugulosa**
6. Leaves distinctly subsinuate-dentate or -serrate . . . . **8. C. cuspidata**
1. Stipules minute, to 1½ mm long, or absent at the uppermost 3–4 nodes, very early caducous.

9. Flowers set in a fascicle on top of a distinct, (2–)3–5 mm long peduncle, the latter not covered with bracts . . . . **9. C. pachyphylla**

9. Inflorescence (or solitary flower) not peduncled.

10. Inflorescence represented by one or several distinct, 3–6 mm long axes; these densely covered with bracts and bearing one or few flowers in the axil of the uppermost bracts.

11. Leaves rather deeply ($1^{1}/_{2}$–2 mm) sinuate-serrate or -dentate.

12. Leaves glabrous . . . . **10. C. carrii**

12. Leaves pilose to tomentose underneath . . . . **11. C. clutiaefolia**

11. Leaves entire or at most minutely denticulate.

13. Leaves pilose to tomentose underneath, at least on midrib and nerves.

14. Petioles up to 3 mm . . . . **11. C. clutiaefolia**

14. Petioles 5–10 mm.

15. Leaves shortly pilose on midrib and nerves underneath. Calyx-lobes glabrous outside. **12. C. stapfiana**

15. Leaves ± densely patent-pilose to velvety all over the intervenium. Calyx-lobes ± densely pilose outside.

16. Leaves (12–)15–20(–25) by (5–)7–10(–11) cm. Transverse veins very numerous and dense, prominent on both sides . . . . **13. C. velutinosa**

16. Leaves 5–10(–12) by (2–)3–4 cm. Transverse veins less dense, obscure above. **14. C. lobbiana**

13. Leaves glabrous or practically so.

17. Calyx-lobes entirely glabrous outside.

18. Stamens 8, equal in length. Leaves oblong-lanceolate to oblong-elliptic. **15. C. albicans**

18. Stamens 10, their filaments alternately unequal in length. Leaves ovate-lanceolate. **16. C. papuana**

17. Calyx-lobes ± densely pubescent outside.

19. Flowers sessile or nearly so.

20. Leaves ± distinctly reticulate, 10–20 by $4^{1}/_{2}$–7(–10) cm; petiole 5–7 mm. **3. C. macrantha**

20. Leaves not reticulate, subsessile.

21. Leaves thinly chartaceous, 7–9(–11) by 2–4 cm . . . . **17. C. arfakensis**

21. Leaves chartaceous to subcoriaceous, $9^{1}/_{2}$–14 by ($4^{1}/_{2}$–)5–7(–9) cm. The glabrous form of **11. C. clutiaefolia**

19. Pedicels $1^{1}/_{2}$ mm . . . . **18. C. brunneo-striata**

10. Inflorescence represented by distinct fascicles or glomerules; these sometimes growing out into very short (1–2 mm), divaricate, densely bracteate axes with age, or fascicles reduced to a solitary flower.

22. Bracts rather large (2–4 mm), mostly concealing the pedicels and/or the flowers at base.

23. Bracts membranous, glabrous.

24. Leaves glabrous.

25. Nerves 6–7 pairs. Leaves yellowish when dry . . . . **19. C. rinoreoides**

25. Nerves 9–13 pairs. Leaves brownish when dry.

26. Leaves membranous. Petiole 6–8 mm . . . . **20. C. megalophylla**

26. Leaves chartaceous to subcoriaceous. Petiole up to 3 mm . . . . **11. C. clutiaefolia**

24. Leaves pilose to tomentose beneath . . . . **11. C. clutiaefolia**

23. Bracts ± chartaceous, the outer ones densely appressed-pubescent . . . . **21. C. trivalvis**

22. Bracts small, up to 1 mm, concealing the pedicels only when they are very short.

27. Leaves pilose to tomentose on the intervenium underneath, or pilose on the midrib and nerves only, or pilose in the inner angles of the nerves with the midrib only (domatia).

28. Leaves manifestly and ± sharply serrate or at least serrulate by glands protruding manifestly beyond the leaf-margin . . . . **22. C. velutina**

28. Leaves obtusely crenate or denticulate to entire.

29. Leaves ± distinctly inequilateral (mostly cuneate at one side, rounded at the other at the base).

30. Pedicels 1–2 mm.

31. Leaves softly tomentose all over beneath, or at least on midrib and nerves. Nerves 5–7(–8) pairs, impressed above . . . . **23. C. impressinervia**

31. Leaves hairy only at the inner angles of the nerves with the midrib beneath (domatia). Nerves 8–9(–10) pairs, not or slightly impressed above.

32. Stamens 12. Calyx-lobes glabrous outside or nearly so . . . . **24. C. anisophylla**

32. Stamens 10. Calyx-lobes pubescent outside.

33. Leaves not or very obscurely pellucid-punctate, oblong, (3–)4–6 cm wide. **25. C. hosei**

33. Leaves ± distinctly pellucid-punctate, ovate to ovate-oblong, 5–$7^{1}/_{2}$(–9) cm wide.

34. Leaves shallowly sinuate-dentate, their pellucid dots small. Ovary densely pilose. **26. C. globifera**

34. Leaves entire or obscurely crenate, their pellucid dots and lines conspicuous. Ovary glabrous or slightly pilose at the short style only . . . . . . **27. C. fuliginosa**

30. Pedicels 3–5(–6) mm.

35. Leaves ± glabrous above, pilose to tomentose beneath. Fruit oblong, (3–)4–6 cm long when full-ripe . . . . **28. C. grewiaefolia**
35. Leaves soft-tomentose on both sides. Fruit ± ovoid, ± $2\frac{1}{2}$ cm long. **28a. C. grewiaefolia** *var.* **cinerea**
29. Leaves ± equilateral.
36. Pedicels up to 2 mm, mostly slender.
37. Branchlets grey- to yellowish-velvety at the tips.
38. Leaves with 6–8 pairs of nerves, 5–10(–12) by (2–)3–4 cm; midrib densely pilose above. **14. C. lobbiana**
38. Leaves with 10–12 pairs of nerves, (15–)20–29 by (5–)7–11 cm; midrib glabrous above. **29. C. philippinensis**
37. Branchlets shortly pubescent or hirsutulous or early glabrescent at the tips.
39. Leaves membranous to thinly chartaceous, 7–11(–13) by $3\frac{1}{2}$–$5\frac{1}{2}$ cm.
40. Petioles 8–10 mm . . . . **30. C. elliptifolia**
40. Petioles mostly up to 2, rarely up to 5 mm . . . . **5. C. microcarpa**
39. Leaves chartaceous to subcoriaceous, 15–25(–30) by (5–)6–10(–11) cm.
41. Leaves densely reticulate beneath . . . . **31. C. mindanaensis**
41. Leaves not or obscurely reticulate beneath.
42. Nerves (9–)10–12 pairs . . . . **32. C. phanerophlebia**
42. Nerves *c.* 7 pairs . . . . **33. C. kostermansii**
36. Pedicels at least 3 mm long, mostly longer and rather thick.
43. Fascicles or glomerules few- to many-flowered.
44. Leaves lanceolate or oblong-lanceolate. Pedicels ± 4 mm.
45. Leaves 13–15 by $3\frac{1}{2}$–$4\frac{1}{2}$ cm, pubescent both on the midrib and nerves beneath. **34. C. brassii**
45. Leaves 5–10 by $2\frac{1}{2}$–$3\frac{1}{2}$(–4) cm, very slightly pubescent on the midrib beneath. **35. C. monticola**
44. Leaves elliptic or oblong-elliptic. Pedicels 8–14 mm . . . . **36. C. ripicola**
43. Flowers 1–2 per axil.
46. Leaves ovate-oblong. Pedicels and calyx-lobes ferrugineous-pubescent outside. **37. C. angiensis**
46. Leaves elliptic or subovate-elliptic. Pedicels and calyx-lobes glabrous outside. **38. C. archboldiana**
27. Leaves glabrous beneath.
47. Leaves distinctly prominent-reticulate on both sides.
48. Inflorescences normally on defoliate branchlets.
49. Leaves entire or nearly so.
50. Nerves (10–)12–16 pairs.
51. Petals erect in anthesis . . . . **39. C. pallida**
51. Petals reflexed in anthesis . . . . **46. C. flavovirens**
50. Nerves 7–8 pairs . . . . **43a. C. clarkei** *var.* **kunstleri**
49. Leaves regularly subserrate-dentate . . . . **40. C. yatesii**
48. Inflorescence normally on foliate branchlets.
52. Leaves 24–30(–36) by 8–$11\frac{1}{2}$ cm. Nerves 14–18(–26) pairs . . . . **41. C. gigantifolia**
52. Leaves up to 22 cm long, but mostly shorter. Nerves 4–9(–10, rarely more: *cf. 46. C. flavovirens*) pairs.
53. Calyx-lobes ± densely greyish-puberulous *inside*.
54. Ripe fruit 3–4(–6) cm long.
55. Leaves elliptic-oblong or oblong, $5\frac{1}{2}$–15 by (3–)4–6 cm . . . . **42. C. tuberculata**
55. Leaves narrow-oblong, 15–25 cm long.
56. Fascicles or glomerules few- to many-flowered.
57. Fruit oblong-ellipsoid. Leaves 5–$7\frac{1}{2}$ cm wide . . . . **43. C. clarkei**
57. Fruit ± obovoid. Leaves ± 4 cm wide . . . . **43a. C. clarkei** *var.* **kunstleri**
56. Flowers solitary or rarely in twos . . . . **44. C. macrocarpa**
54. Ripe fruit $1\frac{1}{2}$–2 cm long.
58. Petioles 3–5 mm.
59. Pedicels 2 mm . . . . **45. C. ledermannii**
59. Pedicels 4–5 mm . . . . **35. C. monticola**
58. Petioles 8–10 mm. Pedicels ± 4 mm . . . . **38. C. archboldiana**
53. Calyx-lobes glabrous *inside* or nearly so.
60. Ripe fruit $3\frac{1}{2}$-5(–7, very rarely up to 9) cm long. Pedicels 10–15 mm, very slender. **46. C. flavovirens**
60. Ripe fruit up to $2\frac{1}{2}$ cm long.
61. Flowers solitary or rarely in twos.
62. Nerves 8–9 pairs. Pedicels 8–14 mm . . . . **36. C. ripicola**

62. Nerves 4–5(–6) pairs. Pedicels shorter.
63. Flowers subsessile . . . . **47. C. minutiflora**
63. Flowers 4–5 mm pedicelled . . . . **37. C. angiensis**
61. Fascicles or glomerules few- to many-flowered.
64. Leaves laxly pellucid-lineate, not or obscurely pellucid-punctate.
65. Leaves subcoriaceous, $7^{1}/_{2}$–9 by $2^{1}/_{2}$–3(–4) cm . . . . **48. C. flexula**
65. Leaves coriaceous, (10–)12–18(–20) by ($4^{1}/_{2}$–)5–8(–10) cm . . **49. C. capitellata**
64. Leaves not or minutely pellucid-punctate . . . . **16. C. papuana**
47. Leaves not or obscurely reticulate above, little to distinctly reticulate beneath.
66. Petiole up to 2 mm long.
67. Petiole *c.* 2 mm thick . . . . **50. C. brevipes**
67. Petiole 1 mm thick.
68. Flowers sessile. Leaves lanceolate . . . . **51. C. novo-guineensis**
68. Pedicels $1^{1}/_{2}$–2 mm long.
69. Leaves elliptic to oblong-elliptic . . . . **52. C. brideliifolia**
69. Leaves lanceolate to ovate-lanceolate . . . . **16. C. papuana**
66. Petioles at least 3 mm, mostly longer.
70. Flowers solitary or in twos.
71. Petiole 3–5 mm. Leaves denticulate to nearly entire . . . . . **53. C. euphlebia**
71. Petiole (8–)10–15 mm. Leaves ± manifestly serrate-crenate. A form with the flowers reduced in number of . . . . **28b. C. grewiaefolia** *var.* **deglabrata**
70. Fascicles or glomerules few- to many-flowered.
72. Leaves distinctly serrate or crenate.
73. Leaves manifestly inequilateral, mostly obscurely pellucid-punctate. Pedicels 5–10 mm. **28b. C. grewiaefolia** *var.* **deglabrata**
73. Leaves equilateral or practically so.
74. Leaves broadly cuneate to subtruncate at the base. Pedicels 2–3 mm.
75. Calyx-lobes 5 mm. Leaves distinctly pellucid-punctate . . . . **54. C. oreogenes**
75. Calyx-lobes 3–$3^{1}/_{2}$ mm. Leaves not or minutely pellucid-punctate **55. C. halmaherensis**
74. Leaves narrower, cuneate into the petiole, not or minutely pellucid-punctate. Pedicels $1^{1}/_{2}$–2 mm. Calyx-lobes 2 mm . . . . **16. C. papuana**
72. Leaves entire or nearly so.
76. Leaves manifestly inequilateral.
77. Calyx-lobes pubescent outside. Pedicels 2–4 mm . . . . **56. C. flexicaulis**
77. Calyx-lobes entirely glabrous outside. Pedicels 1 mm . . . . **57. C. glabra**
76. Leaves equilateral or practically so.
78. Pedicels *c.* 4 mm . . . . **58. C. urophylla**
78. Pedicels up to 2 mm.
79. Leaves very manifestly and ± densely pellucid-punctate and -lineate.
80. Stamens 8, of the same length . . . . **59. C. loheri**
80. Stamens 10, the filaments alternately longer and shorter . . . . **60. C. olivacea**
79. Leaves not or very minutely pellucid-punctate or -lineate.
81. Leaves lanceolate . . . . **51. C. novo-guineensis**
81. Leaves oblong-ovate to lanceolate-ovate . . . . **16 . C. papuana**

1. Casearia auriculata SLEUM. Blumea 7 (1954) 486.

Small tree; branchlets terete, greyish, glabrous. *Leaves* rather long, obtusely acuminate at the apex, attenuate at the base, sessile, subcoriaceous, obscurely and minutely pellucid-punctate, dull and blackish when dry, 8–11 by $1^{3}/_{4}$–$2^{1}/_{2}$(–$2^{3}/_{4}$) cm; midrib elevated on both sides, nerves 5–6 pairs not or obscurely impressed above, slightly prominent beneath, veins inconspicuous. Stipules 4–5 by 6–10 mm. *Flowers* 2–3 in each axil, surrounded at their base by numerous, glabrous, ovate, membranous bracts 1–2 mm. Pedicel pubescent, 2 mm. *Calyx* tubular, pubescent outside, pink when fresh, in all 5 mm long; lobes oblong, 1.6 by 1.2 mm, patent or somewhat recurved in anthesis. *Stamens* 10; filaments glabrous, alternately 0.5 and 0.3 mm long. Staminodes very short, pilose. *Ovary* columnar, glabrous, 4 by 1 mm.

Distr. *Malaysia:* NW. New Guinea, once found near Ramoi (Sorong).

2. Casearia amplectens SLEUM. Blumea 7 (1954) 484.

Treelet $1^{1}/_{2}$ m; branchlets rather densely yellowish-pilose, soon glabrescent and covered with grey cork. *Leaves* obtusely acuminate and somewhat falcate at the apex, membranous, brown and dull when dry, distinctly pellucid-punctate and -lineate, pubescent at and near the petiole, the midrib and the nerves beneath, glabrous elsewhere, margin obtusely crenate-serrate, the teeth 1 mm high and 3–6 mm distant, 9–15 by $4^{1}/_{2}$–$5^{1}/_{2}$ cm; midrib prominent on both sides, nerves 6–8 pairs, curved-ascending and excurrent along the leaf-margin, somewhat impressed above, prominent beneath, veins inconspicuous; petiole *c.* 2 mm or shorter in the uppermost leaves. Stipules 4–6 by 6–8 mm. *Flowers* 1–2 per axil, nearly sessile, seen only in a not yet full developed state. Bracts several, membranous, glabrous, 1 mm. *Calyx* tubular, in all ± 3 mm long, somewhat fleshy, fulvous-sericeous outside, glabrous inside; lobes oblong, *c.* 1 mm. *Stamens* 10; filaments glabrous, alternately 0.6 and 0.3 mm, dilatate in the middle. Staminodes rudimentary, pilose. *Ovary* columnar, glabrous, *c.* 3 by 1 mm. *Fruit* fleshy, red, 1½–2 by 1 cm; peduncle 2 mm.

Distr. *Malaysia:* N. New Guinea, once found in rain-forest undergrowth of the Idenburg River, 850 m.

3. Casearia macrantha GILG, Bot. Jahrb. 55 (1918) 290, f. 9.

Shrub 1½–3 m; branchlets applanate; younger parts nigrescent or dark brownish, smooth, glabrous, elsewhere soon covered with cork. *Leaves* ovate-oblong or oblong, rarely oblong-lanceolate, shortly gradually acuminate to the apex, broadly cuneate at the base, coriaceous or nearly so, not or obscurely pellucid-punctate, glabrous, entire or inconspicuously and remotely denticulate, 10–20 by 4½–7(–10) cm; midrib nearly flat above, strongly raised beneath, nerves 6–7 pairs, curved-ascending, little or not prominent above, veins ± transverse, little but visibly prominent on both sides as are the reticulations; petiole glabrous, 5–7 mm. Stipules lanceolate, mostly persistent at the upper nodes, sometimes rather early caducous, leaving distinct scars, 5–6 by 3–4 mm. *Flowers* 1–2, white, sessile on top of a short (3–7 mm), solitary axis, the latter densely covered by numerous bracts over its whole length. Bracts membranous, ovate-acuminate, glabrous, ± 2 mm. *Calyx* in all *c.* 6–7 by 3 mm, 5-lobed in the upper half, tubular in the inferior one, ± densely pilose both in- and outside. *Stamens* 10; filaments glabrous, alternately 2 and 1½ mm long. Staminodes subulate, densely pilose, *c.* 1 mm. *Ovary* narrow-ovoid, pilose, 5–6 mm.

Distr. *Malaysia:* NE. New Guinea (Sepik region, Kani Mts, Sattelberg).

Ecol. In dense mountain-forests, 850–1000 m.

4. Casearia rhynchophylla GILG, J. Arn. Arb. 10 (1929) 81; WHITE, *ibid.* 244.

Shrub 1–2½ m, divaricately branched; young branchlets rather densely pilose, soon glabrescent. *Leaves* oblong or obovate-oblong, 1½ cm, obtusely subcaudate-acuminate at the apex, cuneate at the base, little inequilateral, membranaceous to chartaceous, brown and dull when dry, densely pellucid-punctate and -striate, glabrous above, softly and rather densely pilose to tomentose below specially on the midrib and nerves, regularly sinuate-serrate, teeth sharp, 1–1½ mm high and 4–6 mm distant, (10–)12–17 by (4–)5–7 cm; midrib little prominent above, more distinctly so beneath, nerves 11–13 ascending pairs, red on the lower surface of young leaves, veins inconspicuous above, little elevated underneath. Stipules pubescent, acute, finely serrate. *Flowers* several in each axillary cluster, sessile. Bracts membranous, rather numerous, ciliate at the apex, glabrous elsewhere, 1½ mm. *Calyx* oblong, in all *c.* 2½ mm long, laxly pubescent outside, glabrous inside; lobes free, obtuse, 1 mm. *Stamens* 10; filaments glabrous, alternately ½ respectively 0.3 mm long. Staminodes deltoid, pilose at the apex, 0.3 mm. *Ovary* ovoid, pilose at the apex. *Fruit* fleshy, red, 1½ cm long, crowned by the subpersistent, 1 mm long style; peduncle 1 mm.

Distr. *Malaysia:* SE. New Guinea (Vailala River and Sogeri region).

5. Casearia microcarpa SLEUM. Blumea 7 (1954) 489.

Shrub 2 m, branchlets finely pubescent at the tips only, soon glabrescent and covered with grey cork, terete, striate. *Leaves* elliptic-oblong, shortly (1 cm) subacutely acuminate at the apex, cuneate into the petiole, thinly chartaceous, practically not pellucid-punctate, glabrous except the very finely hairy midrib, brownish and dull when dry, entire or nearly so, *i.e.* minutely and remotely serrate at the young leaves only, (6–)8–12(–13) by 3–5(–6) cm; midrib little elevated above, prominent beneath, nerves 6–8 ascending pairs with more or less distinct intercalar ones, ± impressed above, prominent beneath, veins transverse, obscure above, little conspicuous beneath; petiole slightly pubescent, 2–5 mm. Stipules narrowly triangular, minutely pubescent, *c.* 3–5 mm long, *c.* 1 mm wide at the base, subpersistent, becoming firm and corky withage. *Glomerules* 5–8-flowered. Bracts minute, ½ mm. Pedicels slender, glabrous, ± 2 mm. *Calyx* thin, in all 2 mm long, 5-lobed in the upper ⅔, glabrous. *Stamens* 10; filaments thick-filiform, glabrous or nearly so, alternately ⅘ and ⅗ mm. Staminodes obconical, densely pilose at the apex, ½ mm. *Ovary* ovoid, *c.* 1½ mm, glabrous in the lower part, somewhat pilose upwards, attenuate into a short columnar style. *Fruit* (? mature) subglobose, glabrous except the hairy apex, *c.* 8 mm diam.

Distr. *Malaysia:* N. New Guinea (Geelvink Bay, Sepik District, Augusta River), W. New Guinea (McCluer Gulf), apparently also in S. New Guinea (Uta).

Ecol. At very low altitude.

6. Casearia erythrocarpa SLEUM. Blumea 7 (1954) 488.

Small tree, 8 m; only the tips of the branchlets fulvous-hirsute. *Leaves* elliptic-oblong, 1–1½ cm obtusely subcuspidate-acuminate at the apex, broadly cuneate at the base, membranous, brownish when dry, densely pellucid-punctate and -striate, above sparsely, underneath more densely soft-hairy specially on midrib and nerves, finely distantly denticulate, 12–18 by 5–8 cm; nerves (10–)11–12(–14) pairs, as the midrib nearly flat above, prominent beneath, veins obscure above, little but well visibly raised underneath; petiole rather thick, fulvous-tomentose 1½–2½ mm. Stipules pubescent, mostly 1–2-dentate at each side. *Flowers* only known from rests persistent under the fruit. *Calyx* in all 2½ mm long, 5-lobed in the upper half, hairy outside, glabrous inside. *Stamens* 10; filaments glabrous, filiform, alternately 0.7 and 0.5 mm long. Staminodes elongate-triangular, barbate at the apex, ½ mm. Ovary not seen. *Fruit* oblong, red, with *c.* 8–10 red-coloured seeds.

Distr. *Malaysia:* SE. New Guinea (Fly River), once found.

Ecol. Rain-forest undergrowth, at 80 m.

7. Casearia rugulosa BL. Mus. Bot. 1 (1850) 255; MIQ. Fl. Ind. Bat. 1, 1 (1855) 712; MERR. En. Born. (1921) 413.—*C. minutidens* MERR. Philip. J. Sc. 11 (1916) Bot. 94; En. Born. (1921) 413.—*C. pubescens* MERR. *l.c.* 95, respectively 413.—*C. lobbiana* (*non* TURCZ.) HEINE in FEDDE, Rep. 54 (1951) 242.—*C. hosei* (*non* MERR.) HEINE *l.c.*

Shrub or small tree, 2–5(–10) m; branchlets slender, somewhat angular, rather densely pilose with spreading, ferrugineous, soft hairs. *Leaves* oblong, rarely ovate-oblong, abruptly (1–2 cm) acutely acuminate at the apex, broadly cuneate to subtruncate or rounded at the base, very rarely subcordate, mostly thinly chartaceous, distinctly pellucid-punctate and -lineate, brownish-olivaceous when dry, dull or slightly shining above, somewhat inequilateral, entire, but when younger with rather numerous very minute glandlike teeth, glabrous on the upper surface except the midrib and nerves, the undersurface laxly beset with ± spreading short ferrugineous hairs, more densely so on the midrib and nerves, (6–)7–20 by (3–) $4^{1}/_{2}$–7(–$8^{1}/_{2}$) cm; midrib very little raised above, distinctly prominent beneath, nerves (7–)8–10 pairs, ascending, not rarely slightly impressed above, little prominent beneath, veins inconspicuous above, transverse and more elevated beneath, not reticulate; petiole ± tawny, 3–6 mm. Stipules pubescent. *Flowers* whitish or greenish, but purple at the base when fresh, in many-flowered fascicles, 4–5 flowers developed only at the same time. *Calyx* in all $2^{1}/_{2}$–3 mm long, deeply 5-lobed, densely pubescent outside, glabrous inside. *Stamens* (8–)10; filaments glabrous, alternately 0.8 and 0.6 mm. Staminodes 0.5 mm, pilose. *Ovary* ovoid, rather densely pubescent. *Fruit* oblong-elliptic, $1^{3}/_{4}$–$2^{1}/_{2}$(–$3^{1}/_{2}$) by 1–$1^{1}/_{2}$(–2) cm, sessile or very shortly (up to 2 mm) peduncled, orange or orange-yellow when fresh, laxly shortly pilose. *Seeds* white, embedded in a red pulp.

Distr. *Malaysia:* Borneo.

Ecol. In rain-forest on hilly ground or crests of ridges, 650–1600 m, *fl.* Oct.–Febr., *fr.* Febr.

Vern. *Kundawok*, Sungei.

8. Casearia cuspidata BL. Mus. Bot. 1 (1850) 255; SLOOT. Bijdr. Flac. (1919) 150; Bull. Jard. Bot. Btzg III, 7 (1925) 409 (*excl. syn. C. rugulosa*).—*C. turbinata* BL. *l.c.*—*C. grandifolia* MIQ. Fl. Ind. Bat. 1, 1 (1855) 712; Suppl. 1 (1860) 132.—*C. forbesii* BAK. *f.* J. Bot. 62 (1924) Suppl. 43; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 416.

Shrub or small tree, *c.* 3 m; branchlets terete, glabrous, but somewhat angular and dark-brown velvety at the innovations. *Leaves* oblong or oblong-elliptic, long ($1^{1}/_{2}$–$2^{1}/_{2}$ cm) and sharply acuminate at the apex, rounded or broadly cuneate, rarely subcordate at the base, ± equilateral, subcoriaceous or firmly chartaceous, pellucid-punctate and -striate, dark-brown and dull above when dry, paler beneath, glabrous above, soft yellowish-brownish tomentose over the whole undersurface, more densely so on midrib and nerves, distinctly and rather regularly sinuate-denticulate (teeth ± protracted towards the leaf-apex, ± 1 mm high, 4–6 mm spaced, with a distinct little gland underneath), 15–25(–30) by (5–)7–10(–13) cm; midrib slightly impressed above, very prominent beneath, nerves 7–10(–13) pairs, ascending, flat or somewhat impressed above, prominent beneath, veins slightly reticulate and little prominent specially above; petiole tomentose 4–8(–12) mm. Stipules subulate, first dark brown-velvety, later glabrescent, 5–7 by 1 mm. *Flowers* pale green, several (rarely 1–2 only) from each axil. Bracts ovate, membranous, rather densely pubescent, 2 mm. *Calyx* yellowish-grey-sericeous in- and outside, in all $2^{1}/_{2}$ mm long, deeply 5-lobed. *Stamens* 10 (–12), equal in length; filaments glabrous, 1 mm. Staminodes triangular-obtuse, $^{1}/_{2}$ mm, barbellate at the apex. *Ovary* broadly conical, ± densely pubescent. *Fruit* orange, elliptic, laxly pubescent, ± $2^{1}/_{2}$ by $1^{1}/_{4}$ cm; peduncle *c.* 5 mm.

Distr. *Malaysia:* Sumatra (Mts Singalang and Dempo).

Ecol. Rain-forests, 1300–1700 m.

Note. Not in Tonkin as mentioned by GAGNEPAIN (Fl. Gén. I.C. 2, 1921, 1002, based on BALANSA 3187, which represents an undescribed species).

9. Casearia pachyphylla GILG, Bot. Jahrb. 55 (1918) 288, f. 8.

Tree 15–20 m, with a dense flattened crown; young shoots densely fulvous-tomentose, rather tardily glabrescent; branchlets terete, longitudinally striate, with dilute-brownish cork, densely beset with lenticels. *Leaves* ovate-oblong, the very young ones sometimes ovate-lanceolate, shortly obtusely acuminate at the apex, nearly rounded at the base or broadly cuneate into the petiole, entire, sub-coriaceous, the adult ones still ± fulvous-pilose beneath specially at the midrib and nerves, respectively the angles of the midrib with the nerves, finally entirely glabrous, brown and dull when dry, not or obscurely pellucid-punctate, 7–12 by $2^{1}/_{2}$–5 cm; midrib little prominent above, strongly so beneath, nerves 5–6 suberect pairs nearly flat above, prominent beneath, veins manifestly transverse, veinlets densely and finely reticulate on both sides specially beneath. Inflorescence ferrugineous-pubescent. *Flowers* dull yellowish- or brownish-greenish, disposed in 2–5-flowered fascicles on top of a stoutish short peduncle, not all developed at the same time, thus also solitary flowers occasionally occur on top of the above-mentioned peduncle. Pedicels slender, if well developed 5–7 mm long, surrounded at the base by numerous small bracts. *Calyc* deeply 5-lobed; lobes $2^{1}/_{2}$–3 mm, short-hairy in- and outside. *Stamens* 10; filaments laxly pilose, alternately $1^{1}/_{2}$ and 1.2 mm. Staminodes 1.2 mm, subrectangular, fleshy, hairy specially at the apex. *Ovary* ovoid, manifestly attenuate towards the top, rather densely pubescent; stigma thick-capitate. *Fruit* long-peduncled.

Distr. *Malaysia:* NE. New Guinea (Mts Schrader and Saruwaged).

Ecol. In mossy mountain-forest and hilly ground, 1700–2400 m.

Note. This species is unique among the Malaysian *Casearias* by its peduncled inflorescence, a character otherwise known only in some Brazilian species of the genus.

10. Casearia carrii SLEUM. Blumea 7 (1954) 487.

Shrub 3 m; branchlets somewhat angular, minutely pubescent, soon covered with greyish cork. *Leaves* ovate-oblong, 1–$1^1/_2$ cm, subcaudate-acuminate at the apex, cuneate at the base into the petiole, glabrous or practically so, sub-coriaceous, laxly obscurely pellucid-punctate and -striate, brownish and dull when dry, teeth rather regular (1–$1^1/_2$(–2) mm high, 3–6 mm distant), 7–14(–18) by 4–6(–8) cm; midrib slightly raised above, manifestly so beneath, nerves 5–6 pairs curved upwards, flat above, little prominent beneath, veins transverse, conspicuous only on the undersurface; petiole glabrous, 3–6 mm. *Flowers* whitish, 1–2 sessile on top of a short (*c.* 3 mm long) many-bracteate axis. Bracts ovate, acute, membranous, 2 by $1^1/_2$ mm. *Calyx* nearly cylindrical, in all 4 mm long, 5-lobed in the upper third only and pubescent there in- and outside, ± glabrous elsewhere outside. *Stamens* 10; filaments thick-filiform, glabrous, alternately 1 and 0.7 mm. Staminodes inconspicuous, represented by a few hairs only. *Ovary* elongate-fusiform, 3 by 1 mm, ± densely hairy.

Distr. *Malaysia:* SE. New Guinea (Central Division).

Ecol. In secondary forest, 360–1300 m.

11. Casearia clutiaefolia BL. Mus. Bot. 1 (1850) 255; MIQ. Fl. Ind. Bat. 1, 1 (1855) 711; SCHEFF. Ann. Jard. Bot. Btzg 1 (1876) 24; GILG, Bot. Jahrb. 55 (1918) 284, f. 7; SLOOT. Bijdr. Flac. (1919) 152; Nova Guinea 14 (1924) 193; Bull. Jard. Bot. Btzg III, 7 (1925) 409.—*C. mollis* K. SCHUM. Fl. Kais. Wilh. Land (1889) 50, *non* H.B.K. 1821.

Shrub or small tree 3–10 m; branchlets subangular, first rather densely soft-pubescent with spreading subferrugineous hairs, afterwards glabrous. *Leaves* oblong or elliptic-oblong, or rarely ovate or ovate-elliptic, initially membranous and very conspicuously pellucid-punctate and -striate, but subcoriaceous or at least firmly chartaceous when mature, then laxly pellucid-striate, but little punctate, shortly and mostly bluntly acuminate at the apex, cuneate to nearly rounded at the base, mostly little inequilateral and obscurely serrate or subentire, rarely more conspicuously sinuate-dentate or -serrate, the upper surface mostly greyish and dull when dry, glabrous except the midrib, the whole of the undersurface varying in pubescence from densely yellowish-hairy or -velutinous to nearly glabrous, but with hairs ± persistent on the midrib and nerves beneath, rarely wholly glabrous (then entire), (7–)9–16 (rarely up to 21) by $4^1/_2$–6(–$9^1/_2$, rarely up to 14) cm; midrib little raised above, very prominent beneath, nerves 10–13 pairs, curved-ascending, not or little prominent above, in very young leaves ± impressed, distinctly elevated beneath, veins transverse and little elevated on the undersurface only, the finer reticulations obscure; petiole 2–3 mm, stout (1–2 mm), ± densely pubescent. *Flowers* whitish or yellowish, crowded on top or at the upper part of a short (2–4 mm) axis densely covered by numerous, ovate, obtuse, membranous, subglabrous bracts (± 2 mm diam.), solitary or in fascicles of 2–3. Pedicel ± 1 mm. *Calyx* in all *c.* $3^1/_2$ mm long, 5-lobed in the upper $^1/_2$ to $^2/_3$, pubescent in- and outside. *Stamens* 10; filaments hairy, alternately 0.8 and 0.4 mm long. Staminodes elongate-triangular, 0.3–0.4 mm, densely long-hairy, specially at the apex. *Ovary* narrow-ovoid, 2 by 0.6 mm, laxly hairy; style short and thick. *Fruit* elongate-ovate or elliptic, subtrigonous, orange or yellow, laxly hairy, *c.* $1^1/_2$ cm long, with the 1–2 mm long peduncle mostly on top of a very short axis from which the bracts have mostly disappeared. *Seeds* several; aril bloodred, laciniate.

Distr. *Malaysia:* New Guinea (apparently rather widely distributed), possibly in the Moluccas (Morotai).

Ecol. In rain-forests, mainly at 10–500 m and near the coast, once found at 850 and 1000 m; *fl. fr.* Jan.–Dec.

Note. GILG figures (*l.c.* fig. 7E) a 'female' flower, which apparently is nothing else than a normal flower beyond anthesis with a developed ovary.

12. Casearia stapfiana RIDL. Kew Bull. (1938) 110.

Small tree or shrub; branchlets angular, glabrous, soon covered with a thin greyish cork. *Leaves* ovate or oblong-ovate, shortly gradually obtusely acuminate at the apex, cuneate to rounded (or rarely slightly cordate) at the base, subcoriaceous or firmly chartaceous, brown when dry, somewhat paler beneath, with numerous minute and mostly rather badly visible pellucid dots (no lines), mostly entire or nearly so, the young ones minutely denticulate, (16–)20–28 by (8–)10–14 cm; midrib slightly prominent above, distinctly so beneath; nerves 6–8 ascending pairs excurrent along the leaf-margin, nearly flat above, prominent beneath, veins rather obscure above, prominent-reticulate beneath; petiole stout, 2 mm diam., 5–8 mm long. *Flowers* several on top of short (3–6 mm) nearly quadrangular axes, these densely covered by numerous, small, pubescent, ovate bracts, 3–6 of these axes fascicled or congested in the leaf-axils. Pedicels 1–2 mm, glabrous. *Calyx* in all $2^1/_2$ mm long, deeply 5-lobed. *Stamens* 10; filaments glabrous, alternately 0.6 and 0.3 mm. Staminodes 0.3 mm, barbate. *Ovary* elongate-ovoid, 2 by 1 mm, hairy, with a short thick style. *Fruit* $2^1/_2$–3 by $1^1/_2$ cm, red, many-seeded; peduncle *c.* 2 mm.

Distr. *Malaysia:* Borneo (Sarawak).

Ecol. In forests up to 300 m.

13. Casearia velutinosa Ridl. J. Str. Br. R. As. Soc. *no* 75 (1917) 34; Fl. Mal. Pen. 1 (1922) 831.

Shrub 1–2½ m; branchlets flexuous, dark brownish-rusty-velvety, terete and striate, the older parts light-brown and glabrescent. *Leaves* oblong to ovate-oblong, abruptly (1–2 cm) acutely acuminate at the apex, broadly cuneate to rounded at the base, thinly coriaceous, not or rather obscurely and laxly pellucid-punctate and -striate, glabrous, dark brown and shining above when dry, initially soft-tomentose beneath, but ± glabrescent except the midrib and nerves, regularly minutely denticulate to entire, (12–)15–20(–25) by (5–)7–10(–11) cm; midrib and 10–12 curved-ascending pairs of nerves mostly slightly impressed above, manifestly prominent beneath, veins very densely transverse and parallel to each other, little but distinctly raised on both faces, other finer reticulations rather inconspicuous; petiole stout (± 2 mm), ± tomentose to glabrescent, 5–6 mm. *Flowers* pale-green, on top of short (3–4 mm), many-bracteate axes, several of these in fascicles and divergent from each other. Pedicels ± 1 mm. *Calyx* 2–2½ mm, deeply 5-lobed, rather densely pilose in- and outside. *Stamens* 8, of equal length; filaments glabrous or nearly so, ½ mm. Staminodes very short, densely long-hairy. *Ovary* ovoid, *c.* 1 mm long, laxly hairy. *Fruit* yellow, laxly pilose, *c.* 1.8 by 1 cm; peduncle 2 mm.

Distr. *Malaysia:* Malay Peninsula (Perak, Dindings, Selangor, Trengganu, Kemaman, Johore), perhaps in Br. N. Borneo (Sandakan).

Ecol. On banks of streams in jungle, from low altitude up to 850 m.

Vern. *Miang*, Trengganu.

14. Casearia lobbiana Turcz. Bull. Soc. Nat. Moscou 31 (1858) 463; Clarke, in Hook. *f.* & Th. Fl. Br. Ind. 2 (1879) 594; King, J. As. Soc. Beng. 67, ii (1898) 15; Ridl. Fl. Mal. Pen. 1 (1922) 830; Sloot. Bull. Jard. Bot. Btzg III, 7 (1925) 405; Burk. & Henders. Gard. Bull. Str. Settl. 3 (1925) 378.

Treelet or shrub up to 6 m; young branches slender, the tips densely tawny-velvety. *Leaves* oblong or oblong-lanceolate, 1–1½ cm acutely acuminate at the apex, narrowed to rounded at the base, membranous to thinly chartaceous, densely pellucid-punctate and -striate, the upper surface glabrescent except the midrib and nerves, lower surface ± sparsely soft-pubescent, densely so to velvety on the midrib and nerves beneath, entire, olivaceous or brownish when dry 5–10(–12) by (2–)3–4 cm; midrib and nerves flat above or nearly so, little prominent beneath; nerves 8–10 pairs, rather straight and little curved upwards, veins densely transverse, little raised on both faces; petiole tomentose, 6–8 mm long, *c.* 1 mm thick. *Flowers* pale-greenish, in few-flowered glomerules, these somewhat growing out with age to very short (2 mm) axes, on very short (*c.* ½ mm) pedicels. Bracts minute, ovate-acute, ½ mm, appressed-pubescent. *Calyx* puberulous outside, glabrous inside, in all 1½ mm long, deeply 5-lobed. *Stamens* 10; filaments very shortly pubescent to nearly glabrous, alternately ½ and 0.3 mm. Staminodes ½ mm, villous. *Ovary* ovoid, glabrous, 1 mm. *Fruit* almost sessile, glabrous, nearly globose, orange or yellow when ripe, *c.* 1.2 by 0.8 cm. Seeds with crimson aril.

Distr. Malay Peninsula, (Singapore, Malacca, Selangor, Negri Sembilan, Perak, Penang), Riouw (P. Durian), East Coast of Sumatra.

Ecol. Undershrub in lowland-woods up to 900 m; *fl.* Nov.–March, *fr.* July–Nov.

Vern. *Mĕdang kĕrsai, m. kĕrisi*, Mal. Pen., *kaju pidjor dakka, k. sidabu dakka*, Sumatra.

15. Casearia albicans Wall. *ex* Clarke in Hook. *f.* & Th. Fl. Br. Ind. 2 (1879) 593, *pr. p. quoad* Wallich 7197.3; Ridl. J. Str. Br. R. As. Soc. *no* 75 (1917) 34; Fl. Mal. Pen. 1 (1922) 833.

Shrub or small tree up to 10 m, with spreading branches; branchlets glabrous, somewhat angular. *Leaves* oblong-lanceolate to oblong-elliptic, shortly ± obtusely acuminate at the apex, broadly cuneate into the petiole at the base, little inequilateral, firmly chartaceous to subcoriaceous, glabrous, brownish-olivaceous to darkgreen when dry, very shining on both sides, laxly pellucid-lineate, not or minutely pellucid-punctate, entire or slightly crenate, 9–14(–18, rarely up to 20) by (3–)4–6 (–7, rarely up to 9) cm; midrib somewhat impressed above, very prominent and brownish-reddish beneath, nerves *c.* 8 pairs, arcuate-ascending, flat or slightly impressed above, rather prominent beneath, veins and venules densely reticulated and finely elevated on both faces; petiole ± 8 mm, glabrous. *Flowers* white to pale green, on or near the top of short (3–5 mm), many-bracteate axes, these mostly in fascicles of 2 or 3, rarely solitary. Bracts ovate, acute, membranous, short-pilose towards their apex, ± 2 mm. Pedicel ± 1 mm. *Calyx* thin, in all 2–2½ mm long, deeply 5-lobed. *Stamens* 8, equal in length; filaments glabrous, ½ mm. Staminodes as long as the filaments, barbate. *Ovary* elongate-ovoid, glabrous. *Fruit* oblong, orange when fresh, *c.* 1.2 cm long.

Distr. Malay Peninsula (Penang and Perak).

Ecol. In dense jungle, in Perak on limestone, 150–550 m.

16. Casearia papuana Sleum. Blumea 7 (1954) 491.

Shrub 1–1½ m; branchlets slender, terete, glabrous, the tips dark brown when dry. *Leaves* ovate-lanceolate, gradually acuminate, subfalcate, subacute or blunt at the apex, broadly cuneate into the petiole at the base, rigidly membranaceous to nearly subcoriaceous, not or minutely pellucid-punctate, entire, glabrous, somewhat shining and ± dark or blackish brown when dry, 12–17 by (2½–)3–5 cm; midrib nearly flat above, very prominent beneath, nerves *c.* 7–8 pairs, the inferior 4–5 pairs excurrent along the leaf-margin, the superior ones more distinctly curved and anastomosing, little raised above, more so beneath, veins transverse, venules ± visibly reticulated above, more distinctly so beneath; petiole glabrous, 3–4 (–5) mm. *Flowers* greenish-white, several along and on top of short, thick, mostly solitary axes, these 3–4 mm long and densely set with minute, ovate, scariose bracts. Pedicel 1½ mm. *Calyx* in all 2 mm long, 5-lobed to the middle, glabrous outside, puberulent inside. *Stamens* 10; filaments thickened, glabrous, alternately 0.9 and 0.6 mm. Staminodes very inconspicuous, represented by some hairs only. *Ovary* elongate-ovoid, 2 mm, pilose; stigma minute, capitellate. *Fruit* ellipsoid, red to orange, 2 by 1 cm.

Distr. W. New Guinea (Geelvink Bay); probably conspecific specimens seen from the Moluccas (Aru Isl.).

Ecol. In rain-forest (also *Agathis*-forest) or in fringing forest on rocky slopes, 100–500 m.

17. Casearia arfakensis SLEUM. Blumea 7 (1954) 485.

Shrub; branchlets rather slender, terete, the tips densely minutely pubescent, soon glabrescent and grey lower down. *Leaves* oblong, *c.* 1 cm obtusely acuminate at the apex, broadly cuneate at the base into a very short (± 2 mm) petiole, thinly chartaceous when mature, brownish to dark olivaceous when dry, laxly and ± well visibly pellucid-lineate (not pellucid-punctate), entire to remotely denticulate by minute glands, glabrous, 7–9(–11) by 2–4 cm; midrib somewhat prominent beneath, nerves 6–7 pairs, flat above or slightly impressed, raised beneath, veins transverse, nearly obscure above, little prominent underneath. Stipules triangular, minute, 1–1½ mm long, sometimes longer persistent, but mostly rather early caducous. *Flowers* single on top of a solitary, short (*c.* 3 mm), many-bracteate axis. Bracts membranous, ovate, subacute, pubescent, 1½ mm. *Calyx* tubular, in all 5 mm long, 1½ mm diam., rather densely pubescent outside, glabrous inside, 5-lobed in the upper half; lobes oblong. *Stamens* 10; filaments thick-filiform, subulate towards their apex, glabrous, alternately 1.2 and 0.9 mm. Staminodes reduced to some hairs. *Ovary* elongate, *c.* 5 mm long, rather densely hairy. *Fruit* (*ex coll.*) 'elongate-elliptic, 4 by 1 cm, seeds several, with bloodred aril.'

Distr. *Malaysia:* NW. New Guinea (Mt Arfak, near Putat), once found.

18. Casearia brunneo-striata GILG, Bot. Jahrb. 55 (1918) 291.

Shrub 1–1½ m; branchlets somewhat applanate, glabrous, fuscous, soon covered with cork, lenticels numerous. *Leaves* oblong, shortly ± broadly acuminate at the apex, broadly cuneate at the base, nearly chartaceous, glabrous, dull when dry, rather densely and minutely denticulate or serrulate, densely pellucid-striate, 12–21 by 5–7 cm; midrib strong, nerves 11–13 pairs, ± at right angles with the midrib, little raised above, prominently so beneath, veins very numerous and densely reticulate, little prominent above, manifestly so beneath; petiole 1–3 mm. *Flowers* yellowish-white, in few- to many-flowered fascicles, these on short (up to 4 mm) axes, which are covered by numerous, small bracts. *Calyx* 2 mm, probably glabrous, 'densely brownish-pellucid striate'. *Stamens* 10(–11), alternately of unequal length, said to be jointed at the base into a prominent hairy ring. *Ovary* ovoid, densely longish-pilose.

Distr. *Malaysia:* NE. New Guinea (Sepik region).

Ecol. In rain-forest along stream, 20–100 m.

Note. No material seen; holotype (B) lost, and no other type-material seems to exist.

19. Casearia rinoreoides SLEUM. Blumea 7 (1954) 491.

Shrub 3 m, glabrous in all parts; branchlets somewhat angular at tips, soon becoming terete, olivaceous-yellowish as are the leaves when dry. *Leaves* ovate-oblong, gradually 1–1½ cm subacutely acuminate at the apex, attenuate into the petiole at the base, subcoriaceous, firm, more pallid and dull beneath, minutely and remotely crenate-serrate to nearly entire, 8–12 by 3–4½ cm; midrib distinctly prominent beneath, nerves 6–7 pairs, curved-ascending, not or little raised above, more distinctly so beneath, veins ± transverse, densely reticulated and elevated on both faces; petiole ± 1 cm long, 1 mm diam. *Flowers* sessile, solitary or 2–3, in a fascicle or mostly on top of a very short (1 mm) many-bracteate axis, surrounded or nearly concealed by numerous ovate, subacute, membranous, glabrous bracts 1–2 mm diam. *Calyx* glabrous, somewhat fleshy, in all 2 mm long, deeply 5-lobed. *Stamens* 10, equal in length; filaments glabrous, ½ mm. Staminodes very short, laxly pilose. *Ovary* thick-ovoid, pubescent. *Fruit* ellipsoid, *c.* 1.8 by 1.2 cm, orange-red.

Distr. NW. New Guinea (Nabire), once found.

Ecol. In rain-forest, 300 m.

20. Casearia megalophylla GILG, J. Arn. Arb. 10 (1929) 81; WHITE, *ibid.* 244.

Large bushy shrub, *c.* 2 m; branchlets angular, glabrous. *Leaves* oblong, *c.* 2 cm obtusely acuminate at the apex, cuneate at the base, thinly chartaceous, with many pellucid dots and lines, brownish when dry, ± inequilateral, glabrous, rather regularly serrate-crenate (teeth obtuse up to 1 mm high, 3–4 mm distant), midrib nearly flat above, prominent beneath, 20–32 by 10–12½ cm; nerves 10–12 pairs, rather straight, upwards curved-ascending towards the leaf-margin, obscure above, conspicuously raised beneath, veins manifestly transverse, little elevated on both faces, finer reticulations obscure; petiole rather thick, glabrous. *Flowers* white, solitary or 2–3 in a fascicle, sometimes on a very short (up to 1½ mm), many-bracteolate stalk. Bracts ovate, acuminate, membranous, subglabrous, *c.* 1½ mm. *Calyx* ± densely sericeous in- and outside, 2 mm, deeply 5-lobed. *Stamens* 10; filaments sparsely pilose, alternately 0.6 and 0.3 mm. Staminodes represented by small hairy tufts. *Ovary* elongate-ovoid, 2 by 1 mm, densely hairy.

Distr. *Malaysia:* SE. New Guinea (Gulf Division).

Ecol. In rain-forest at low elevation.

Note. A similar, perhaps conspecific specimen seen from N. New Guinea (Mamberamo River).

21. Casearia trivalvis (BLANCO) MERR. Sp. Blanc. (1918) 275; En. Philip. 3 (1923) 116.—*Samyda trivalvis* BLANCO, Fl. Filip. (1837) 374, ed. 2 (1845) 263, ed. 3, 2 (1878) 124.—*C. fragilis* (*non* VENT.) F.-VILL. Nov. App. (1880) 93.—*C. solida* MERR. Gov. Lab. Publ. (Philip.) 35 (1906) 46; Philip. J. Sc. 1 (1906) Suppl. 99.—*C. zschokkei* ELM. Leafl. Philip. Bot. 8 (1919) 3083.—*Gelonium pinatubense* ELM. Leafl. Philip. Bot. 9 (1934) 3186.—*Suregada pinatubensis* CROIZ. Bull. Bot. Gard. Btzg III, 17 (1942) 217.

Tree 1½–5(–8) m, shrub-like in habit; branches rigid, crookedly rebranched, divaricate, the tips short brownish-hirsute, soon covered with whitish cork. *Leaves* elliptic or elliptic-oblong or ovate-oblong, rather abruptly and shortly (1–1½ cm) obtusely or acutely acuminate at the apex, cuneate at the base, equilateral, rigidly chartaceous to subcoriaceous, entire or obscurely remotely dentate, very minutely pellucid-punctulate or practically impunctate, sublucid and pale grey-olivaceous when dry, dull and somewhat paler beneath, (6–) 8–15(–18) by (4–)5–7(–10) cm; midrib flat or slightly immersed above in dry specimens, strongly prominent beneath, nerves *c.* 5–6(–8) on each side, ascending, their ends strongly curved upward, little prominent only beneath, veins laxly reticulate and little raised on both sides; petiole rather stout, manifestly grooved above, glabrous, (4–)6–9(–15) mm, dull reddish-brown when alive. *Flowers* white or cream, fragrant, in 4–12-flowered glomerules chiefly from the axils of fallen leaves. Bracts very unequal in size and shape, the outer ovate, subacute, densely appressed-pubescent, glabrescent with age, the inner ones thinner. Pedicels stoutish, pubescent, ± 2 mm at anthesis, later elongating up to 4 mm. *Calyx* 2½–3 mm, densely pubescent outside, nearly glabrous inside, deeply 5-lobed, manifestly pellucid-punctate and -striate. *Stamens* 8, equal in length; filaments filiform, glabrous, 1.2–1.5 mm. Staminodes nearly rectangular, thick, densely hirsute, nearly as long as the filaments. *Ovary* conical-ovoid, laxly pilose. *Fruit* subglobose to ellipsoid, trigonous to the apex, *c.* 2 cm long, *c.* 1½ cm diam., bright red, subtended by the accrescent calyx-lobes; peduncle rather slender, subglabrous, *c.* 1 cm.

Distr. *Malaysia:* Philippines (Luzon, Marinduque, Mindoro).

Ecol. In primary forests, up to 800 m; *fl. fr.* Jan.–Dec.

Vern. *Boog-boog*, *kapikapihan*, *malagañgyat*, *malatagyan*, Tag., *marakiuas*, Neg.

22. Casearia velutina BL. Mus. Bot. 1 (1850) 253 incl. *var. pilosiuscula* BL.; MIQ. Fl. Ind. Bat. 1, 1 (1855) 708 incl. *var.* α & β; Suppl. 1 (1860) 132; SLOOT. Bijdr. Flac. (1919) 153; Bull. Jard. Bot. Btzg III, 7 (1925) 406; DOCTERS VAN LEEUWEN Zoocec. (1926) 393.—*Daphne decandra* BL. Bijdr. (1825) 650, *non C. decandra* JACQ. 1760, *cf.* HALLIER *f.* Med. Rijksherb. Leiden 44 (1922) 31. —*C. propinqua* BL. Mus. Bot. 1 (1850) 253; SLOOT. Bijdr. Flac. (1919) 154.—*C. elliptica* (*non* WILLD.) BL. Mus. Bot. 1 (1850) 253; MIQ. Fl. Ind. Bat. 1, 1 (1855) 709, SLOOT. Bijdr. Flac. (1919) 163. —*C. tomentosa* (*non* ROXB.) KOORD. & VAL. Bijdr. Booms. Java 1 (1894) 176 *incl. var. glabra* K. & V. 177; KOORD. Exk. Fl. Java 2 (1912) 635; Atlas Baumart. Java 2 (1914) t. 344; SLOOT. Bijdr. Flac. (1919) 161.—*C. multipunctata* MERR. Pap. Mich. Acad. Sc. 19 (1934) 174.

Shrub or tree, up to 15 m; branchlets angular, ± patently and densely short-hairy to velvety. *Leaves* oblong-elliptic or oblong, rarely ovate, rounded or shortly acuminate at the top (acumen ½–1½ cm, blunt or rather sharp), ± inequilateral, rounded at one side, attenuate at the other, rarely ± cordate at the base, thinly herbaceous, distinctly pellucid-punctate and striate, obscurely or mostly distinctly serrate-dentate, at first ± densely pubescent above, finally pubescent there on the midrib only, or entirely glabrous, the whole of the lower surface, specially on the nerves, velvety, rarely ± glabrescent with age, 5–13(–21) by 2–6(–7½) cm; midrib not or little raised above, distinctly so beneath, nerves (4–5–)6–8(–10) pairs, sometimes a little impressed above, always prominent beneath, veins ± transverse, not or mostly little but visibly raised on both surfaces as are the finer reticulations; petiole densely pubescent, 5–15(–18) mm. *Flowers* rather numerous, fascicled. *Calyx* green or blue-green, ± densely patently pubescent outside, glabrous inside, *c.* 2 mm, deeply 5-lobed. Bracts minute, numerous, densely pubescent, 1 mm. Pedicels slender, pubescent, 4 mm. *Stamens* 5–8; filaments equal in length, pilose, 1.8 mm. Staminodes 1.2 mm, rather flat, hairy at the apex. *Ovary* narrow-ovoid, nearly glabrous, as long as the calyx. *Fruit* ovoid, glabrous, verruculose when dry, 1.2–1.5 cm long, *c.* 1 cm diam.; peduncle rather slender, glabrescent, 5–7 mm.

Distr. *Malaysia:* Sumatra (E. & W. Coast), Java.

Ecol. Both in mixed primary rain-forests, rarely in teak-forests, once on limestone, 200–1500 m; *fl.* Jan.–Dec.

Vern. *Kabanbara*, *tjikalbalung*, J.

Note. The type specimen of *C. multipunctata* MERR. possesses small, less equilateral leaves than the average but falls within the variability of *C. velutina* BL.

23. Casearia impressinervia MERR. Philip. J. Sc. 11 (1916) Bot. 96; En. Born. (1921) 412.

Tree; branchlets blackish when dry, puberulous on the younger parts, soon glabrescent. *Leaves* oblong, *c.* 1 cm rather sharply acuminate at the apex, acute or cuneate into the petiole at the base, rigid and ± coriaceous, dark-brown when dry, not pellucid-punctate, glabrous and somewhat shining above, paler and softly tomentose with pale spreading hairs underneath at least at the midrib and nerves, domatia always present, entire, 6–8 (–10) by 2–3(–4½) cm; midrib and nerves distinctly impressed above, prominent beneath, veins transverse, visible only on the undersurface, reticulations fine; petiole pubescent, 7–10 mm. *Flowers* pale, *c.* 4–6 in each fascicle. Pedicels slightly pubescent, 2 mm. Bracts very minute, pubescent. *Calyx c.* 3½ mm, pubescent outside, deeply 5-lobed. *Stamens* 10; filaments glabrous, alternately 1.8 and 1.5 mm. Staminodes narrow-oblong, villose at the apex, nearly 1.8 mm. *Ovary* elongate-ovoid, 3 mm long, laxly pilose towards the top.

Distr. *Malaysia:* Borneo (Sarawak).

Note. Perhaps only a small-leaved form of *C. hosei.*

24. Casearia anisophylla GILG, Bot. Jahrb. 55 (1918) 289.

Treelet 4–6 m; bark grey; branchlets applanate, reddish-nigrescent when dry, minutely pubescent, soon glabrescent, smooth, striate. *Leaves* ovate-oblong to ovate-lanceolate, *c.* 1¹/₂ cm and rather broadly acuminate at the apex, rounded and inequilateral at the base, dark olivaceous and somewhat shining above when dry, more dilutely so and dull beneath, subcoriaceous, not or minutely pellucid-punctate, glabrous except yellowish domatia, 14–18 by 4–5 cm; midrib stout, prominent on both faces, nerves 6–7 pairs, slightly impressed above, prominent beneath, veins transverse and venules numerous, minutely prominent on both faces; petiole glabrous, 6–7 by 1¹/₂ mm. *Flowers* pale-green, nigrescent when dry, 3–10 per fascicle. Bracts small and dense, pubescent. Pedicels 2–3 mm, glabrous. *Calyx* 2¹/₂–3 mm, practically glabrous in- and outside, deeply 5-lobed, lobes ovate-oblong. *Stamens* 12; filaments glabrous, slender, alternately 1.1 and 0.8 mm. Staminodes broadly oblong, densely whitish-hairy on top *c.* 0.6 mm. *Ovary* ovoid, *c.* 2 mm, glabrous except some hairs towards the apex.

Distr. *Malaysia:* NE. New Guinea (Sepik region), once collected.

Ecol. In dense rain-forest, 850 m.

25. Casearia hosei MERR. Philip. J. Sc. 11 (1916) Bot. 93; En. Born. (1921) 412; Pl. Elm. Born. (1929) 210; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 394. —*C. moultonii* RIDL. Kew Bull. (1938) 111.

Tree or shrub, 3–5 m; branchlets minutely grey-pubescent or mostly glabrous, older parts very dark brown-red when dry. *Leaves* oblong or sub-ovate-oblong, distinctly shortly (1–2 cm) acutely, or bluntly acuminate at the apex, ± inequilateral and broadly cuneate to rounded at the base, firmly chartaceous, entire, dark brown when dry, not or very obscurely pellucid-punctate, shining and glabrous above, slightly paler and dull beneath, ± puberulent on midrib and nerves beneath, always with domatia, 10–17 by (3–)4–6 cm; midrib slightly impressed over the whole length above, very prominent beneath, nerves (8–)9–10 pairs, rather obscure and often very slightly impressed above, prominent beneath, curved and ± anastomosing with each other, veins laxly transverse, reticulations fine, specially beneath; petiole puberulent or glabrous, *c.* 8 mm. *Flowers* greenish, blackish when dry, 3–4 per fascicle. Bracts broadly ovate, acuminate, pubescent, 1 mm. Pedicels 1–1¹/₂ mm, stoutish, slightly greyish-puberulent. *Calyx c.* 2¹/₂ mm, sparingly greyish-pubescent outside, glabrous inside, deeply 5-lobed, lobes oblong, subacute. *Stamens* 10; filaments glabrous or nearly so, alternately 1¹/₂ and 1.2 mm. Staminodes oblong-linear, 0.9 mm, pilose specially at their apex. *Ovary* narrow-ovoid, glabrous or slightly hairy towards the top, 2 mm. *Fruit* subglobose, *c.* 8 mm diam., orange-red; peduncle slender, 3–4 mm. *Seeds* few; aril red.

Distr. *Malaysia:* Borneo, Central Celebes.

Ecol. In primary forests, up to 1500 m.

26. Casearia globifera GILG, Bot. Jahrb. 55 (1918) 289.

Shrub or tree; young branches reddish-blackish when dry, applanate, very shortly pilose, soon glabrescent. *Leaves* ovate to ovate-oblong, shortly and broadly acuminate at the apex, broadly cuneate to nearly rounded at the base, chartaceous, shallowly sinuate-dentate, ± manifestly and rather minutely pellucid-punctate, but not -striate, puberulent on midrib and nerves beneath, glabrous elsewhere, dark-brown and dull when dry, 12–18 by 5–7¹/₂(–9) cm; midrib little raised above, strongly so beneath, nerves (9–)10–11, flat above, prominent beneath, veins transverse, visibly elevated underneath, reticulations rather fine and little prominent on both faces specially beneath; petiole 7–10 by nearly 2 mm. *Flowers* 1–2 developed simultaneously from a subglobose cushion formed by numerous, small, pubescent bracts; pedicels up to 2 mm. *Calyx* 3 mm, somewhat pilose outside. *Stamens* 10; filaments alternately longer and shorter. Staminodes elongate and densely pilose. *Ovary* ovoid-subglobose, densely pilose, with a short and thick style.

Distr. *Malaysia:* NE. New Guinea (Djamu River), once found.

Ecol. Rain-forests, 300 m.

Note. There is a sterile isotype in Paris; the description of the flowers was copied from the original diagnosis.

27. Casearia fuliginosa (BLANCO) BLANCO, Fl. Filip. ed. 2 (1845) 262, ed. 3, 2 (1878) 123, t. 90; MERR. Philip. J. Sc. 1 (1906) Suppl. 99; Fl. Manila (1912) 335; Sp. Blanc. (1918) 275; En. Philip. 3 (1923) 115.—*Anavinga fuliginosa* BLANCO, Fl. Filip. (1837) 372.—*C. elliptica* (*non* WILLD.) NAVES in BLANCO, Fl. Filip. ed. 3 (1877–83) t. 90; VIDAL, Cat. Pl. Prov. Manila (1880) 31.—*C. moluccana* (*non* ROXB.) MERR. Philip. Bur. For. Bull. 1 (1903) 41.—*C. glauciramea* ELM. Leafl. Philip. Bot. 4 (1912) 1517; MERR. En. Philip. 3 (1923) 115.—*C. densifolia* ELM. Leafl. Philip. Bot. 4 (1912) 1516.—*C. nitens* MERR. J. Philip. Sc. 30 (1926) 412.

Shrub or small tree, 2–6 m; branchlets flexuous, often zig-zag, nigrescent, angular, puberulous on the tips, terete and glabrous elsewhere. *Leaves* generally ovate-oblong, somewhat variable in size and shape, shortly acuminate often slightly falcate at the apex, the tip blunt, ± broadly cuneate to rounded at the base, mostly very inequilateral (often one side rounded, the other cuneate at the base), firmly chartaceous, glabrous except greyish domatia, mostly dark brown to nigrescent when dry, paler beneath, somewhat shining above, dull beneath, mostly rather densely and conspicuously pellucid-punctate and -striate, (6–)7–15(–20) by (2–)3½–5(–6½, rarely up to 8) cm, entire or ± obscurely crenulate; midrib flat above, very prominent beneath, nerves (7–)8–10 pairs, slightly curved, ± parallel to each other, inconspicuous or somewhat impressed above, raised beneath, veins obsolete above, minutely elevated beneath together with the dense and very fine reticulations; petiole 0.6–1(–1½) cm, mostly pubescent. *Flowers* white to pale green, blackish when dry, in few- to many-flowered clusters. Bracts ovate, small (½ mm), densely greyish-pubescent. Pedicels *c.* 2 mm, pubescent. *Calyx* membranaceous, *c.* 2 mm, deeply 5-lobed, pubescent outside, laxly so inside. *Stamens* 10; filaments thick-filiform, glabrous or laxly hairy, alternately 0.9 respectively 0.6 mm; anthers subglobose, 0.4 mm. Staminodes 0.4 mm, penicillate at the apex. *Ovary* ovoid, laxly pilose at the short style. *Fruit* ovoid to ellipsoid, 1–1.2 by 0.8 cm, red to yellow when mature; peduncle pubescent, 3–4 mm. *Seeds c.* 4.

Distr. *Malaysia:* Philippines (Luzon, Mindoro, Ticao, Sibuyan, Samar, Masbate, Dinagat, Mindanao, Tawi-Tawi).

Ecol. Rather common in thickets and secondary forests below 250 m, also near the sea, often on sandy or gravelly river-banks and along creeks.

Uses. Wood used for casts and bars.

Vern. *Bagna*, *tapat-tápat*, *butong-manók*, *kaluag*, Tag., *baling-káhoi*, C. Bis., *baltik*, *sangkí*, Ig. *bina kag*, *pariñgorauan*, Neg., *luyong-lúyong*, S.L. Bis., *malaserésa*, Pamp., *mukok*, Bon., *sigai-sigai*, *talitan*, Sbl.

28. Casearia grewiaefolia VENT. Choix (1803) 48; BL. Mus. Bot. 1 (1850) 252; MIQ. Fl. Ind. Bat. 1, 1 (1855) 706 *incl. var. grosse-serrata* MIQ.; *ibid.* 707; CLARKE in HOOK. *f.* & TH. Fl. Br. Ind. 2 (1879) 594; KOORD. & VAL. Bijdr. Booms. Java 1 (1894) 173, *incl. var. contermina* K. & V. *l.c.* 175 *et var. subcuneata* (MIQ.) K. & V. *l.c.*; KING, J. As. Soc. Beng. 67, ii (1898) 16; KOORD. Minah. (1898) 472; Jungh. Gedenkb. (1910) 181; Exk. Fl. Java (1912) 635; Atlas Baumarten 2 (1914) f. 342 (*var. contermina*); SLOOT. Bijdr. Flac. (1919) 144; MERR. En. Born. (1921) 412; GAGNEP. Fl. Gén. I.C. 2 (1921) 1003, *pr. p.*; RIDL. Fl. Mal. Pen. 1 (1922) 830; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 395; DOCTERS VAN LEEUWEN, Zoocecid. (1926) 393; CRAIB, Fl. Siam. En. 1 (1931) 736; MALM in FEDDE, Rep. 31 (1934) 281; DOCTERS VAN LEEUWEN, Ned. Kruidk. Arch. 51 (1941) 195. —*Samyda grewiaefolia* POIR. Encycl. Suppl. 5 (1817) 32.—*C. variabilis* BL. Mus. Bot. 1 (1850) 252.—*C. subcuneata* MIQ. Fl. Ind. Bat. 1, 1 (1855) 706.—*C. contermina* MIQ. *ibid.* 707.—*C. microdon* MIQ. Fl. Ind. Bat. Suppl. (1860) 333, 132.—*C. kerrii* CRAIB, Kew Bull. (1911) 55; GAGNEP. Fl. Gén. I.C. 2 (1921) 1002; CRAIB, Fl. Siam. En. 1 (1931) 737.—*C. agusanensis* ELM. Leafl. Philip. Bot. 7 (1915) 2652; MERR. En. Philip. 3 (1923) 114.—*C. confertiflora* MERR. Philip. J. Sc. 13 (1918) 34; En. Philip. 3 (1923) 115.—*C. sogerensis* BAK. *f.* J. Bot. 61 (1923) Suppl. 22.—*C. oblonga* CRAIB, Kew Bull. (1930) 405; Fl. Siam. En. 1 (1931) 738.—**Fig. 36.**

For further synonyms see under the varieties.

var. **grewiaefolia.**

Shrub or tree 2–20(–35) m, fluted at the base when old, buttresses up to 1 m; bark greyish pale-brown or whitish, rough, pustulate; branchlets quadrangular, ± densely rusty-tomentose, soon glabrescent. *Leaves* variable in shape, generally oblong, sometimes ovate-oblong, shortly (1–2 cm) acuminate and mostly rather obtuse at the apex, broadly cuneate to rounded at the base, sometimes truncate or subcordate, always ± distinctly inequilateral, firmly chartaceous, olivaceous or brownish when dry, paler beneath, glabrous above except the midrib, ± densely rusty- to yellowish-, rarely more greyish-pilose to -tomentose beneath, not very glabrescent in the typical form, mostly regularly minutely to rather coarsely crenate, sometimes nearly entire, ± densely pellucid-punctate and -striate specially in young leaves, 8–10(–16) by (3–)3½–6 (rarely up to 8) cm; midrib flat or mostly slightly grooved above, prominent beneath, nerves (8–)10–14 pairs, little curved-ascending and ± parallel to each other, the inferior 2–3 pairs usually from the leaf-base, all not or little raised above, markedly so beneath, veins ± transverse, little prominent on both faces, finer reticulations visible but very little prominent, sometimes nearly obscure; petiole rather slender, 0.7–1½ mm diam., pubescent or glabrescent, 6–10(–12) mm. *Flowers* white to yellowish-greenish, the ovary often galled and then the calyx-lobes and pedicels usually stoutish and enlarged. *Fascicles* many-flowered, but sometimes reduced to few flowers or very rarely to a solitary flower, often in the axils of fallen leaves. Pedicels rather slender, ± pubescent, 5–6(–8) mm. Bracts numerous, pubescent, up to 1 mm diam. *Calyx* appressed-pilose outside, more laxly so inside, 2½–3 mm, deeply 5-lobed. *Stamens* normally 8, rarely 10, slightly differing in length; filaments rather slender, glabrous or a little pubescent, *c.* 1½ mm. Staminodes oblong, thick, densely hairy, specially at the apex, 1 mm. *Ovary* ovoid, glabrous or laxly pilose upwards; style short but distinct. *Fruit* compressed-ellipsoid, orange to yellow when ripe, glabrous, boldly ridged when dry, (2½–)3½–4 by *c.* 1.7–1.8 cm when full developed. *Seeds* several, with orange-red aril.

Distr. Indo-China, Siam, in *Malaysia:* Sumatra, Malay Peninsula (apparently rather rare, in Perak, Dindings & Johore), Java (rather common), Lesser Sunda Islands (Bali), Borneo, Celebes, Moluccas (Sula), Philippines and New Guinea (Sogeri). The *var. deglabrata* also in Melanesia.

Ecol. In not too shady, open, primary and secondary forests and in dry thickets, also in teak-forests, from the lowlands up to 450 m, rarely ascending up to 900, very rarely up to 1300 m, in rather barren and stony localities, often on calcareous soil and marl, also on coral limestone rocks; *fl. fr.* Jan.–Dec.

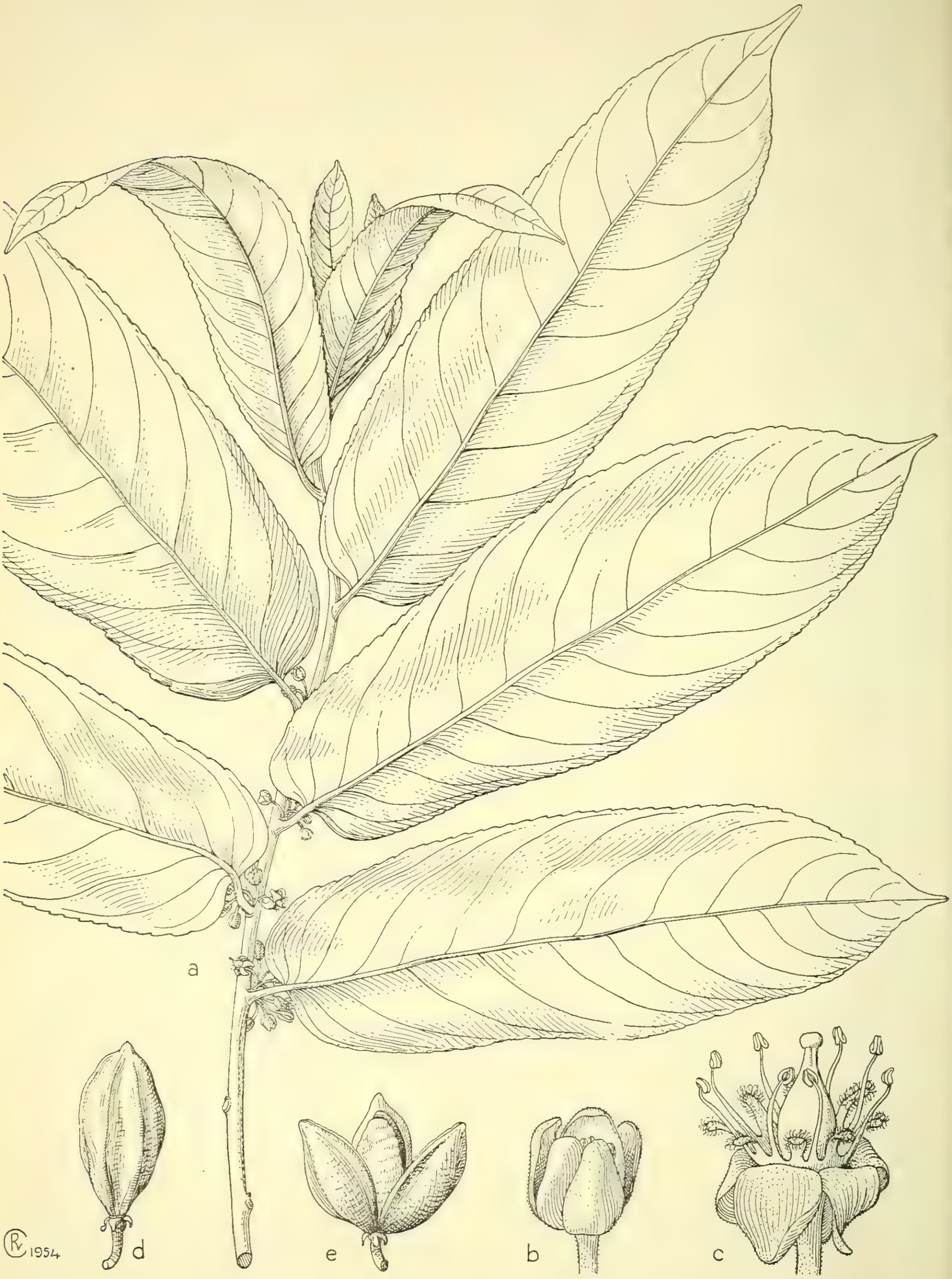

Fig. 36. *Casearia grewiaefolia* VENT. *a*. Flowering twig, × ²/₃, *b*. young flower, × 5, *c*. flower in full anthesis, × 5, *d*. fruit, × ²/₃, *e*. *ditto*, dehisced, × ²/₃ (*b–c* after KOSTERMANS 5409, *d* after KOSTERMANS 5926).

Uses. The fruit has a bitter, burning taste. Wood white to pale brown, apparently not used.

Vern. *Madang klapah*, Palemb., *kaju rajah*, Lampongs, *pĕlangas gunung*, Billiton, *ring gupgup*, Sum. E. Coast, *balam pĕlapah*, Sum. W. Coast, *tada-tada*, M, *balung*, *kaju putih*, *rimbangan*, *ki sumarèng*, *ki bĕsi*, *hanja*, *marèmè tanjung*, S, *durènan glam*, *kalak krisik*, *klĕgan*, *kalak usik*, *sĕtjang*, *langsĕp lutung*, *dluwak*, *kĕdu*, *balung*, *balong*, *djangklot kĕpu*, J, *gadungan*, *morron balung*, Md.. Borneo: *Surian*, SE. Borneo, *biling*, Kutei, *tapion angian*, *t. kirabas*, *tapai-tapai*, Dusun. Celebes: *Simpokio*, *kerekere*, *lamboä*, *karikis lawanan*, *k. sela*, *k. putih*, *lĕlean kulu*, *sunsun*, *torosi*, *aladen*, Manado, *wungkabo*, Muna, *siwua*, *Mingkoka*, *simpokio*, *keu*, Barëe, *we-koro*, Tolalaki. Philippines: *ahtig*, Bag., *inignin*, *kaluag*, *k. babáe*, *magaspang*, *malata-moyan*, Tag., *malata-biang*, Neg., *boyboyok*, *malaponti*, Ilk., *matalung*, *bitang*, Sul., *pañgonalaman*, Ibn.. Moluccas: *dongo-dongo*, (*kaju*) *hatibĕsi*, Sula, Ternate, *fatbis*, Sanana. New Guinea: *beggöe*, *bisèmang*, Atam.

var. **cinerea** (TURCZ.) SLEUM. *stat. nov.*—*C. cinerea* TURCZ. Bull. Soc. Nat. Moscou 31 (1858) 462; VIDAL, Phan. Cuming. Philip. (1885) 115; Rev. Pl. Vasc. Filip. (1886) 140; MERR. Philip. J. Sc. 1 (1906) Suppl. 99; Sp. Blanc. (1918) 275; En. Philip. 3 (1923) 114.—*Samyda serrulata* (*non* L.) BLANCO, Fl. Filip. (1837) 374.—*Samyda pubescens* (*non* L.) BLANCO, Fl. Filip. ed. 2 (1845) 263, ed. 3, 2 (1878) 124.—*C. tomentosa* (*non* ROXB.) F.-VILL. Nov. App. (1880) 93.—*C. pilosissima* QUIS. & MERR. Philip. J. Sc. 37 (1928) 171.

Leaves velutinous on both sides. Fruit more ovoid than in the typical species.

Distr. *Malaysia:* Philippines (Luzon, SE. Mindanao).

Ecol. In primary and secondary forests, up to 600 m.

Vern. *Butong-manók*, Bik., *tulibas*, *kaluag*, Tag., *karimbubua*, Ilk., *maraligau*, Bis.

var. **deglabrata** KOORD. & VAL. Bijdr. Booms. Java 1 (1894) 174; KOORD. Minah. (1898) 471; Atlas Baumart. Java 1 (1914) f. 343; SLOOT. Bijdr. Flac. (1919) 149.—*C. uniflora* DECNE, Nouv. Ann. Mus. 3 (1834) 428; Herb. Timor. Descr. (1835) 100; MIQ. Fl. Ind. Bat. 1, 1 (1855) 712; SLOOT. Bijdr. Flac. (1919) 163; Bull. Jard. Bot. Btzg III, 7 (1925) 413.—*C. hexagona* DECNE, Nouv. Ann. Mus. 3 (1834) 429; Herb. Timor. Descr. (1835) 101; BL. Mus. Bot. 1 (1850) 254; MIQ. Fl. Ind. Bat. 1, 1 (1855) 711; SLOOT. Bijdr. Flac. (1919) 160; Bull. Jard. Bot. Btzg III, 7 (1925) 405; MEIJER DREES, Comm. For. Res. Inst. 33 (1951) 106.—*C. hexagona* DECNE *var. gelonioides* BL. Mus. Bot. 1 (1850) 225; MIQ. Fl. Ind. Bat. 1, 1 (1855) 711; SLOOT. Bijdr. Flac. (1919) 160.—*Laurus serrata* BLANCO, Fl. Filip. (1837) 319, ed. 2 (1845) 224, ed. 3, 2 (1878) 55, *non C. serrata* MACF. & SW.—*C. salacioides* BL. Mus. Bot. 1 (1850) 252; MIQ. Fl. Ind. Bat. 1, 1 (1855) 707; SCHEFF. Ann. Jard. Bot. Btzg 1 (1876) 24.—*C. truncata* BL. Mus. Bot. 1 (1850) 252; MIQ. Fl. Ind. Bat. 1, 1 (1855) 707.—*C. variabilis* BL. *var. sphaerocarpa* BL., *var. nudata* BL. Mus. Bot. 1 (1850) 252.—*C. laurina* BL. Mus. Bot. 1 (1850) 253; MIQ. Fl. Ind. Bat. 1, 1 (1855) 708; SLOOT. Bijdr. Flac. (1919) 153; Bull. Jard. Bot. Btzg III, 7 (1925) 394; MERR. En. Born. (1921) 412; MEIJER DREES, Comm. For. Res. Inst. 33 (1951) 105.—*C. glabrata* BL. Mus. Bot. 1 (1850) 253; MIQ. Fl. Ind. Bat. 1, 1 (1855) 708, Suppl. (1860) 132, 334.—*C. angustata* TEYSM. & BINN. Nat. Tijd. Ned. Ind. 2 (1851) 305; Ned. Kruidk. Arch. 3 (1855) 409; MIQ. Fl. Ind. Bat. 1, 1 (1855) 710.—*C. gonocarpa* MIQ. Fl. Ind. Bat. 1, 1 (1855) 1093; Suppl. (1860) 132; SLOOT. Bijdr. Flac. (1919) 156; Bull. Jard. Bot. Btzg III, 7 (1925) 398.—*C. leucolepis* TURCZ. Bull. Soc. Nat. Moscou 31 (1858) 463; CLARKE in HOOK. *f.* & TH. Fl. Br. Ind. 2 (1879) 591; F.-VILL. Nov. App. (1880) 115; VIDAL, Rev. Pl. Vasc. Filip. (1886) 141; Phan. Cuming. Philip. (1885) 115; STAPF, Trans. Linn. Soc. 4 (1894) 164; MERR. Philip. J. Sc. 10 (1915) Bot. 184; *op. cit.* 11 (1916) Bot. 96; En. Born. (1921) 412; RIDL. Fl. Mal. Pen. 1 (1922) 831.—*C. glomerata* (*non* ROXB.) F.-VILL. Nov. App. (1880) 93.—*C. polyantha* MERR. Philip. J. Sc. 1 (1906) Suppl. 99; En. Philip. 3 (1923) 116; Philip. J. Sc. 29 (1926) 401.—*C. crenata* MERR. Philip. J. Sc. 1 (1906) Suppl. 99; Sp. Blanc. (1918) 276; En. Philip. 3 (1923) 115.—*C. subcordata* MERR. Philip. J. Sc. 9 (1914) Bot. 328; En. Philip. 3 (1923) 116.—*C. moluccana* (*non* ROXB.) BAK. *f.* J. Bot. 62 (1924) Suppl. 42.—*C. densifolia* (*non* ELM.) SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 412.—*C. luteocarpa* ELM. Leafl. Philip. Bot. 9 (1934) 3189.

Differing from typical *C. grewiaefolia* by a ± pronounced glabrescence in all parts, and apparently occurring together with it in many localities. The leaves not rarely are somewhat thicker, less or not pellucid-punctate.

Distr. *Malaysia:* Occupies the same area as the type, but extends besides to Lesser Sunda Islands (Lombok, Sumbawa, Timor), the Moluccas (Key, Batjan, Ternate), New Guinea (Arfak), and Melanesia (Admiralty Isl., New Britain, Solomon Isl.: Bougainville).

Ecol. Similar to the type variety, mostly in forests at low elevation, up to 900 m.

Vern. See the names mentioned under the type variety.

29. Casearia philippinensis MERR. Philip. J. Sc. 10 (1915) Bot. 329; En. Philip. 3 (1923) 116.

Shrub or small tree, up to 3 m; branchlets slender, softly ferrugineous-tomentose initially, soon glabrescent and covered with greyish-yellowish cork. *Leaves* oblong to oblong-lanceolate, gradually tapering into an acute apex, broadly cuneate at the base, firmly chartaceous, brownish-olivaceous when dry, glabrous above except the midrib, softly brownish-tomentose all over the undersurface, very densely so on the midrib and the nerves, entire, with rather numerous fine, pellucid points, pellucid lines few or absent, 20–29 by 7–10 cm; midrib not or little raised above, prominent beneath, nerves curved-ascending rather obscure above, prominent and paler beneath, veins ± transverse, inconspicuous above, lax and little raised beneath; petiole robust (1½ mm diam.), tomentose, *c.* 5 mm long. *Flowers* solitary, or mostly 2–3 in a fascicle, yellowish (not seen); pedicels 1–1½ mm at anthesis. Bracts pubescent, 1 mm. *Calyx* 4–5 mm, nearly glabrous in- and outside, deeply 5-lobed. *Stamens* 10, equal; filaments glabrous, 2½ mm. Staminodes villose towards the apex, 1½ mm. *Ovary* ovoid, subglabrous, 3 mm. *Fruit* pink to red, *c.* 2½ by 1½ cm, glabrous, resinous dots well visible in the epidermis with a lens; peduncle 2–3 mm, slender, pubescent.

Distr. *Malaysia:* Philippines (Luzon, Mindanao, Samar).

Ecol. In forests along streams from low elevation up to 850 m.

Vern. *Komombong*, Lanao.

30. Casearia elliptifolia MERR. Philip. J. Sc. 11 (1916) Bot. 92; En. Born. (1921) 412.

Small tree 6 m; branchlets slender, dilutely olivaceous, first somewhat angular and minutely pubescent, soon terete and glabrous. *Leaves* elliptic, rarely oblong-elliptic, *c.* 1 cm subacutely acuminate at the apex, broadly cuneate at the base, ± equilateral, firmly membranous to chartaceous, mostly distinctly pellucid-punctate and -striate, pale olivaceous to brownish when dry, ± shining on both faces, entire, 7–11 by 3½–5½ cm, glabrous or at most with very fine hairs beneath along the midrib and nerves; midrib nearly flat above, prominent beneath, nerves 6–7 pairs curved-ascending along the leaf-margin, inconspicuous above, raised beneath, veins rather closely transverse, little prominent above, conspicuous beneath, veinlets little but manifestly reticulate on both faces; petiole mostly pubescent, slender. *Flowers* pinkish, in few-flowered fascicles, only 1–2 developed at the same time. Pedicels sparingly pubescent, up to 2 mm. Bracts rather numerous, brown, pubescent outside, *c.* 1 mm. *Calyx* sparsely pubescent outside, distinctly pellucid-punctate, 2 mm, deeply 5-lobed. *Stamens* 10, equal; filaments filiform, glabrous, 1 mm. Staminodes triangular-ovate, barbate at the apex, 0.6 mm. *Ovary* ovoid, glabrous, 2 mm. *Fruit* ovoid to ellipsoid, yellow, glabrous, somewhat rugose when dry, up to 1 cm long; peduncle 2 mm. *Seeds c.* 6; aril not lacerate.

Distr. *Malaysia:* Borneo (Sarawak, W. Kutei, Mt Kinabalu).

Ecol. In mountain-forests up to *c.* 2000 m.

31. Casearia mindanaensis MERR. Philip. J. Sc. 20 (1922) 410; En. Philip. 3 (1923) 116.

Shrub or small tree; young branches pubescent at the tips, soon glabrescent and covered with greyish cork, lenticels orbicular-elliptic, distinct, rather numerous. *Leaves* oblong to oblong-elliptic, abruptly (2 cm) obtusely acuminate at the apex, broadly cuneate to obtuse at the base, minutely denticulate in the upper half, entire towards the base, chartaceous, olivaceous and dull above, brownish and somewhat shining beneath when dry, laxly rather obscurely pellucid-punctate and -striate, glabrous above, beset with very short appressed hairs on the undersurface specially on midrib and nerves, glabrescent, 25–30 by 10–12 cm; midrib nearly flat above, very prominent beneath, nerves 8–9 pairs, ± suberect, flat, prominent beneath, veins ± transverse and veinlets obscure above, both densely reticulated and ± manifestly raised beneath; petiole stout (*c.* 3 mm diam.), ± 8 mm long, initially pubescent, soon corticated. *Flowers* apparently few per fascicle. Pedicel very short. *Calyx* (below the fruit) glabrous or nearly so, 4 mm, manifestly pellucid-punctate, deeply 5-lobed. *Fruit* nearly ellipsoid, 1.5–1.8 by 1.2 cm, reddish to yellowish when fresh, glabrous; peduncle 2 mm. *Seeds* 4–5 mm long; aril fimbriate.

Distr. *Malaysia:* Philippines (Mindanao: Zamboanga), once collected.

Ecol. In forests along streams at *c.* 200 m.

Vern. *Dalipa*, Sub.

32. Casearia phanerophlebia MERR. Philip. J. Sc. 10 (1915) Bot. 277; En. Philip. 3 (1923) 116.—*C. wenzelii* MERR. & QUIS. Philip. J. Sc. 76 (1944) 54.

Small tree or shrub; branchlets minutely pubescent on the growing tips, glabrescent elsewhere, first red-brown, greyish-yellowish later, striate longitudinally. *Leaves* oblong or elliptic-oblong, shortly abruptly acuminate at the apex, acute at the base, subcoriaceous, entire or obscurely denticulate, rather dark reddish-brown and ± dull when dry, a little paler beneath, rather densely pellucid-punctate, but the dots sometimes difficult to observe in old leaves, glabrous above, ± densely pubescent by minute, patent hairs beneath on the midrib and nerves, ± glabrescent, 14–24 by (5–)6–10 cm; midrib little prominent above, strongly so beneath, nerves ± curved-ascending, flat or slightly impressed above, prominent beneath, veins distantly transverse somewhat prominent beneath only, veinlets rather obscure; petiole stout (*c.* 2½ mm), 5–8 mm, subglabrous. *Flowers* white to yellowish, crowded in fascicles, these often at the nodes of fallen leaves. Bracts numerous, membranous, ovate, glabrous, *c.* 1 mm, forming a semiglobose cushion. Pedicels 1½–2 mm, pubescent. *Calyx* 4–5 mm, laxly appressed-pubescent outside, deeply 5-lobed. *Stamens* 8 (sometimes 7) equal; filaments filiform, glabrous, 1.8 mm; anthers ovate, 1 mm, apiculate by the protruding connective. Staminodes *c.* 1 mm, glabrous at the base, densely barbate in the upper half. *Ovary* elongate-ovoid, rather densely pilose. *Fruit* ellipsoid, laxly pilose, *c.* 1½ cm long (perhaps not yet full ripe), red; peduncle pilose, 2 mm.

Distr. *Malaysia:* Philippines (Mindanao, Leyte, Luzon: Tayabas).

Ecol. In primary and secondary forests, on moist soil, *c.* 150–500 m.

33. Casearia kostermansii SLEUM. Blumea 7 (1954) 488.

Shrub 3 m; branchlets rather densely short-pubescent, soon glabrous and longitudinally striate. *Leaves* oblong-ovate, rather abruptly (1½–2 cm) acutely acuminate at the apex, broadly cuneate to nearly rounded at the base, chartaceous to subcoriaceous, densely pellucid-punctate but not -lineate, brown and dull when dry, more pale beneath, entire or very obscurely glandular-denticulate, laxly hairy on the midrib above, more densely so underneath both on midrib and nerves when young, glabrescent but remaining hairy at midrib and nerves underneath, 15–20 by (6–)7–9 (–11) cm; midrib thick, nearly flat above, strongly prominent beneath, nerves curved and excurrent along the leaf-margin, somewhat impressed above, prominent beneath, veins and venules nearly obscure above, reticulated but little raised beneath; petiole pubescent, 1½ mm diam., 5–7 mm long. *Glomerules* nearly globose, formed by many, very short (1–1½ mm), densely and minutely bracteate stems, many-flowered. Pedicel rather thick, 1½–2 mm. *Calyx* yellowish-greenish, nearly 4 mm, glabrous in- and outside, 5-lobed to ⅔ of its height. *Stamens* 10; filaments thick-filiform, glabrous, alternately 0.6 and 0.3 mm. Staminodes 0.2 mm, densely whitish-hirsute. *Ovary* narrow-ovoid, 2.2 mm, densely long-hairy; stigma sessile, elongate, thick, *c.* 1 mm long. Immature *fruit* laxly pilose, more densely so towards the apex; peduncle thick, *c.* 2 mm long.

Distr. *Malaysia:* S. Borneo (Sampit-Balikpapan region), once collected.

Ecol. On dry land or low ridge, on sandy loam soil, 10–40 m.

34. Casearia brassii SLEUM. Blumea 7 (1954) 486.

Tree 4 m; branchlets blackish when dry, rather densely greyish-patent-pilose. *Leaves* lanceolate to oblong-lanceolate, gradually attenuate at the apex into a *c.* 3 cm long acute and somewhat curved acumen, acute at the base, chartaceous, with very conspicuous, pellucid dots and lines, dark red-brown when dry, a little shining above, dull beneath, entire or obscurely undulate, glabrous above except the midrib, rather densely patent-pilose on midrib and nerves underneath, glabrous elsewhere; midrib impressed above, prominent beneath, 13–15 by 3½–4½ cm; nerves 8–9 pairs, the inferior 3–4 suberect, superior ones more curved, all obscurely inarched near the leaf-margin, veins rather densely transverse, visibly raised as well as the finer reticulations, specially beneath; petiole slender, ± 1 cm, pubescent. *Flowers* green, in 4–6-flowered fascicles. Bracts numerous, ovate, 1 mm, pubescent. Pedicels ± 4 mm, pubescent. *Calyx* 3 mm, appressed-pubescent outside, rather deeply 5-lobed. *Stamens* 10 (rarely 12); filaments thick-filiform, glabrous, alternately 2 and 1½ mm. Staminodes similar to the filaments, 1 mm, barbate at the apex. *Ovary* elongate-ovoid, 3 mm, glabrous in the inferior half, pilose towards the short style.

Distr. *Malaysia:* SE. New Guinea (Upper Wassi Kussa River), once collected, in fringing rain-forest.

35. Casearia monticola SLEUM. Blumea 7 (1954) 489.

Tree 6 m or shrub; branchlets slender, nigrescent, entirely glabrous. *Leaves* oblong to lanceolate-oblong, ½–1 cm obtusely subfalcate-acuminate at the apex, cuneate at the base, not or slightly inequilateral, thinly chartaceous, dark-brown and rather dull when dry, not or obscurely pellucid-punctate, not or very laxly pellucid-striate, entire or shallowly crenulate, glabrous, sometimes very laxly pilose at the midrib underneath, 5–10 by (2–)2½–3(–3½) cm; midrib flat above, prominent beneath, nerves 4–5 pairs curved-ascending, the lowest pair from the leaf-base, little elevated beneath, reticulations rather dense and finely prominent on both faces; petiole blackish, glabrous, *c.* 5 mm. Uppermost *glomerules* little conspicuous, inferior ones thick, subglobose, up to 4 mm diam., composed of many short axes, many-flowered. Bracts minute, ½ mm diam., pubescent. Pedicels slender, nearly glabrous, 4–5 mm. *Calyx* membranous, pale green, 2 mm, ± densely appressed-pilose in- and outside. *Stamens* 8 or 10; filaments terete, pubescent, alternately 0.9 and 0.6 mm; anthers subglobose, 0.3 mm diam. Staminodes clavate, densely subferrugineous-villous, 0.4 mm. *Ovary* narrow-ovoid, 1½ mm, gradually attenuate into a thick style, pubescent in the inferior half, glabrous upwards.

Distr. *Malaysia:* SE. New Guinea (Central Division).

Ecol. In forests, 1500–1650 m.

36. Casearia ripicola SLEUM. Blumea 7 (1954) 492.

Tree 6–15 m; branchlets ferrugineous-tomentose at the tips, soon glabrous and covered with numerous, pale, oblong lenticels. *Leaves* elliptic or oblong-elliptic, rarely oblong, ½–1 cm subacutely or obtusely acuminate at the apex, cuneate to rounded at the base, dark brownish and little shining when dry, chartaceous, glabrous above except the nerves, ± densely rufous-tomentose initially beneath, specially on midrib and nerves, entirely glabrescent at maturity the midrib and domatia excluded, entire or minutely distantly denticulate, ± conspicuously pellucid-punctate, not pellucid-lineate, (6–)8–13(–15) by (3–)4–6½ cm; midrib slightly impressed above, strongly raised beneath, nerves 8–9 pairs, ± curved and parallel, reticulations rather dense and little, but visibly raised on both faces; petiole pubescent, *c.* 5 mm. *Flowers* whitish to greenish or yellowish, rather numerous per fascicle, but mostly few developed at the same time. Bracts numerous, 1 mm, forming a nearly semi-globose cushion. Pedicels slender, ferrugineous-pubescent. *Calyx* 3 mm, rusty-pilose outside, laxly so inside, 5-lobed nearly to the base. *Stamens* 10; filaments thick-filiform, pilose, alternately 2 and 1.7 mm. Staminodes similar to the filaments, but barbate at the apex, 1 mm. *Ovary* ovoid, 1½ mm, pubescent, attenuate into a nearly glabrous, columnar, 1 mm long style. *Fruit* ellipsoid, orange-yellow, pilose, 2½ by 1½ cm; pedicel slender, 1–1½ cm.

Distr. *Malaysia:* W. New Guinea (Habbema Lake region), very similar material seen from SE. New Guinea (Central Division).

Ecol. In dense primary and secondary rainforests, on moist, flooded ground, 1900–2700 m.

37. Casearia angiensis SLEUM. Blumea 7 (1954) 484.

Shrub 3 m; branchlets laxly rusty-pilose at the tips, glabrescent elsewhere, nigrescent, lenticels obscure. *Leaves* ovate-oblong, *c.* 1 cm obtusely acuminate at the apex, broadly cuneate to nearly rounded at the base, slightly inequilateral, greenish-olivaceous and somewhat shining when dry, subcoriaceous, conspicuously pellucid-punctate and -striate, glabrous above, laxly pilose on midrib and nerves beneath or entirely glabrescent, but always with yellowish domatia, entire or very minutely and remotely glandular-denticulate towards the apex, (5–)7–9(–10) by 2½–4 cm; midrib and 4–5(–6) pairs of nerves nearly flat above, prominent beneath, veins distinctly transverse, venules densely reticulate-prominent on both surfaces; petiole laxly appressed-pilose, 6–9 mm. *Flowers* greenish, in few-flowered fascicles, 1, rarely 2, flowers developed at the same time. Bracts minute, ½ mm, rusty-pubescent as are the pedicels and the calyx. Pedicel 4–5 mm. *Calyx* 2½ mm, deeply 5-lobed. *Stamens* 10, 5 of these normally developed; filaments filiform, glabrous, 1 mm, 5 others reduced in size, filaments ½ mm only. Staminodes 10, filiform, pilose, more densely so at the apex. *Ovary* ovoid, glabrous, 3 mm; style very short. Immature *fruit c.* 1.2 cm long, glabrous.

Distr. NW. New Guinea (Mt Arfak: Angi Gita Lake), once collected.

Ecol. In moist forests, 1800 m.

38. Casearia archboldiana SLEUM. Blumea 7 (1954) 485.

Treelet 3–8 m; branches long, drooping, branchlets entirely glabrous, younger parts and tips nigrescent when dry, older ones pallid-spotted where parts of the dark epidermis have disappeared. *Leaves* elliptic or subovate-elliptic, 1–1½ cm obtusely subcaudate-acuminate at the apex, attenuate into the petiole, somewhat inequilateral, firmly subcoriaceous, shining on both surfaces, dark-brown when dry, younger ones rather densely and distinctly, mature ones obscurely pellucid-punctate, not pellucid-striate, entire, glabrous, but mostly with distinct domatia, 4½–7½ by (2–)2½–3½ cm; midrib prominent on both faces, nerves 4–5 pairs curved upwards and obscurely joining each other near the leaf-margin, little prominent above, distinctly so beneath, veins and veinlets rather densely reticulated on both surfaces; petiole glabrous 8–10 mm. *Fascicles* few-flowered, 1(–2) flowers developed at the same time. Bracts minute, ½ mm, scarious, pubescent. Pedicels slender, *c.* 4 mm. *Calyx* greenish, glabrous outside, papillose-puberulous inside, *c.* 2 mm, rather deeply 5-lobed. *Stamens* 8, subequal; filaments filiform, glabrous, 1 mm. Staminodes clavate, ½ mm, densely hirsute. *Ovary* narrow-ovoid, glabrous, 1½ mm. *Fruit* ellipsoid, red, 1½–2 by 1 cm; peduncle 4 by 1 mm.

Distr. *Malaysia:* N. New Guinea (Bernhard Camp: Idenburg River).

Ecol. Mossy forests, 1700–1800 m.

39. Casearia pallida CRAIB, Kew Bull. (1930) 406; Fl. Siam. En. 1 (1931) 738.

Tree 7–15(–20) m; branchlets angular and glabrous at the tips, terete and greyish-corticate in the older parts. *Leaves* oblong, shortly obtusely acuminate at the apex, broadly cuneate to rounded or subcordate at the base, ± equilateral, chartaceous to subcoriaceous, shining and pallid-olivaceous when dry, entirely glabrous, entire to shallowly undulate, (15–)20–28 by (5½–)6–9(–10) cm; midrib not prominent above, distinctly so beneath, nerves (12–)14–16 pairs, slightly or not raised above, prominent beneath, curved along the margin, veins transverse, veinlets forming dense reticulations which are rather prominent on both surfaces; petiole glabrous 1½–2 cm. *Flowers* congested in many-flowered fascicles, these composed of many, very short, woody, flower-bearing tubercles, which are united in a semiglobose cushion, beset with very numerous, small (½ mm), pubescent bracts. Pedicels slender, subglabrous, 6–8 mm. *Calyx* 4 mm, greenish-white, glabrous, 5-lobed to the base. *Stamens* 10, equal in length; filaments thick-filiform, 3 mm, nearly glabrous. Staminodes clavate, densely hairy, specially at the apex, 2.2 mm. *Ovary* narrow-ovoid, densely hairy, 4 mm; style glabrous, very short. *Fruit* yellowish, oblong, pilose at the apex, *c.* 4½–7 by 2–3 cm; peduncle *c.* 1½ cm. *Seeds* numerous, *c.* 6 mm.

Distr. Siam, in *Malaysia:* Sumatra (Padang Uplands, *leg.* BECCARI), once collected at *c.* 360 m.

Note. Near to *C. flavovirens* BL. in leaf-characters, but apparently not conspecific.

40. Casearia yatesii SLEUM. Blumea 7 (1954) 492.

Shrub?; branchlets glabrous, soon covered with a grey thin cork. *Leaves* oblong, shortly gradually obtusely acuminate at the apex, broadly cuneate to nearly rounded at the base, subcoriaceous to firmly chartaceous, rather densely pellucid-punctate and -striate, brown and somewhat shining when dry, glabrous, regularly glandular-subserrate-dentate (teeth ½–1 mm high, 4–5 mm spaced), 10–17 by 5–7 cm; midrib and nerves nearly flat or slightly impressed above, distinctly prominent beneath, nerves (8–)9–10 pairs, curved-ascending, veins ± transverse, reticulations fine and rather dense, prominent on both faces; petiole rugose, glabrous, *c.* 1½ cm. *Flowers* in many-flowered glomerules at the nodes of defoliate branchlets. Bracts numerous, ovate, densely hairy, ½ mm, forming a semiglobose cushion. Pedicels rather slender, glabrous, 6–8 mm. *Calyx* 4 mm, glabrous, thin, deeply 5-lobed. *Stamens* 10, equal; filaments thick-filiform, glabrous, 3½ mm. Staminodes thick, clavate, densely hirsute, 1.8 mm. *Ovary* narrow-ovoid, 4 mm, gradually attenuate, towards the top into a short style, ± densely hairy.

Distr. *Malaysia:* E. Sumatra (Asahan), once collected, possibly also in N. Sumatra (Atjeh).

41. Casearia gigantifolia SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 399, f. 14; HEYNE, Nutt. Pl. (1927) 1141.

Tree *c.* 20 m; branchlets glabrous. *Leaves* oblong or oblong-elliptic, gradually attenuate at the apex, rounded to cordate at the base, sometimes very inequilateral, olivaceous-brownish when dry, coriaceous or nearly so, laxly pellucid-punctate and -striate, glabrous, rather shining on both surfaces, entire or slightly crenate, midrib somewhat prominent above, strongly so beneath, nerves strongly curved and ± parallel to each other, veins transverse, finely but distinctly prominent on both faces as are the reticulations; petiole glabrous, 1½–2 cm. *Flowers* dilutely greenish (not seen), apparently in rather many-flowered fascicles in the axils of longer persistent leaves. Pedicels glabrous, up to 9 mm. *Calyx* glabrous, 4 mm, deeply 5-lobed, the lobes oblong, 2 mm wide. *Stamens* (9–)10, equal; filaments 2 mm, shortly hairy towards the base; anthers 1 mm. Staminodes barbate, 2 mm. *Ovary* attenuate-ovate, appressed-pilose, 2 mm. *Fruit* woody, 4–6 by 2½–3 cm, sulcate, with 6 ribs; peduncle 1–1½ cm. *Seeds* numerous.

Distr. *Malaysia:* NW. Sumatra (Simalur Isl.).

Ecol. In marshy forest.

Use. Wood sufficiently durable for house-construction.

Vern. *Kadundun dotan, k. silai, k. pajo, ilifen batu.*

42. Casearia tuberculata BL. Mus. Bot. 1 (1850) 254; MIQ. Fl. Ind. Bat. 1, 1 (1855) 709.—*C. hydnocarpoides* QUIS. Philip. J. Sc. 76 (1944) 54.—*C. coriacea* (*non* VENT.) MIQ. Fl. Ind. Bat. 1, 1 (1855) 708; KOORD. & VAL. Bijdr. Booms. 1 (1894) 179; KOORD. Jungh. Gedenkb. (1910) 181; Exk. Fl. Java 2 (1912) 636; Atlas Baumart. Java 2 (1914) t. 345; SLOOT. Bijdr. Flac. (1919) 157; RIDL. Fl. Mal. Pen. 1 (1922) 832; KOORD. Fl. Tjibodas (1923) 193; SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 402, *pro parte*; BURK. & HEND. Gard. Bull. Str. Settl. 3 (1925) 378; DOCTERS VAN LEEUWEN, Zoocecid. (1926) 392; HEYNE, Nutt. Pl. (1927) 1141; MERR. Contr. Arn. Arb. 8 (1934) 110; BURK. Dict. 1 (1935) 472; BACK. Fl. Java (em. ed.) 4, 2 (1942) fam. 84, p. 4.

Medium-sized tree, 4–20 m; bark smooth, whitish; branchlets glabrous, soon covered with a striate, whitish cork. *Leaves* elliptic-oblong to oblong, sometimes ± obovate, mostly ± acutely and sometimes obliquely acuminate at the apex, attenuate into the petiole at the base, ± equilateral, coriaceous to subcoriaceous, laxly but conspicuously pellucid-punctate and -striate, the younger ones red-brown, similarly in colour when dry, entire or nearly so, 5½–15 by (3–)4–6 cm; midrib little or not prominent above, very so beneath, nerves 5–7(–8) pairs arcuate-ascending, mostly little prominent underneath, veins and veinlets densely prominently reticulated on both surfaces; petiole 1–1½ cm, glabrous. *Fascicles* few- or rarely many-flowered. Bracts numerous, scariose, appressed-pilose outside to nearly glabrous, *c.* 1 mm. Pedicels 3–5 mm, glabrous or sparsely pubescent. *Flowers* white or greenish-white, often galled and becoming larger and hard. *Calyx* 3–4(–5) mm, deeply 5-lobed, glabrous or with a few scattered hairs outside, dawny or papillose-velutinous inside, somewhat accrescent in fruit. *Stamens* (6–)8(–9, rarely 10), equal; filaments stoutish, glabrous, 1½ mm. Staminodes similar to the filaments, 1 mm, fimbriate at the apex. *Ovary* ovoid, glabrous or with a few pale hairs, 2½ mm. *Fruit* oblong-ellipsoid, orange to orange-red when fresh, fleshy, (3–)4–5(–6) by ± 1.6 cm; peduncle 7–8 mm. *Seeds* mostly few, 4–6 mm, aril fiery-red.

Distr. *Malaysia:* Sumatra (Atjeh, Tapanuli, Bencoolen), W. Java, once found in the Philippines (Palawan).

Ecol. In Sumatra and Java in mixed montane rain-forest, 1100–1900 m; *fl. fr.* Jan.–Sept.

Uses. Wood hard, white, not durable and too small in size.

Vern. *Tjangtjanatan, ki tèrong, ki pinang, ki tangkil, ki bontèng*, J, *kaju banitan batu*, M.

Note. The differences between *C. tuberculata* and *C. hydnocarpoides* described from Palawan, are so slight, that I cannot maintain the latter as a distinct species. *C. hydnocarpoides* has been collected 'on forested slopes at low altitude', but no fruits were obtained.

Specimens very similar to *C. tuberculata*, but differing by longer, pubescent pedicels, pubescent calyx outside, and the ovary hairy apically, have been found in E. Borneo also at low elevation. As the fruit is not yet known, it cannot be decided, whether these specimens represent a new species or belong to *C. tuberculata*.

43. Casearia clarkei KING, J. As. Soc. Beng. 67, ii (1898) 18; RIDL. Fl. Mal. Pen. 1 (1922) 833.—*C. albicans* (*non* WALL.) CLARKE in HOOK. *f.* & TH. Fl. Br. Ind. 2 (1879) 593, *pr. p.*

var. **clarkei.**

Tree 10–15 m; young branches striate, glabrous. *Leaves* narrow-oblong, gradually acuminate and subacute at the apex, cuneate at the base, ± inequilateral, coriaceous, brownish when dry, glabrous, shining on both faces, 15–25 by 5–7½ cm, entire or nearly so; midrib slightly prominent above, strongly so beneath, nerves 5–7 pairs, curved below, then ascending-suberect, little raised or slightly impressed above, sharply prominent beneath, veins distantly transverse, finely raised on both faces as are the rather dense reticulations; petiole stout, 8–12 mm. *Glomerules* very condensed, many-flowered. Pedicels 6 mm, glabrous. Bracts small, *c.* 0.7 mm, pubescent. *Calyx* green, *c.* 2½ mm, deeply 5-lobed, glabrous outside, densely greyish-puberulous inside. *Stamens* 8, equal; filaments thick-filiform, glabrous, 1 mm. Staminodes thick, somewhat flattened, ½ mm, nearly glabrous except the minutely pilose apex. *Ovary* ovoid, glabrous. *Fruit* ovoid to ellipsoid, bright yellow, 5–6 by 2¹/₂–3 cm.

Distr. *Malaysia:* Malay Peninsula (Malacca, Singapore, Selangor, Perak, Penang).

Ecol. In forests up to 1000 m.

Note. Specially in leaf-characters similar to *C. capitellata*, but the fruit much bigger.

var. **kunstleri** (KING) RIDL. Fl. Mal. Pen. 1 (1922) 833; BURK. & HEND. Gard. Bull. Str. Settl. 3 (1925) 378.—*C. kunstleri* KING, J. As. Soc. Beng. 67, ii (1898) 17.

Differing from the typical species by the ± pear-shaped fruit, 6–7 by 5 cm. Tree 20–28 m, leaves ± 4 cm wide.

Distr. *Malaysia:* Malay Peninsula (Johore, Pahang, Perak, Selangor).

Vern. *Pĕtong kĕkora*, Pahang.

44. Casearia macrocarpa CLARKE in HOOK. *f.* & TH. Fl. Br. Ind. 2 (1879) 593; KING, J. As. Soc. Beng. 67, ii (1898) 18; RIDL. Fl. Mal. Pen. 1 (1922) 853.

Small tree *c.* 6 m, glabrous; young branches reddish. *Leaves* narrow-lanceolate, ± acutely acuminate at the apex, narrowed at the base, thinly coriaceous, red-brown when dry, shining, entire, very laxly or not pellucid-punctate and/or -striate, 10–15 by 2¹/₂–3(–3¹/₂) cm; midrib slightly raised above, prominent beneath, nerves 5–6 pairs, ± erect and excurrent along the leaf-margin, reticulations rather dense and prominent on both surfaces; petiole slender, 6–8(–10) mm. *Flowers* 1–2 per axil. Pedicels *c.* 3¹/₂ mm, glabrous. Bracts few, very small. *Calyx* 2¹/₂ mm, glabrous outside, minutely grey-velvety inside, lobes oblong, blunt, nearly as long as the calyx-tube. *Stamens* 8, equal; filaments thick, 0.8 mm, pilose at the base; anthers ovate, nearly as long as the filaments. Staminodes ¹/₂ mm, densely ferrugineous-hirsute. *Ovary* narrow-ovoid, pilose in the upper half only, 2 mm. *Fruit* narrow-obovoid to ellipsoid, compressed, 3.6–4 by 1.2–1.5 cm. *Seeds* obovoid.

Distr. *Malaysia:* Malay Peninsula (Penang).

Ecol. Hilly forests, local.

Note. Comes near *C. clarkei var. kunstleri*, and perhaps only a narrow-leaved form of it.

45. Casearia ledermannii GILG, Bot. Jahrb. 55 (1918) 286.

Shrub or very slender tree, (1–)1¹/₂–5 m; young branchlets applanate, tips minutely pubescent, soon glabrescent, dark-brown to blackish when dry. *Leaves* ovate or ovate-oblong to oblong, ± abruptly subacutely acuminate at the apex, cuneate at the base into the petiole, entire, firmly chartaceous, laxly pellucid-punctate and-lineate, glabrous, but sometimes very minutely pubescent along the midrib beneath, dark-brown to blackish-brown when dry, 6–8(–10) by 2¹/₂–4¹/₄ cm; midrib not or slightly raised above, distinctly so beneath, nerves (4–)5–6(–7) pairs, curved upwards, flat above, little prominent beneath, reticulations of veins and venules dense and little but markedly prominent on both surfaces specially beneath; petiole glabrous, *c.* 3 mm. *Flowers* greenish, 1 or 2 on top of a very short (1 mm) axis, this densely covered with membranous, pubescent bracts which do not conceal the pedicel. Pedicel rather slender, minutely pubescent, 2–2¹/₂ mm. *Calyx* 1¹/₂ mm, minutely pubescent outside, greyish-papillose or -velutinous inside, deeply 5-lobed. *Stamens* 10; filaments filiform, glabrous, alternately 0.5 and 0.3 mm. Staminodes very short triangular, densely pilose. *Ovary* narrow-ovoid, glabrous, 1.8 mm. *Fruit* (not seen) ovoid-subglobose, orange. *Seeds* few, aril blood-red.

Distr. *Malaysia:* NE. New Guinea (Sepik region).

Ecol. In dense, mossy rain-forest, 1000–1150 m.

46. Casearia flavovirens BL. Mus. Bot. 1 (1850) 254, t. 50; MIQ. Fl. Ind. Bat. 1, 1 (1855) 710; KOORD. & VAL. Bijdr. Booms. 1 (1894) 178; KOORD. Exk. Fl. Java 2 (1912) 636; Atlas Baumarten Java 2 (1914) t. 346; SLOOT. Bijdr. Flac. (1919) 155; Bull. Jard. Bot. Btzg III, 4 (1922) 279; *ibid.* III, 7 (1925) 401; BACK. Fl. Java (em. ed.) 4, 2 (1942) fam. 85, p. 3.—*C. odorata* T. & B. Nat. Tijd. Ned. Ind. 2 (1851) 304; Ned. Kruidk. Arch. 3 (1855) 408; MIQ. Fl. Ind. Bat. 1, 1 (1855) 710.—**Fig. 37.**

Large tree, 15–30 m, bark grey. Branchlets glabrous. *Leaves* elliptical-oblong or elliptical-lanceolate, with long-elongate apex, obtuse or rounded at the base, rarely subcordate or cuneate, coriaceous, glabrous, obtusely crenate-serrate (1 mm) or entire, shining specially above, olivaceous-yellowish when dry, pellucid-punctate, 12–22(–25) by 5–8(–9) cm; midrib little prominent above, very so beneath, nerves 12–15 pairs, curved upwards, nearly flat above, prominent beneath, veins ± transverse and veinlets ± densely reticulate and finely prominent on both surfaces; petiole glabrous, 1–1¹/₂(–2) cm. *Fascicles* many-flowered, normally axillary, but also recorded from leafless nodes. *Flowers* fragrant, greenish-white, light-green or yellowish-green. Bracts minute, scariose, densely pubescent, rather numerous. Pedicels glabrous, slender, 10–15 mm in anthesis. *Calyx* glabrous on both sides, *c.* 5 mm, deeply 5-lobed, lobes reflexed during anthesis. *Stamens* 10; filaments filiform, cream-coloured, 3–4 mm, nearly glabrous; anthers laxly patently hairy, light-yellow. Staminodes light-yellow, clavate, densely hirsute, 3 mm. *Ovary* narrow-ovoid, 5 mm, densely hairy; style 2 mm, glabrescent. *Fruit* ellipsoid, beaked, with 3 strong longitudinal ribs, *i.e.* the edges of the valves, glabrous, hard and hexagonous when dry, orange or yellowish or reddish-orange when ripe, 5–7 (rarely up to 9) by 3–3¹/₂ cm; peduncle 1.2–1.5 cm long, *c.* 2 mm diam. *Seeds* numerous, striate with deep-red aril.

Distr. *Malaysia:* Java, Lesser Sunda Islands (Bali).

Ecol. In mixed primary or devastated rain-forest, up to 800 m; *fl. fr.* Jan.–Dec.

Uses. Wood little durable.

Vern. *Rasakadu*, *huru tulang*, S, *njampu wedi*,

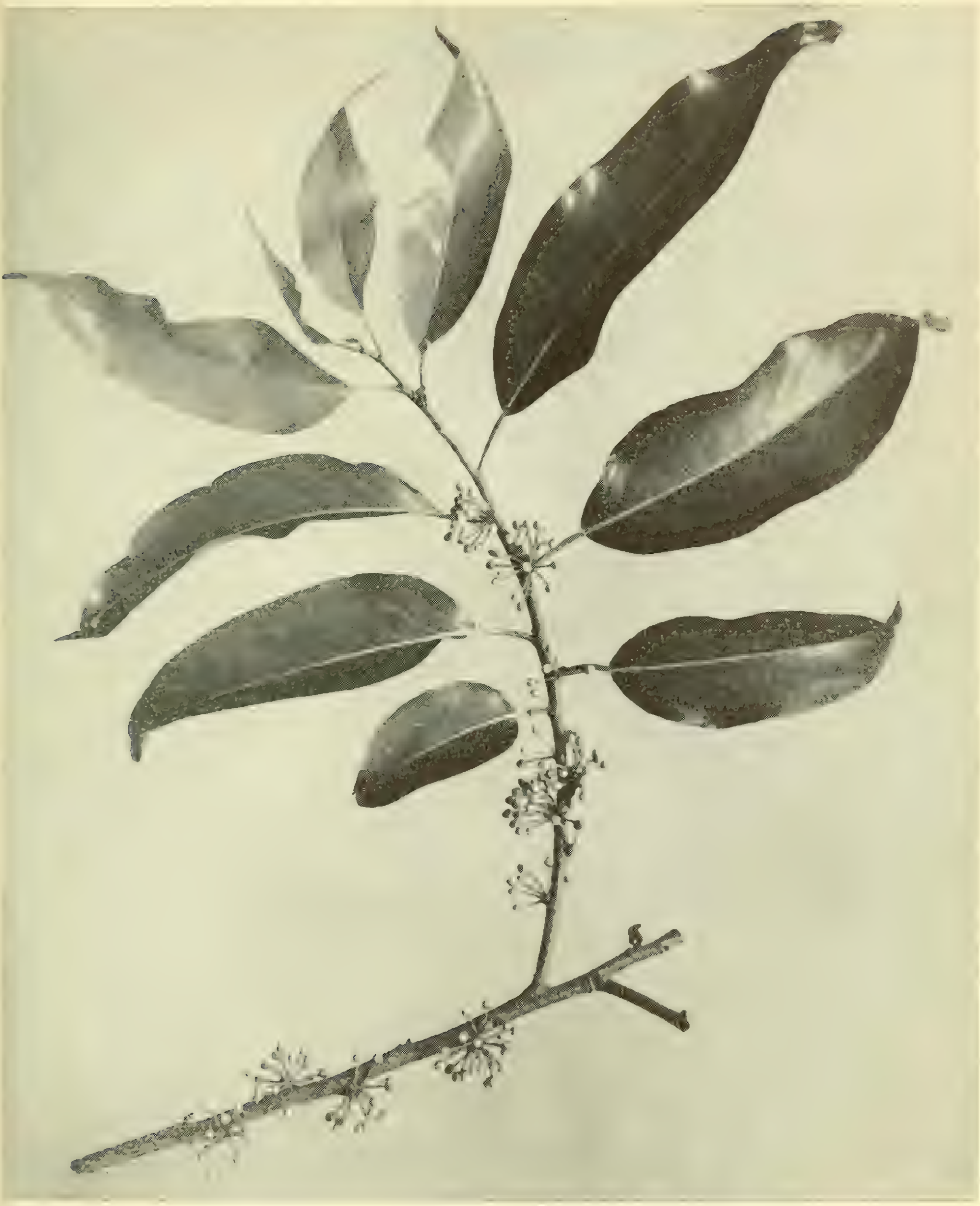

Fig. 37. *Casearia flavovirens* Bl., × 2/7 (C.H.B. IV–F–20a).

bělung, *balung*, *badung*, *pěndjaliran těndjang*, J. Bali: *putih* (*butu*) *mejong*.

47. Casearia minutiflora Ridl. J. Bot. 62 (1924) 297; Hend. Gard. Bull. Str. Settl. 4 (1926) 97.

Shrub 1½ m; branchlets entirely glabrous, striate, soon covered with a thin, grey cork. *Leaves* oblong-lanceolate, 1–1½ cm obtusely acuminate at the apex, cuneate at the base, glabrous, dark green-brownish when dry, shining on both sides, subcoriaceous, entire, laxly pellucid-striate, not or obscurely pellucid-punctate, 5–10 by 2½–4½ cm; midrib distinctly impressed above, prominent beneath, nerves 4–5(–6) pairs, curved-ascending, distinctly anastomosing near the leaf-margin, little prominent above, more so beneath, veins and veinlets equally and ± densely reticulate-prominent on both faces; petiole rather slender, blackish, glabrous, *c.* 5 mm. *Flower* 1–2 per fascicle, subsessile, very small, green. Bracts ovate, subacuminate, 1¹/₂ mm, membranous, glabrous. *Calyx* 2¹/₂ mm, 4 or mostly 5-lobed, the lobes ovate-oblong, obtuse, glabrous on both sides. *Stamens* (6–)8, equal; filaments thick-filiform, subulate towards the apex, glabrous, *c.* 0.9 mm; anthers minute. Staminodes oblong, pilose specially at the apex, 0.6 mm. *Ovary* ovoid, glabrous. *Fruit*, apparently not quite mature, 1¹/₂ by 1 cm, nearly sessile, probably yellow, with 3–4 rather big red *seeds*.

Distr. *Malaysia:* Malay Peninsula (known with certainty only from the type-locality: Fraser Hill, Pahang).

Ecol. Mountain-forest, 1200–1300 m.

Note. Possibly only a few-flowered form of *C. flexula* RIDL.

48. Casearia flexula RIDL. Fl. Mal. Pen. 1 (1922) 832, f. 67.—*C. flexuosa* RIDL. J. Fed. Mal. St. Mus. 7 (1916) 41, *non* CRAIB 1911.

Shrub; branches flexuous, with pale bark, branchlets glabrous. *Leaves* lanceolate, narrowed at both ends, subacute at the apex, thinly coriaceous, glabrous, shining, brownish when dry, laxly pellucid-striate, not or obscurely pellucid-punctate, entire, midrib slightly prominent above, strongly so beneath; nerves 4–5(–6) pairs, nearly flat above, little raised beneath; reticulations dense and rather prominent on both sides; petiole 5–8 mm, slender. *Fascicles c.* 20-flowered. Bracts numerous, membranous, acute, ciliate. Pedicels 2–3 mm, slender, glabrous. *Calyx* 2¹/₂ mm, glabrous. *Stamens* 8, equal; filaments glabrous, 0.8 mm; anthers apiculate by the thick connective. Staminodes oblong-linear, villous at the tips only, ¹/₂ mm. *Ovary* glabrous *c.* 1.6 mm. *Fruit* ellipsoid, said to be apricot-coloured when fresh, *c.* 1.8 cm long; peduncle 5 mm.

Distr. *Malaysia:* Malay Peninsula (known with certainty only from the type-locality: Kedah Peak = G. Jerai), 660–1200 m.

Note. Very similar specimens I saw from G. Angai, Negri Sembilan, 700 m, and G. Tahan, Pahang, 1000–1200 m, G. Hijau, Perak, 1440 m. Also specimens from W. Sumatra: G. Kerintji and G. Talakmau, 1750–2000 m, and Borneo: Mt Kinabalu, 1800 m, Mt Kemul, 1800 m, seem to belong to *C. flexula*, which may be a mountain-form of *C. capitellata* BL. with smaller, less coriaceous leaves.

49. Casearia capitellata BL. Mus. Bot. 1 (1850) 254; MIQ. Fl. Ind. Bat. 1, 1 (1855) 709; MERR. En. Born. (1921) 412.—*C. latifolia* RIDL. J. Str. Br. R. As. Soc. *no* 75 (1917) 34, *obs.*; Fl. Mal. Pen. 1 (1922) 831.—*C. albicans* (*non* WALL. *ex* CLARKE *quoad* WALLICH 7197.2, 7197.3) KING, J. As. Soc. Beng. 67, ii (1898) 16 *quoad* WALLICH 7197.1, 7432.—*C. borneensis* MERR. J. Str. Br. R. As. Soc. *no* 86 (1922) 333; Pl. Elm. (1929) 210.

A big shrub or treelet, 3–4 m, with flexuous white slender branches, quite glabrous. *Leaves* elliptic-ovate to elliptic-oblong, rather abruptly (1¹/₂–2 cm) acuminate and mostly subacute at the apex, broadly attenuate to rounded at the base, thinly coriaceous, flexuous, dark green to brownish when dry, shining on both surfaces, (10–)12–18 (–20) by (4¹/₂–)5–8(–10) cm, very laxly or not pellucid-punctate and -striate, entire; midrib grooved or little prominent, strongly raised beneath, nerves *c.* 8 pairs curved-ascending, little or not prominent above, sharply so beneath, reticulations close, finely but distinctly raised on both faces; petiole rather slender, dark when dry, 6–10(–15) mm. *Flowers* pale-green or white, in mostly many-flowered fascicles. Bracts ovate, acuminate, subacute, 1 mm, pubescent. Pedicels slender, glabrous, 4–5 mm. *Calyx* 2–2¹/₂ mm, glabrous in- and outside, lobes ovate-oblong. *Stamens* 8, equal; filaments filiform, glabrous, 1 mm; anthers minute. Staminodes subrectangular, a little flat, ¹/₂ mm, pilose at the apex. *Ovary* ovoid, glabrous. *Fruit* oblong-ellipsoid, in fascicles of 2–3, yellow to orange when mature, 1¹/₂–2 by 1 cm; peduncle 5 mm. *Seeds* few.

Distr. *Malaysia:* Sumatra (also Simalur & Banka Islands), Malay Peninsula (Penang, Pahang, Selangor, Perak, Wellesley, Trengganu, Kemaman), Borneo.

Ecol. Hill forests, 100–500 m.

Vern. *Mĕlilien*, Banka, *ielah-ielah uding*, *tutun kadundun*, *t.k. buluh*, *arelah uding*, *kadundun sitobulung*, Simalur.

50. Casearia brevipes MERR. Philip. J. Sc. 9 (1914) Bot. 326; En. Philip. 3 (1923) 114.

Small tree or shrub; branchlets slender, minutely pubescent, soon glabrous and brownish to greyish-corticate. *Leaves* oblong or oblong-lanceolate, gradually acuminate and subacute at the apex, broadly cuneate to nearly rounded at the base, chartaceous, glabrous, light-brownish when dry, somewhat shining, densely pellucid-punctate, not or very little pellucid-striate, entire or minutely glandular-denticulate, 14–20 by 4–7 cm; midrib prominent above in the inferior half, very so beneath, nerves 8–10 pairs, straight in the basal part, apically curved upwards, flat above, prominent beneath, reticulations little visible above, distinctly so beneath; petiole *c.* 2 mm long and thick. *Fascicles* few-flowered, on prominent, densely bracteate tubercles. Bracts small, *c.* 0.7 mm diam., pubescent. Pedicels glabrous, *c.* 3 mm. *Calyx* 3 mm, glabrous on both sides, deeply 5-lobed. *Stamens* 10, equal; filaments thick, glabrous, 0.8 mm; anthers ovate, as long as the filaments. Staminodes 0.4 mm, thick, pilose at the apex. *Ovary* narrow-ovoid, 2 mm, glabrous or with a few hairs.Fruit ovoid-ellipsoid, *c.* 1 cm, orange subsessile. *Seeds* red.

Distr. *Malaysia:* Philippines (Luzon, Basilan).

Ecol. In forests along streams at low elevation.

51. Casearia novo-guineensis VAL. Bull. Dép. Agric. Ind. Néerl. 10 (1907) 35; SLOOT. Bijdr.

Flac. (1919) 156; Nova Guinea 14 (1924) 94; Bull. Jard. Bot. Btzg III, 7 (1925) 412.

Small tree or shrub; branchlets initially finely pubescent, glabrescent. *Leaves* elliptic-lanceolate to elliptic-oblong, shortly ± obtusely acuminate at the apex, cuneate at the base, subinequilateral, practically glabrous but very minutely pubescent on the midrib beneath, chartaceous, blackish-brown when dry, obscurely crenulate to entire, not pellucid-punctate or -striate, 11–15 by 3½–5 cm; midrib nearly flat above, prominent beneath, nerves 8–9 pairs, curved upwards, little prominent beneath, veins transverse, rather obscure on both surfaces; petiole glabrous, *c.* 5 mm. *Flowers* few per fascicle. Bracts small, 1 mm, numerous, ovate, subacute, membranous, sparsely pubescent. Pedicels ½ mm. *Calyx* 2½ mm, glabrous, the upper half 5-lobed. *Stamens* 10; filaments filiform, shortly pubescent, alternately 1 and 0.6 mm. Staminodes very short, barbate. *Ovary* narrow-ovoid, 1.6 mm, ± densely hairy.

Distr. NW. New Guinea (P. Jatuwar near Wakobi, Geelvink Bay), in rain-forests.

52. Casearia brideliifolia SLEUM. Blumea 7 (1954) 487.

Shrub 2 m; branchlets laxly beset with minute hairs, practically glabrous, nigrescent when dry, older parts covered with a thin grey cork. *Leaves* elliptic or oblong-elliptic, 1 cm subacutely acuminate at the apex, cuneate into the very short petiole at the base, dark-brown when dry, dull, glabrous, subcoriaceous, the younger rather densely and minutely pellucid-punctate and -striate, mature ones ± without pellucid dots, (10–)12–18 by (5–)6–9 cm, entire to shallowly undulate; midrib prominent beneath, nerves *c.* 9 pairs, curved upwards toward the margin, prominent beneath, veins ± transverse and distant, a little raised beneath only; petiole rather thick, *c.* 2 mm, glabrous. *Fascicles* 3–4-flowered. Pedicels rather thick, *c.* 2 mm, glabrous. Bracts small, ciliate, 1 mm. *Calyx* 2 mm, deeply 5-lobed, glabrous in- and outside. *Stamens* 10; filaments filiform, glabrous, alternately 0.6 and 0.4 mm; anthers minute. Staminodes elongate-triangular, applanate, fimbriate at the apex, ½ mm. *Ovary* ovoid, glabrous, 1½ mm; style short but distinct. Immature *fruit* red, glabrous, on a 2–3 mm long peduncle.

Distr. *Malaysia:* NW. New Guinea (Nabire, Geelvink Bay), once collected.

Ecol. Rain-forest, *c.* 400 m.

53. Casearia euphlebia MERR. Philip. J. Sc. 13 (1918) Bot. 34; En. Philip. 3 (1923) 115.

Shrub *c.* 2 m; young branches slender, pallid, pubescent at the tips, soon covered with peeling, greyish cork. *Leaves* oblong-ovate to oblong-elliptic, 1 cm rather abruptly obtusely acuminate at the apex, very broadly cuneate to rounded at the base, ± equilateral, olivaceous when dry, somewhat shining above, dull beneath, ± firmly chartaceous, distinctly pellucid-punctate and -striate, minutely denticulate to nearly entire, 6–13 by (3½–)4–6 cm; midrib little prominent above, strongly so beneath and sometimes minutely pubescent at the base, nerves *c.* 7 pairs, rather straight-ascending and subparallel to each other, slightly impressed above, markedly prominent beneath, veins laxly transverse obscure above, little raised beneath; petiole glabrous or minutely pubescent, 3–5 mm. *Flowers* solitary. Pedicels stoutish, 2–2½ mm. Bracts very small, few. *Calyx*-lobes elliptic-rounded, *c.* 4 mm, minutely pubescent or nearly glabrous outside. *Stamens* 8 subequal; filaments filiform, glabrous, *c.* 1½ mm; anthers minute, oblong. Staminodes triangular-oblong, truncate, thin and flat, *c.* 1½ mm long, 0.7 mm wide at the base, pilose at the apex. *Ovary* glabrous, ovoid. Young *fruit* red, oblong, *c.* 1½ cm.

Distr. *Malaysia:* Philippines (Leyte, Samar).

Ecol. In forests at low altitude.

54. Casearia oreogenes SLEUM. Blumea 7 (1954) 490.

Small tree or shrub; branchlets angular, nigrescent, minutely pubescent at the tips, glabrous elsewhere, older parts grey-corticate. *Leaves* subovate-elliptic-oblong, gradually obtusely acuminate at the apex, very broadly cuneate to truncate at the base, but protracted into the petiole at the very base, subcoriaceous, rather densely pellucid-punctate and -striate, glabrous except the finely pubescent midrib of the immature leaves, somewhat shining on both surfaces, dark-brown when dry, entire or minutely sinuate-denticulate, 15–20 by 6–9 cm; midrib stout beneath, nerves 10–11 pairs, little curved, straight-ascending towards the leaf-margin and ± parallel to each other, veins transverse, rather obscure above, more conspicuous beneath, reticulations visible underneath only; petiole stoutish, laxly pubescent, 4–7 mm. *Fascicles* 3–4-flowered. Bracts rather few, ovate, pubescent, 1 mm. Pedicels blackish when dry as is the calyx, firm, glabrous, 2–3 mm. *Calyx* subcoriaceous, glabrous outside, puberulous inside, 5 mm, rather deeply 5-lobed, the lobes oblong subacute. *Stamens* 10; filaments filiform, glabrous, alternately 2 and 1½ mm; anthers subglobose, 0.4 mm diam. Staminodes triangular-oblong, applanate, densely whitish-hirsute, 1 mm. *Ovary* ovoid, densely whitish-hairy as is the receptacle, 2 mm, stigma sessile. *Fruit* ellipsoid, laxly pubescent to glabrescent, red, *c.* 1.8 by 1.5 cm; peduncle 3 mm.

Distr. *Malaysia:* NE. New Guinea (Sattelberg region), once found.

Ecol. In hill forest, 600–900 m.

55. Casearia halmaherensis SLOOT. Bull. Jard. Bot. Btzg III, 7 (1925) 410, f. 15.

Treelet or tree, 2½–24 m; branchlets glabrous or nearly so, compressed, blackish when dry. *Leaves* oblong to oblong-ovate, ± abruptly obtusely acuminate at the apex, broadly cuneate to rounded at the base, ± equilateral, firmly chartaceous or subcoriaceous, blackish-brownish when dry, glabrous, shining on both surfaces, not or minutely pellucid-punctate, entire, 10–16 (rarely up to 22) by 4½–6 (rarely up to 10) cm; midrib flat above, prominent beneath, nerves 9–10 pairs, rather straight and subparallel to each other, obscure or slightly impressed above, prominent beneath, veins distantly transverse, nearly inconspicuous above, little prominent beneath, reticulations fine and dense beneath only; petiole 4–6 mm, glabrous. *Fascicles* many-flowered, seen in buds only. Bracts rather few, ovate, acute, ciliate, 1 mm. Pedicels 2–3 mm, glabrous. *Calyx* glabrous outside, nigrescent, *c.* 3 mm. *Stamens* 10; filaments slightly pilose, alternately 1 and 0.7 mm. Staminodes ½ mm, barbate towards the apex. *Ovary* glabrous. *Fruit* ovoid-oblong, *c.* 1.2–2 by 1.1–0.8 cm, yellowish to orange when fresh, nigrescent when dry; peduncle 5–7 mm.

Distr. *Malaysia:* Moluccas (Halmahera, Ternate).

Ecol. Scattered in young forests, up to 350 m.

Vern. *Tu uhi*, Halmah., *dongo-dongo*, Ternate.

56. Casearia flexicaulis K. SCHUM. in SCHUM. & LAUT. Nachtr. Fl. Deut. Schutzgeb. Südsee (1905) 320; GILG, Bot. Jahrb. 55 (1918) 289.

Small tree, 10–12 m, trunk and branches flexuous; branchlets slender, ± densely minutely pubescent, brownish when dry, terete. *Leaves* oblong or lanceolate-oblong, sometimes ovate-oblong, broadly obtusely acuminate at the apex, cuneate at the base, ± inequilateral, coriaceous to subcoriaceous, yellowish-brown when dry, paler beneath, shining above, not pellucid-punctate, entire, 6–10 by 3–4½ cm; midrib slightly prominent above, distinctly so beneath, nerves 5(–6) pairs, curved-ascending, flat, little prominent beneath, veins distantly transverse, nearly inconspicuous above, minutely raised beneath as are the finer reticulations; petiole slender, glabrous, 5–7 mm. *Fascicles* many-flowered, from small, subglobose tubercles. *Flowers* greenish. Bracts small, ½ mm diam., pubescent. Pedicels slender, laxly pilose, 3–4 mm. *Calyx* 3 mm, deeply 5-lobed, pubescent outside, glabrous inside. *Stamens* 10; filaments alternately 1 and 0.6 mm, nearly glabrous. Staminodes ½ mm, densely villous. *Ovary* narrow-ovoid, 2 mm, glabrous or nearly so, the stigma sessile.

Distr. *Malaysia:* NE. New Guinea (Sattelberg, Morobe Distr.).

Ecol. In forests, 1000–1100 m.

Note. WHITE (J. Arn. Arb. 10, 1929, 244) mentions *C. flexicaulis* from British Papua, but his specimen is not conspecific, the nerves being more numerous.

57. Casearia glabra ROXB. Hort. Beng. (1814) 33, *nomen*; Fl. Ind. 2 (1832) 421, *descr.*; MERR. Philip. J. Sc. 11 (1916) Bot. 293.—*C. moluccana* BL. Mus. Bot. 1 (1850) 255; MIQ. Fl. Ind. Bat. 1, 1 (1855) 711; SLOOT. Bijdr. Flac. (1919) 159; Bull. Jard. Bot. Btzg III, 7 (1925) 404; MEIJER DREES, Comm. For. Res. Inst. 33 (1951) 106.

Shrub or small tree, *c.* 3 m; branchlets slender, minutely puberulent. *Leaves* ovate to oblong-ovate, gradually acuminate towards the apex, subacute, broadly or mostly rounded at the base, somewhat protracted into the petiole at the very base, subcoriaceous, entirely glabrous, mostly shining above, ± dark brown when dry, practically not pellucid-punctate, entire to obscurely crenate, (8–)12–16(–20) by (3–)5–8(–10) cm; midrib slightly or not raised above, prominent beneath, nerves 8(–9) pairs, curved and ± parallel to each other, prominent beneath, veins transverse, little conspicuous above, more so beneath as are the fine rather dense reticulations; petiole finely pubescent, *c.* 5 mm. *Fascicles* 4–6-flowered, showing a tendency to grow into very short axes with age. Bracts dense, ovate, acuminate, 1 mm, nearly glabrous. Pedicel glabrous, 1 mm. *Calyx* entirely glabrous, 2½ mm. *Stamens* 10; filaments glabrous alternately 0.9 and 0.6 mm. Staminodes triangular, densely pilose as is the receptacle, ½ mm. *Ovary* narrow-oblong, laxly pilose towards the apex; style short. *Fruit* oblong-elliptic, *c.* 1.2 by 0.8 cm; peduncle 2 mm. *Seeds* few.

Distr. *Malaysia:* Moluccas (Amboina, W. Ceram, Buru: Kajeli).

Ecol. Preferably in evergreen forests up to 1500 m.

58. Casearia urophylla GILG, Bot. Jahrb. 55 (1918) 287.

Treelet 8–10 m; branchlets angular, laxly and very shortly pilose, soon covered with a thin yellowish-greyish cork. *Leaves* oblong or oblong-lanceolate, narrowly and *c.* 2 cm acutely acuminate at the apex, long-attenuate at the base, chartaceous to membranaceous, glabrous, laxly pellucid-punctate and longish pellucid-striate, blackish-brown when dry, 7–10 by 2¾–3¼ cm, entire; midrib prominent on both sides, nerves 8–9(–11) pairs, not raised above, little so beneath, veins numerous and densely reticulated, little or not conspicuous above, prominent beneath; petiole 7–10 mm. *Flowers* yellowish-greenish, numerous in dense fascicles on short (up to 1 mm) axes, these covered with minute, ciliolate bracts. Pedicels slender, sparsely pubescent. *Calyx* 2 mm, short-pilose, deeply 5-lobed. Well-developed flowers and fruits not yet known.

Distr. *Malaysia:* NE. New Guinea (Sepik region: Aprilfluss), once found in rain-forest 60 m.

Note. The species was described with stamens and ovary transformed into sterile leaf-whorls.

59. Casearia loheri MERR. Philip. J. Sc. 9 (1914) Bot. 327; En. Philip. 3 (1923) 115.—*C. elliptifolia* (*nec* MERR. 1916) ELM. *ex* MERR. En. Philip. 3 (1923) 115, *in obs. pr. syn.*; Leafl. Philip. Bot. 10 (1939) 3738, *descr.*—*C. paucinervia* MERR. & QUIS. Philip. J. Sc. 82 (1953) 331.

Small shrub-like tree, 4–6 m; branchlets slender, minutely pubescent, dark brown, the elder parts greyish. *Leaves* oblong-ovate to elliptic, mostly subabruptly obtusely acuminate at the apex, broadly attenuate to rounded at the base, chartaceous, brown and dull when dry, paler beneath, initially very laxly pilose on the midrib beneath, entirely glabrous at maturity, densely, minutely pellucid-punctate, entire, 8–16(–18) by 4–6(–8) cm; midrib a little impressed above, prominent beneath, nerves (4–)5–6(rarely up to 8) pairs, curved-ascending, obscure above, little raised beneath, veins distantly transverse, somewhat elevated beneath, reticulations ± distinct; petiole laxly pubescent, 4–7 mm. *Fascicles* few-flowered. Bracts broad-ovate, pubescent, 0.6 mm. Pedicels 1½–2 mm, pubescent. *Calyx* yellowish-green, laxly pilose outside, glabrous inside, very pellucid-punctate, *c.* 3½ mm. *Stamens* 8, equal; filaments filiform, glabrous, 1.4 mm; anthers oblong-ovate, 0.8 mm. Staminodes oblong, thick, *c.* 0.9 mm, hirsute towards the apex only. *Ovary* ovoid, 1.2 mm, densely subferrugineous-pilose in the upper half, glabrous towards the base. *Fruit* ovoid-ellipsoid, yellow or reddish, glabrous, *c.* 1.2 by 0.8 cm; peduncle 2 mm. *Seeds* 8–12(–15), red, *c.* 5 mm.

Distr. *Malaysia:* Philippines (Luzon, Mindanao, Samar).

Ecol. In primary forests, up to 660 m.

Use. Wood moderately hard, yellowish-white.

60. Casearia olivacea SLEUM. Blumea 7 (1954) 490.

Small tree 4–5 m; branchlets slender, terete, glabrous, brownish. *Leaves* ovate-oblong, 1½–2 cm subcaudate-acuminate and acute at the apex, attenuate at the base into the petiole, chartaceous, olivaceous and dull when dry, very densely and rather minutely pellucid-punctate (not -striate), entire, glabrous, (9–)10–15 by 3–5 cm; midrib little elevated above, manifestly so beneath, nerves (4–)5–6 pairs, curved-ascending and excurrent along the leaf-margin, the superior 2–3 slightly inarched, all obscure above, little prominent beneath, veins ± transverse and distant, somewhat raised beneath, reticulations inconspicuous. *Fascicles* 4–6-flowered. *Flowers* white. Bracts minute, ½ mm, densely whitish-pubescent, forming small glomerules. Pedicels laxly pilose, ± 1½ mm. *Calyx* laxly pilose outside, puberulous inside, the 5 lobes *c.* 3 mm. *Stamens* 10; filaments thick-filiform, very laxly pilose, alternately 1.1 and 0.8 mm; anthers subglobose, 0.4 mm diam. Staminodes ½ mm, whitish-hirsute. *Ovary* narrow-ovoid 2½ mm, rather densely pilose; style very short. *Fruit* ellipsoid, glabrous or nearly so, red with yellow or greenish streaks, 3–3½ by 2–3 cm when ripe; peduncle pubescent, 4 mm.

Distr. *Malaysia:* SE. New Guinea (Fly River and Sogeri region).

Ecol. Rather common in rain-forest undergrowth, sometimes on low ridges, below 100 m.

Excluded

Casearia coriacea VENT. Choix (1803) 45, t. 45. —*C. fragilis* VENT. *ibid.* 47.—*C. fasciculata* BOJ. Hort. Maur. (1837) 71.

C. coriacea was described by VENTENAT after a specimen said to be collected at 'Batavia' by RICHE, one of the botanists of the voyage by 'La Recherche' and 'L'Espérance' (1791–1794). Subsequently, other material from Java was referred to VENTENAT's species, *e.g.* by KOORDERS & VALETON and by VAN SLOOTEN. None of them examined VENTENAT's type specimen. The latter reduced *C. tuberculata* BL. and *C. capitellata* BL. to the so-called *C. coriacea.*

The examination of the holotype of *C. coriacea*, preserved at Geneva, revealed, that *C. coriacea* is not conspecific with the Javanese plant, but distinctly so with *C. fragilis* VENT. from Réunion and Mauritius. It is now clear, that the type-specimen was not collected in Java, but in Mauritius, touched by the same expedition on their return voyage.

Casearia esculenta ROXB. Hort. Beng. (1814) 90, *nom. nud.*; Fl. Ind. 2 (1832) 422, *descr.*

C. esculenta was described from the Circar Mts (NE. Deccan); neither a type-specimen nor an original drawing seem to exist. Following the description by GAMBLE, Fl. Madras 3 (1919) 521, and concluding from Indian material, *C. esculenta* ROXB. is not represented in Malaysia, as *e.g.* KING, RIDLEY and VAN SLOOTEN were inclined to accept. Malaysian material formerly identified as *C. esculenta* belongs to *C. capitellata* BL., *C. minutiflora* RIDL., *C. tuberculata* BL. or other species.

Casearia tinifolia VENT. Choix (1803) 47, t. 47.—*Samyda tinifolia* POIR. Encycl. Suppl. 5 (1817) 32.—*Chaetocrater tinifolia* RAF. Sylv. Tell. (1838) 149.

This species was described by VENTENAT on the basis of a specimen assumed to have been collected in Java by LAHAYE, but material corresponding to the excellent plate in VENTENAT's work has never been collected again in Java. The type-specimen at Geneva is identical with material collected by COMMERSON (*no* 300) in Mauritius and preserved in the Paris Herbarium. The specimen of LAHAYE, who also joined the expedition of 'La Recherche' and 'L'Espérance', was apparently wrongly localized and came from Mauritius.

Casearia luzonensis WARB. in E. & P. Nat. Pfl. Fam. III, 6a (1893) 51, f. 19 D–F(*fr.*).

Unrecognizable; no description has been published.

GENERA AND SPECIES EXCLUDED

Dovyalis macrodendron GILG, Bot. Jahrb. 55 (1918) 282, f. 5; in E. & P. Nat. Pfl. Fam. ed. 2, 21 (1925) 441, f. 202.

Distr. NE. New Guinea (Sepik River), 100–200 m.

Note. The type: LEDERMANN 7400 (B) has been destroyed; no isotype seems to exist.

This species was described and figured with flowers in fascicles *opposite* the leaves. As *Dovyalis* has always axillary flowers, the species does not belong to this genus. Apparently not belonging to the *Flacourtiaceae*, perhaps to *Euphorbiaceae*.

Quadrasia euphorbioides ELM. Leafl. Philip. Bot. 7 (1915) 2656.
Described as a monotypic genus from the Philippines. MERRILL (En. Philip. 2, 1923, 430) reduced it to *Claoxylon* (*Euphorbiaceae*).

SALICACEAE (M. Jacobs, Leyden)

1. SALIX

TOURN. *ex* LINNÉ, Sp. Pl. 2 (1753) 1015; Gen. Pl. ed. 5 (1754) 447; ANDERSSON, Kongl. Svenska Vet.-Ak. Handl. 6, 1 (1865) 1–180; in DC. Prod. 16^2 (1868) 191; PAX in E. & P. Pfl. Fam. 3, 1 (1889) 29.—**Fig. 1, 3.**

Dioecious trees or shrubs. Growth-mode in flushes. *Leaves* simple, spirally arranged, mostly elliptic to linear, often deciduous. Stipules mostly caducous, sometimes wanting. Catkins terminal, on short, caducous, axillary axes (bearing dwarfed leaves in Mal. *spp.*). *Flowers* about spirally arranged along the rhachis of the catkin, each subtended by a membranous, entire bract. *Perianth* absent. *Disk* variable in shape, often consisting of 2 median lobules, or only one adaxial (in extra-Mal. *spp.* rarely more in a whorl, or cupular). *Stamens* (1–)2–15, in Malaysian *spp.* free or nearly so; anthers dehiscing longitudinally. *Ovary* more or less stipitate, 1-celled, consisting of 2 carpels; style more or less distinct, lobed. Ovules several, anatropous, basal, inserted amidst a mass of gradually developing, 1-celled hairs on 2 marginal placentas in the lower part of the ovary; the hairs arising both from the funicle and surrounding tissue. *Capsule* 2-valved, valves recurving. *Seeds* small, pushed out together with the hairs, without endosperm; testa thin.

Distr. About 300 *spp.*, except a few tropical and subtropical ones, restricted to the temperate and cold zones of the N. hemisphere.

Note. The tropical to subtropical section *Humboldtianae* PAX to which *S. tetrasperma* belongs, is assumed to possess the most primitive structure in the genus.

KEY TO THE SPECIES

1. Leaves elliptic-lanceolate, more than 2 cm broad, glandular-serrate. Bracts wholly haired. Stamens 4–15 . . . . **1. S. tetrasperma**
1. Leaves lanceolate-linear, less than $1^1/_2$ cm broad, finely serrate. Bracts haired only at the base. Stamens 2 . . . . **2. S. babylonica**

1. Salix tetrasperma ROXB. Pl. Coast Corom. 1 (1795) 66, t. 97; BLUME, Bijdr. (1825) 516; WIGHT, Ic. 5 (1852) t. 1954; MIQ. Fl. Ind. Bat. 1, 2 (1859) 460; ANDERSSON, Kongl. Svenska Vet.-Ak. Handl. 6, 1 (1865) 1, f. 1; in DC. Prod. 16^2 (1868) 192; MIQ. Ill. Fl. Arch. Ind. (1870) 11; BRANDIS, For. Fl. (1874) 462, t. 58; F.-VILL. Nov. App. (1880) 210; HOOK. *f.* Fl. Br. Ind. 5 (1888) 626; KOORD. Exk. Fl. Java 2 (1912) 44; MERR. Sp. Blanc. (1918) 119; En. Philip. 2 (1923) 22; RIDL. Fl. Mal. Pen. 3 (1924) 393; JOCHEMS, Trop. Natuur 15 (1926) 200–203; CORNER, Wayside Trees (1940) 581, t. 175; BACK. Bekn. Fl. Java (em. ed.) 6a (1948) fam. 123.—*S. azaolana* BLANCO, Fl. Filip. ed. 2 (1845) 539; ed. 3, 3 (1879) 187, 188; MERR. Govt Lab. Publ. (Philip). 27 (1905) 81; Philip. J. Sc. 1 (1906) Suppl. 182.—*S. horsfieldiana* MIQ. Fl. Ind. Bat. 1, 2 (1859) 461; Suppl. (1861) 187, 474; ANDERSS. *l.c.* (1865) 3.—*S. zollingeriana* MIQ. *ex* ZOLL. Syst. Verz. 2 (1854) 108, *nom. nud.* (*zollingeri*); Fl. Ind. Bat. 1, 2 (1859) 462, *descr.*—*S. sumatrana* MIQ. Fl. Ind. Bat. Suppl. (1861) 187, 474.—*S. javanica* ANDERSS. *l.c.* (1865) 3.—*S. junghuhniana* ANDERSS. *ex* MIQ. Ill. Fl. Arch. Ind. (1870) 13.—**Fig. 1, 3.**

Evergreen or (in semi-arid climates) deciduous shrub or small to moderate-sized tree up to 25 by 1 m though generally smaller, branches more or less drooping. Young shoots nearly glabrous to rather densely greyish white-hairy, glabrescent. Stipules small, early caducous or wanting. *Leaves* ($^1/_2$–)1–3(–4) cm petioled, elliptic to lanceolate, variable in shape but nearly always broadest just below or at the middle, (6–)8–16(–24) by (2–)$2^1/_2$–4(–6) cm, herbaceous to subcoriaceous, glabrous or glabrescent, sometimes shining on the upper surface, seldom glaucous underneath, base narrowed to rounded, apex acute to acuminate, margin serrulate-denticulate, rarely subentire; the teeth bearing a minute, sessile, dark-coloured gland; midrib prominent, pale, lateral nerves numerous, distinct. *Catkins* on the twigs of the previous flush, upon short twigs (0–)$^1/_2$–2(–3) cm long and with 0–3(–5) caducous leaves, lax-flowered, the ♂ ones more or less pendulous, 4–12 cm long, the ♀ ones more straight, 3–10 cm long, in fruit somewhat longer; rhachis white-tomentose.

♂ *Flowers:* Bracts elliptic, 1–2(–3) mm long, concave, densely white-haired on both sides; apex rounded, seldom blunt; nerves 3, more or less distinct. Stamens free, 4–15, but on the same plant the variation in number is not beyond 3, sometimes different in length due to unequal development, 3–$3^1/_2$(–4) mm long in anthesis; filaments thin,

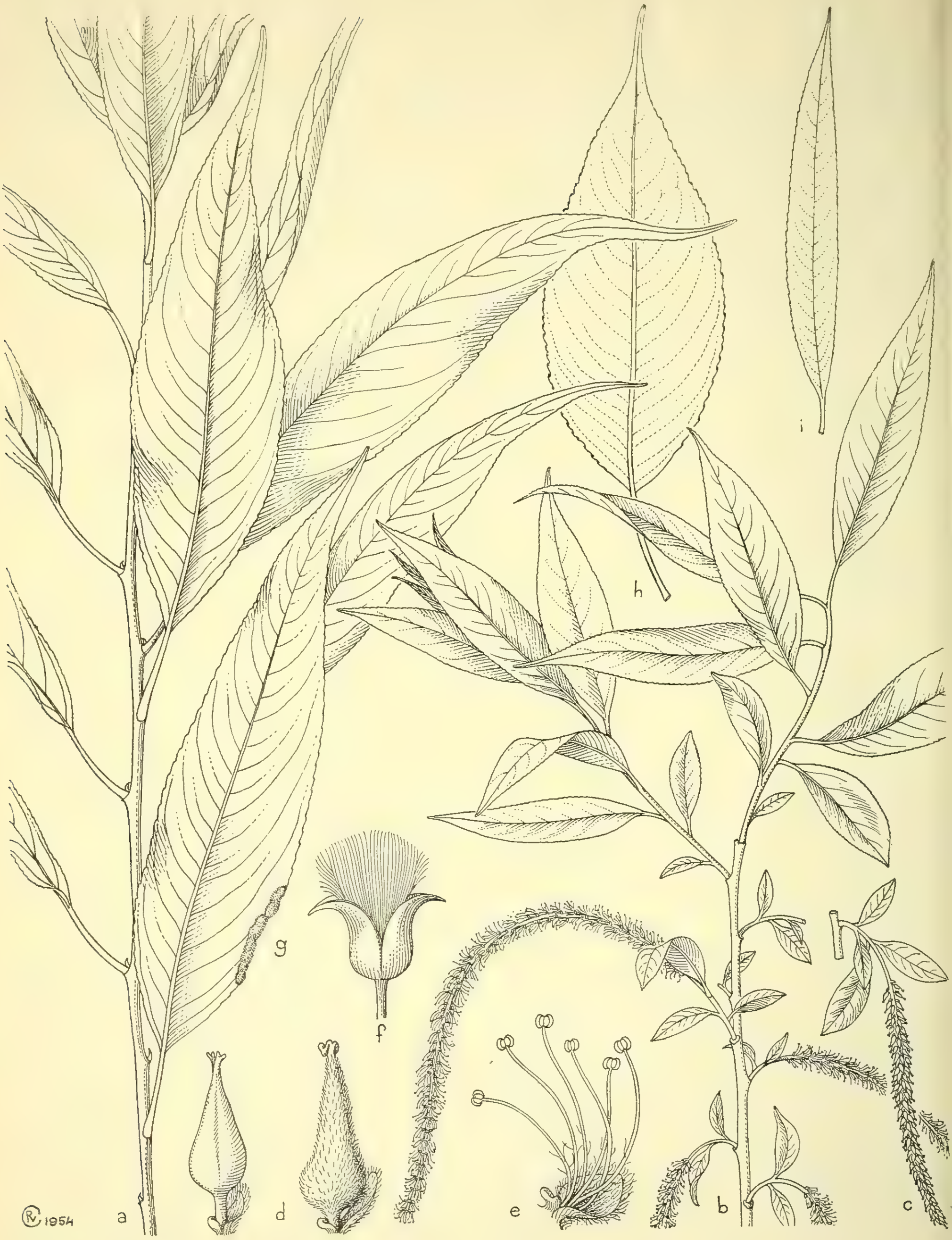

Fig. 1. *Salix tetrasperma* ROXB. *a.* Sterile twig, *b.* ♂ flowering twig, *c.* ♀ catkin, all × 2/3, *d.* 2 different ♀ flowers, × 18, *e.* ♂ flower, × 18, *f.* fruit, × 7, *g.* acarocecidium on the leaf margin, *h.* leaf of a Philippine specimen, × 2/3.—*i. Salix babylonica* L., leaf.

sometimes sparsely white-haired at the base; anthers elliptic, small, yellow, glabrous. Disk fleshy, variously shaped, adaxial part 1/2–1 mm long and wide, simple to bifid, abaxial part like a small scale adjoining the bract. ♀ *Flowers:* Bracts as in the ♂, caducous. Ovary ± 1 mm stalked, conical with rounded base, 3–4 mm long, sometimes short-haired. Style distinct or not, more or less deeply 2-lobed. Disk as in the ♂ flower. *Fruit* 7 mm long; hairs white, silky, 5 mm long. *Seeds* 4, elliptic, 2 mm long, grey-blackish brown with lighter rhaphe, somewhat rough when dry, glabrous.

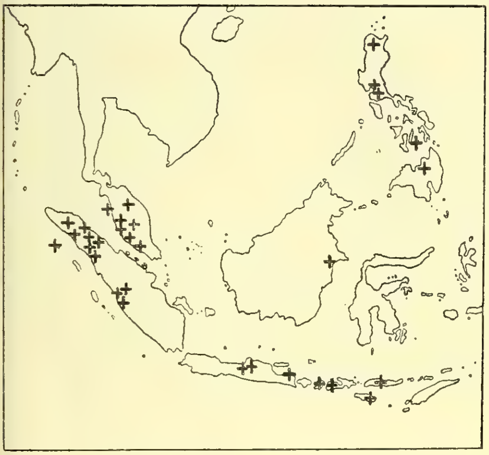

Fig. 2. Localities of *Salix tetrasperma* Roxb. in Malaysia.

Distr. Throughout SE. Asia, from Afghanistan and the Punjab (cultivated) eastwards through Burma, Siam, Indo-China to S. China (cult.?) (Yunnan, Kwangsi, Kwangtung) and Formosa, in *Malaysia:* N. and Central Sumatra, Simalur Isl., Malay Peninsula (introduced), the N. part of Central and E. Java, the Lesser Sunda Islands (Lombok, Sumbawa, Sumba, Flores), E. Borneo [*pr.* Samarinda, near Bungalun River, 10 m alt., Rutten 719 (U) ♀], Philippines (Luzon, Bohol, Mindanao). Fig. 2.

In the Malay Peninsula only ♂ specimens have been found and it is assumed to have been introduced there; this may have been the case in some other localities.

Ecol. Along water-courses, riverbanks, fringing streamsides and banks of pools and lakes, mostly in the lowlands, ascending in the Himalayas to 2100 m, in Sumatra to 1500 m (fig. 3), and in the Philippines to medium altitudes. Flowers are found throughout the year; the secreted honey attracts insect-visitors.

Dispersal of seeds is partly performed through the air as seeds adhere to the woolly hair-flakes which facilitate airborne dispersal. Buoyancy power of seeds seems to be short, according to Ridley (Disp. 226). Vegetative dispersal is by water.

Two kinds of galls have been reported by van der Meer Mohr (Bull. Jard. Bot. Btzg III, 8, 1926, 114–115, t. 18) and by Docters van Leeuwen (Ned. Kruidk. Arch. 51, 1941, 133), *viz* an acarocecidium (fig. 1g) caused by Eriophyidae, causing swollen, recurved, hairy, pale green later pink leaf-margin galls (in Sumatra and Malaya), and a dipterocecidium, caused by Cecidomyidae, slightly deforming the ♂ catkins with inflated filaments (in Sumatra).

Wood anat. Pearson & Brown, Comm. Timb. India 2 (1932) 1012; Reyes, Commonwealth Philip. Dept Agric. Techn. Bull. 7 (1938) 54.

Uses. In Malaya planted on the dikes of the rice-fields, and by Chinese on embankments of tanks and mines, apparently for protecting the soil, according to Burkill found in every village in some of the northern parts of the Peninsula. It is also sometimes pollarded for forming fences. Propagation is easy by cuttings. It is said to be used against fever; as a matter of fact the crystalline glucosid, salicin, occurs in many Salixes and is a febrifuge. According to Burkill & Haniff (Gard. Bull. Str. Settl. 6, 1930, 254) a decoction is used cold for ulceration of the nose. Apparently, no one has yet examined the bark for salicin.

None of the uses mentioned above have been reported from Java and none is definitely known from the Philippines (*cf.* Quisumbing, Med. Pl. Philip. 1951, 220). In the latter islands the timber is stated to be occasionally used for house-building purposes.

Vern. *Kapeh kapeh*, *api api*, S, *dĕdalu*, *dalu dalu*, S, M, *gĕndalu*, *nalu ayĕr*, *jĕndalu*, *mĕ(n)dalu*, M, *anjang anjang*, *assang*, J, *kad(d)ju anjang*, J, Md; Philippines: *libás*, *malatíki*, *tiáun*, Tag., *maksa*, C. Bis.

Note. The Philippine specimens are remarkably uniform and characterized by long-petioled, elliptic-oblong, shining, acuminate leaves (tip *c.* 1 cm); midrib fulvous, nerves distinctly prominent; shoots and leaves already glabrous when young (fig. 1h). However, the flowers show no difference from other *tetrasperma* and similar specimens have been found in Sumatra and Malaya, connected by transitional forms with the common type.

2. Salix babylonica Linné, Sp. Pl. 2 (1753) 1017; Andersson, Kongl. Svenska Vet.-Ak. Handl. 6[1] (1865) 50, f. 32; Miq. Ill. Fl. Arch. Ind. (1870) 14; Brandis, For. Fl. (1874) 465, t. 59; Back. Bekn. Fl. Java (em. ed.) 6a (1948) fam. 123.—*S. chinensis* Burman *f.* Fl. Ind. (1768) 211 (*err. typ.* 311); Merr. Philip. J. Sc. 19 (1921) 345.—*S. japonica* (*an* Thunb.?) Blume, Bijdr. (1825) 516; Koord. Exk. Fl. Java 2 (1912) 44.—*S. pendula* (*an* Moench.?) K. Koch, Dendrologie 2 (1872) 507 *pro stirp. mal.*—**Fig. 1i.**

Tree or shrub with mostly drooping, reddish branches. Twigs when young pilose, later glabrous, and when older with distinct, acute, axillary buds. *Leaves* 2–5 mm petioled, linear-lanceolate, 6–12 by 1/2–1 1/4(–2 1/4) cm, shiny above, glaucous or dull green below, base blunt, apex acute, margin finely serrate; midrib prominent, whitish. *Catkins* short, on twigs of the previous flush, terminal on

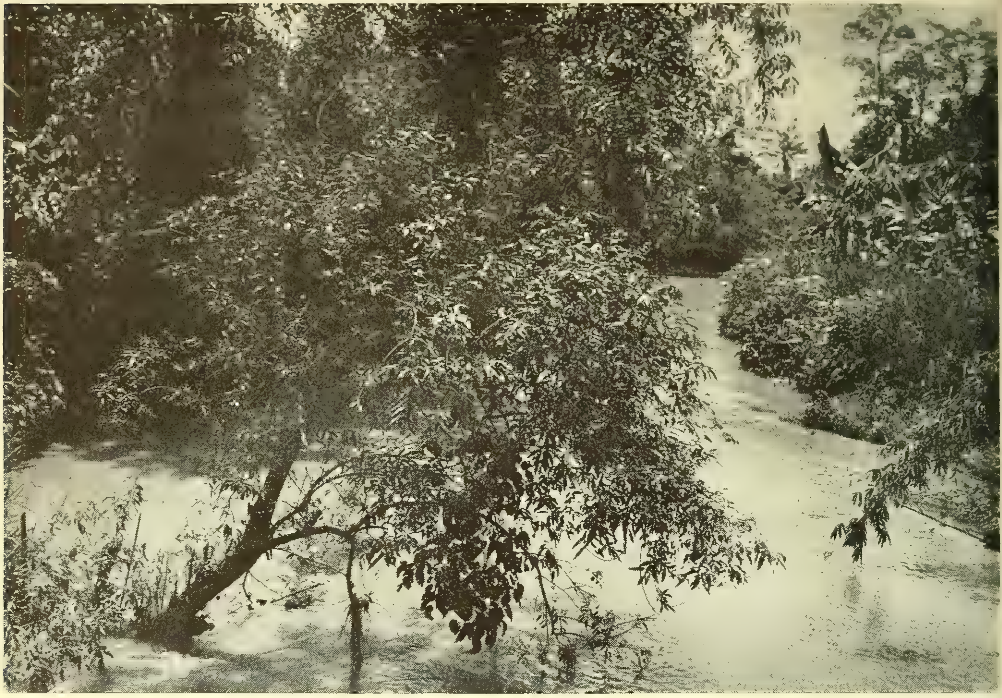

Fig. 3. *Salix tetrasperma* ROXB. along a stream in Sumatra East Coast (JOCHEMS).

short shoots with a few, small, entire leaves. Rhachis short-haired, rather dense-flowered. ♂ *Flowers:* Bracts thin, ovate-elliptic, 1½ mm long, with 3 distinct nerves and cucullate top, white-villous only at the base. Stamens 2, connate at the very base, 4–4½ mm long; filaments filiform, somewhat haired at the base; anthers small. Disk not very fleshy, adaxial part about as large as the abaxial part, elliptic, 2–3 times as short as the bract. ♀ *Flowers* (not found in Malaysia): Bracts acute, 2–2½ mm, only at the base vaulted and haired. Ovary nearly sessile, conical, not or somewhat longer than the bract, glabrous, with a distinct, 4-lobed style. Disk only adaxial, flat, 1 mm long.

Distr. Possibly wild in Persia, China, Japan, and widely cultivated in S. and Central Europe, SW. and S. Asia, the Himalaya, in *Malaysia:* only cultivated in the Malay Peninsula (*cf.* note below), in Java (Priangan, Diëng), and the Philippines (Luzon, one sterile specimen).

Ecol. In Java cultivated since a long time, first recorded by BURMAN in 1768 (after a specimen received from KLEYNHOFF in 1759, preserved at Geneva)[1]; 1000–2200 m, only ♂ plants; *fl.* throughout the year.

Vern. *Tjemeten, tjumeti*, J.

Note. The identity of *Salix sp.* mentioned by CORNER in his Wayside Trees 1 (1940) 581 as to be cultivated in gardens in the Malay Peninsula, is not certain. CORNER himself suspects that it is *S. babylonica.*

Excluded

Populus deglubata REINW. *ex* BLUME, Mus. Bot. 1 (1849) 83 *in syn.* = *Eucalyptus deglupta* BL.

Salix urophylla LINDL. *ex* ANDERSSON, Act. Acad. Reg. Scient. Holm. (1850) 487 is according to HOOKER (Fl. Br. Ind. 5, 1888, 637) based on a WALLICH specimen (Cat. 3708), incomplete and worthless for any identification. ANDERSSON (Kongl. Svenska Vet.-Ak. Handl. 6¹, 1867, 5) refers to this species the specimen ZOLLINGER 2927 from E. Java, which MIQUEL had already described as *S. zollingeriana*, here reduced to *S. tetrasperma.*

'*Salix calophylla* WALL.' A specimen under this name in Herb. Kew, said to have been collected by GRIFFITH and labelled 'Malacca' is according to RIDLEY (Fl. Mal. Pen. 3, 1924, 393) utterly unlike the Malayan Salices and has doubtless wrongly been localized.

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(1) An other specimen of herb. BURMAN (L), cultivated in Java, wrongly identified as *S. babylonica* or *S. japonica*, appeared to be *Spiraea thunbergii* SIEB.

HAEMODORACEAE (C. G. G. J. van Steenis, Leyden)

Perennial, caulescent, rhizomatous herbs with fasciculate, fibrous roots, sometimes stoloniferous, rarely with rounded tubers. *Leaves* radical, equitant, linear or ensiform, strongly laterally compressed (*Iris*-like), with an open or closed amplexicaulous, sheathing base, closely striate-nerved or plicate-nerved. *Flowers* ⚥, in *Mal. spp.* actinomorphic, paniculate. *Perianth-segments* 6, 2-seriate, free. *Stamens* 3, epipetalous; filaments ± free; anthers 2-celled, basifixed or versatile, introrse, splitting lengthwise. *Ovary* superior to inferior, 3-celled. Style simple, usually filiform, stigma punctiform. Ovules ∞ to 2 per cell, on axile placentas. *Capsule* loculicid, 3-valved. Seeds with abundant endosperm and a small embryo, often flat, sometimes winged.

Distr. About 9 or 16 genera, mainly in Australia, less in S. Africa and N. and tropical America, in *Malaysia* one native *sp.* of an otherwise Australian genus and one American ornamental.

Note. The delimitation of the family has been rather different in different handbooks, but since several genera have been assigned to the *Liliaceae*, *Amaryllidaceae*, or other families, the circumscription has been narrowed down to a rather homogeneous group (*cf.* Pax, Pflanzenfamilien ed. 2, 15a, 1930, 386–390, and Hutchinson, Fam. Fl. Pl. 2, 1934, 164).

KEY TO THE GENERA

1. Sheathing leaf-base open, blade 4–5 mm broad, tough. Flowers red to blackish. Ovary inferior, half-superior in fruit. Ovules 2 per cell . . . . **1. Haemodorum**
1. Base of leaf-sheath closed, blade 2–3 cm wide, not tough. Flowers white. Ovary and fruit superior. Ovules ∞ in each cell . . . . **2. Xiphidium**

1. HAEMODORUM

J. E. Smith, Trans. Linn. Soc. Lond. 4 (1798) 213; Benth. Fl. Austr. 6 (1873) 418.—**Fig. 1.**

Erect, glabrous, tough, perennial herbs; stem-base or rhizome thickened and enclosed in the persistent, sheathing (but open) leaf-bases; roots fibrous, densely covered with hair-roots, looking spongy, often red. Stem (inflorescence) mostly branched, noded, with reduced leaves. *Leaves* flat (or terete), entire, linear, amplexicaulous; sheaths open. *Inflorescence* terminal on the (mostly solitary) stem, paniculate, (head-like contracted or spike-like,) nigrescent; branches subtended by stem-clasping, bract-like reduced leaves. Pedicels mostly provided with 2 often scarious bracteoles. *Flowers* usually fragrant, red, black, or greenish. *Perianth* persistent, rather erect. *Filaments* often enclosed by the inrolled margins of the inner tepals and coherent with them at their ultimate base, persistent!; anthers sagittate at the base, versatile. Apex of the ± obconial *ovary* truncate, often slightly bulging between the stamens. Style filiform. *Ovules* 2 per cell, laterally attached to a protruding, thickened placenta in the upper part of each cell. *Capsule* semi-inferior, ± 3-lobed, opening with 3 radial, apical slits. Placenta much thickened in fruit, bearing on each side a large, winged, peltately attached, flattened seed.

Distr. About 20 *spp.* in Australia (most in the N. half), one in Tasmania, in *Malaysia:* one *sp.* in New Guinea.

Ecol. Mostly plants of dry savannah land.

Notes. In both editions of the 'Pflanzenfamilien' it is copied from Endlicher (Iconogr. t. 98) that the flower of *H. spicatum* R.Br. possesses 3 ovules per cell. In the flowers I examined of this species there are only 2; I assume that Endlicher mistook the placental knob, on which these 2 ovules are laterally attached, for a third ovule (fig. 1 d–f).

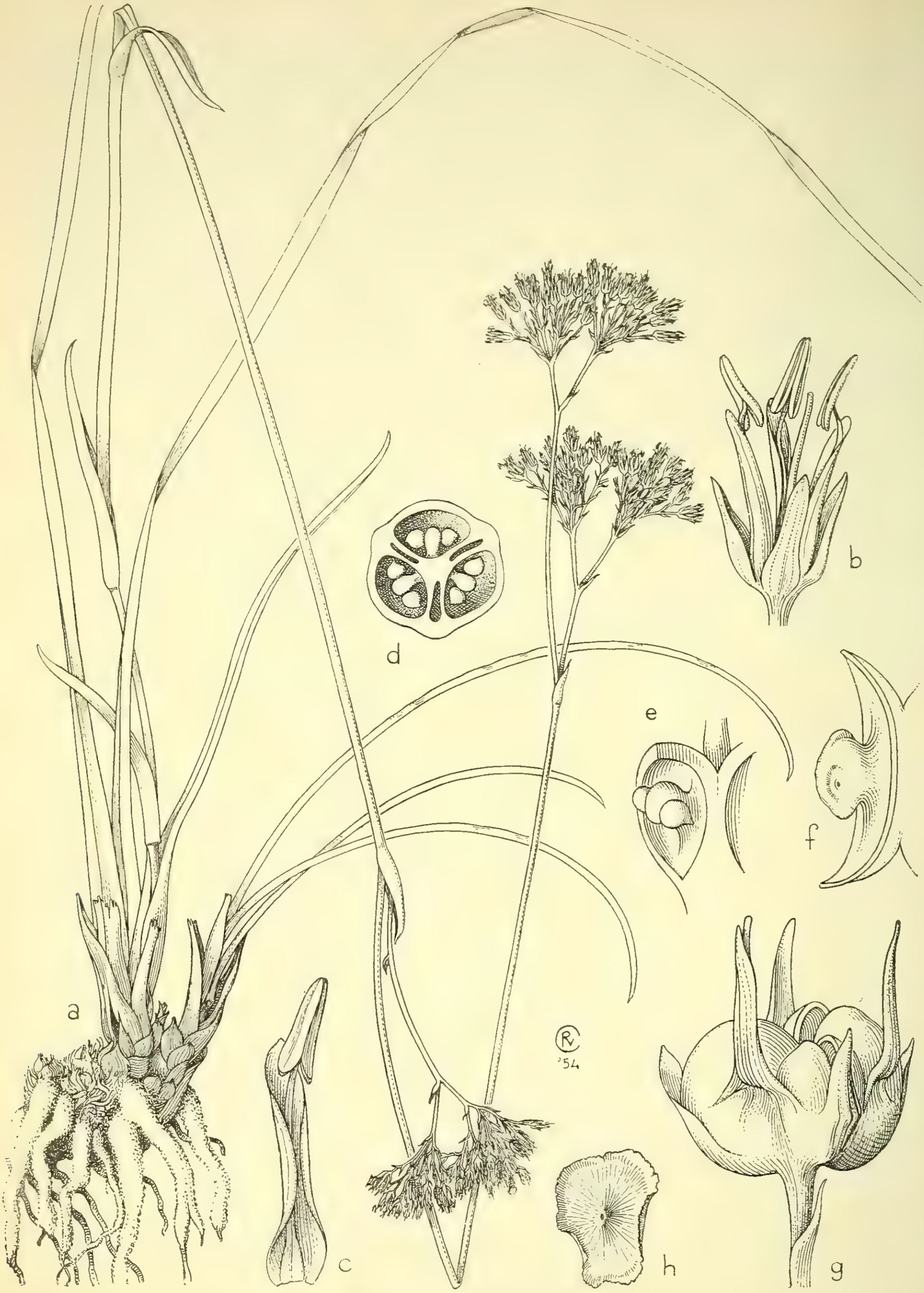

Fig. 1. *Haemodorum corymbosum* VAHL. *a*. Habit, × ²/₃, *b*. flower, × 5, *c*. inner tepal and stamen, × 7, *d*. section of ovary, *e*. insertion of ovules in longitudinal section, *f*. placenta in fruit, *g*. fruit with concrescent perianth and persistent filament, cells dehisced on top, that in front ± abortive, × 3.— *h*. Seed of *H. planifolium* R.BR., × 3 (*a–g* after BRASS 8384, *h* after CONSTABLE 5266).

1. Haemodorum corymbosum VAHL, En. Pl. 2 (1806) 179; BRITTEN, Ill. Bot. COOK's Voy. 3 (1905) 93, t. 303; DOMIN, Bibl. Bot. 20 (1915) 527; EWART & DAVIES, Fl. North. Terr. (1917) 73.—*H. coccineum* R.BR. Prod. (1810) 300; BENTH. Fl. Austr. 6 (1873) 422; F.v.M. Descr. Not. Pap. Pl. 2 (1890) 67; BAILEY, Queensl. Fl. pt 5 (1902) 1600; HALLIER *f.* Nova Guinea 8 (1913) 902; BRASS, J. Arn. Arb. 19 (1938) 190; STEEN. *ibid.* 28 (1947) 420.—**Fig. 1.**

Rootstock woody, red in section. *Leaves* tough, drooping, fine-striate, 30–60 cm by 4–6 mm, those on the stem (inflorescence) all amplexicaulous on the nodes, gradually reduced in size upwards, upper ones sustaining the branches of the inflorescence bract-like. Stem (with inflorescence) 50–100 cm high (of which the unbranched part occupies 30–70 cm). *Flowers* red, numerous, in dense cymes forming a compact, corymbose, large or depauperate panicle. Pedicels 2–10 mm, mostly with 2 appressed, scarious, lanceolate, 1-nerved, very acute, 3–4 mm long bracteoles inserted at unequal height. *Tepals* oblong-lanceolate; outer ones thickened and subsaccate at the base, 5–6 by 1½–1¾ mm; inner ones narrower, 6–7 by 1½–1¾ mm; all lengthwise 5-nerved, apex bluntish, margins slightly scarious. *Filaments* nearly as long as the inner tepals, linear, flat, ½ mm broad, slightly broadened at the base, apex filiform; anthers elliptic, flat, 3 by 1 mm, incised to *c.* ⅓–¼ from the base, blunt at both ends; connective minutely apiculate. Style filiform, 7–8 mm. *Capsule* roundish, enveloped by the erect, somewhat accrescent tepals, *c.* 8–10 mm through, by abortion sometimes only 2–1 cells developed. *Seeds* not seen.

Distr. Australia (tropical parts of the Northern Territory and Queensland), in *Malaysia:* S. New Guinea (Mai-Kussa, Wassi Kussa, Okaba, Merauke area).

Ecol. In grass-fields and in *Melaleuca* and *Banksia* lowland, coastal savannah forest; common on sour, grey, clay soil, hard packed in the dry season and an inch to ankle deep in water during the wet, together with *Schoenus*, *Rhynchospora*, *Drosera*, *Thysanotus*, *Tricoryne*, *Velleia*, *etc.* (BRASS, *l.c.*); *fl.* July–Sept., *fr.* Dec.

The perianth of this and other *spp.* is apparently never wholly expanded during anthesis and is, therefore, not very conspicuous. The whole plant is provided with a red coloured substance in its tissues, to which the generic name alludes.

The leaf-sheaths form a *tunica* round the rootstock, thus providing an excellent protection from fires in the dry season.

Uses. The roasted rootstock is eaten by Australian aborigines. In Australia a strong fibre is made from the long, tough leaves; also bags are plaited from them. The plant is bitter and reputed poisonous to stock in Queensland (F. M. BAILEY, Queensl. Agr. J. 5, 1899, 41–42).

Vern. *Scarlet blood root*, Queensl.

Notes. The type of this species is the BANKS & SOLANDER specimen on which J. E. SMITH apparently based his generic description and to which VAHL gave the specific epithet. An allied species is *H. planifolium* R.BR.

2. XIPHIDIUM

AUBL. Hist. Pl. Guiane Fr. 1 (1775) 33, vol. 3, t. 11.

Rhizomatous, erect, perennial, stoloniferous herb. *Flowers* in terminal panicles with cincinnate branches. Anthers basifixed. *Ovary* superior, each cell with numerous ovules. *Capsule* globose, fleshy. *Seeds* numerous, small, black.

Distr. Monotypic, tropical America and the West Indies.

Note. The generic name *Xiphidium* is sometimes credited to LOEFLING, Iter Hisp. (1758) 179. Mr EXELL informs me that in this work *Xiphidium* is published *in synonymis* under the Iridaceous genus *Ixia.*

1. Xiphidium coeruleum AUBL. Hist. Pl. Guiane Fr. 1 (1775) 33, vol. 3, t. 11; WILLD. Sp. Pl. 1 (1797) 248; BACKER, Handb. Fl. Java pt 3 (1924) 80 incl. *var. albidum* BACKER; BAKHUIZEN VAN DEN BRINK *f.* in BACKER, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 236, *ditto*; STANDL. & STEYERMARK, Fieldiana (Bot.) 24, 3 (1952) 102, fig. 21.—*X. albidum* LAMK, Ill. 1 (1791) 131.—*X. album* WILLD. Sp. Pl. 1 (1797) 248.

Perennial, erect, but stems often nodding, 40–70 cm. *Leaves* fan-wise arranged, rather densely set, linear-lanceolate, (incl. the closed sheath) 30–50 by 2–3 cm; sheaths only amplexicaulous at the base, somewhat narrower than the blade; blade remotely minutely toothed specially at the posterior margin. *Panicles* 6–25 cm excluding the 15–30 cm long stem (peduncle), rather dense; branches patent, densely short-hairy. Bracts ovate-triangular, inconspicuous. *Flowers* ± nodding, white, base sometimes greenish, 1–5 mm pedicelled. *Tepals* oblong, white, creamy or the inner side bluish, sparsely pubescent, obtuse, 6–9 by 2½–3 mm, inner ones broadest, all 4–5-nerved. Filaments flat, short, *c.* 2 mm; anthers yellow to orange, 1¾–2 mm. Style longer than the stamens. *Capsule* orange to dull-red, finally purple black, *c.* 7–10 mm. *Seeds* subglobose, warty.

Distr. Native of S. America, in *Malaysia* sometimes cultivated in gardens in the lowland and hills.

PAPAVERACEAE (C. G. G. J. van Steenis, Leyden)

Annual or perennial, laticiferous herbs, rarely shrubs. *Leaves* (in Mal. *spp.*) spirally arranged, often incised. Stipules 0. *Flowers* mostly solitary, large, actinomorphic, ☿, 2–3-merous. *Sepals* caducous or calyptrate, free or united. *Petals* free, 4–6, rarely more or absent, biseriate, imbricate, often crumpled in bud; nectaries absent. *Stamens* ∞, free; anthers 2-celled, dehiscing lengthwise. *Ovary* superior, 1-celled, with 2 or more parietal placentas (sometimes with protruding placentas or a spurious wall). Stigmas opposite or alternate with the placentas. Ovules 1 to numerous. *Capsule* opening by valves (or pores). *Seeds* small, with a crested or smooth raphe, or arillate; embryo minute; endosperm copious, fleshy or oily.

Distr. About 23 genera, of which the bulk on the N. hemisphere, few in Central & S. America, almost absent from Africa and Australia, in *Malaysia* none native.

Note. The family is treated here in the strict sense, leaving the *Fumaria*-group as a separate family.

KEY TO THE GENERA

1. Prickly, annual herb. Flowers solitary. Corolla large . . . . **1. Argemone**
1. Unarmed, perennial shrub. Flowers in rich-flowered panicles. Corolla absent . . . **2. Bocconia**

1. ARGEMONE

Tournef. *ex* Linné, Gen. Pl. ed. 5 (1754) 225, *no* 574; Prain, J. Bot. 33 (1895) 130, 208; Fedde, Pflanzenreich Heft 40 (1909) 271.—**Fig. 1.**

Erect, mostly annual, glaucous herbs, rarely shrubby or woody at the base; milk yellow, fetid. *Leaves* pinnatifid-dentate (cnicoid or ilicoid), mostly prickly (rarely hispid). *Flowers* terminal, solitary, surrounded by *c.* 3 foliaceous bracts, in old plants often in a large, leafy inflorescence, 3-merous. *Flowers* white, rarely yellow or rose, erect in bud; receptacle narrow-conical. *Sepals* 3, valvate, vaulted, horned below the apex, caducous in anthesis, falling off together. *Petals* 6, strongly plicate in bud, patent during anthesis. Filaments filiform; anthers basifixed, extrorse, twisted after flowering. *Ovary* ovate to oblong; placentas 3–7, each ∞-ovulate; style very short, stigma 3–7-lobed, lobes opposite the placentas. *Capsule* oblong, valves dehiscing from the apex to about $^{1}/_{3}$ (rarely to the base) loosening from the placentas, replum mitre-shaped, attached to the style-base. *Seeds* ∞, globular, reticulate-ribbed; raphe cristate; endosperm oily.

Distr. About 6–9 *spp.* in Mexico, West Indies and the Western and Eastern United States, one introduced in the Old World and now a pantropical weed.

1. **Argemone mexicana** Linné, Sp. Pl. 1 (1753) 508; Bl. Bijdr. (1825) 49; Miq. Fl. Ind. Bat. 1, 2 (1858) 92; Warb. Bot. Jahrb. 13 (1891) 317; Backer, Fl. Bat. (1907) 46; Fedde, Pflanzenreich Heft 40 (1909) 273; Backer, Schoolflora Java (1911) 52; Merr. Fl. Manila (1912) 212; En. Philip. 2 (1923) 206; Schroo, Trop. Natuur 5 (1916) 102–106, f. 1–5; Backer, Onkruid. Jav. Suiker. (1930) 249, Atlas t. 160; Bruggeman, Ind. Tuinb. (1948) 72, f. 30.—**Fig. 1.**

Annual, thistle-like prickly, glabrous, 30–100 cm, with a firm taproot; latex bitter. Stem firm, terete, pithy, with scattered prickles. Lower *leaves* crowded ± in a rosette, petioled, higher ones sessile, semi-amplexicaulous, very variable in shape, sinuate-pinnatifid, glaucous, white variegate-pruinose along the main nerves, 5–22 by 3–7 cm, prickles both scattered along the margin and on the nervation of the undersurface. *Flowers* scentless, sessile or on a very short pedicel. *Calyx*-lobes green with a very acute terete horn below the apex and a few prickles. *Petals* obovate, bright yellow, $1^{3}/_{4}$–3 cm long. Stamens 7–12 mm; anthers ± $2^{1}/_{2}$ mm long. *Ovary* ovate, with long soft bristles, 8–10 mm. Stigma dark-red, 3–6-lobed. *Capsule* $2^{1}/_{2}$–4 cm long, with rounded ribs (later valves of the fruit) separated by pruinose grooves, on the ribs with sharp, erect prickles, dehiscing to about $^{1}/_{3}$; valves 3–6. *Seeds* ± globular, ± $1^{1}/_{2}$–$1^{3}/_{4}$ mm diam., fine trabecular-reticulate, black-brown, hilum pale, prominent.

Distr. Native of the West Indies, Mexico, *etc.*, introduced in *Malaysia:* Penang, Java (*e.g* Djakarta, Klaten, Probolinggo), Lesser Sunda

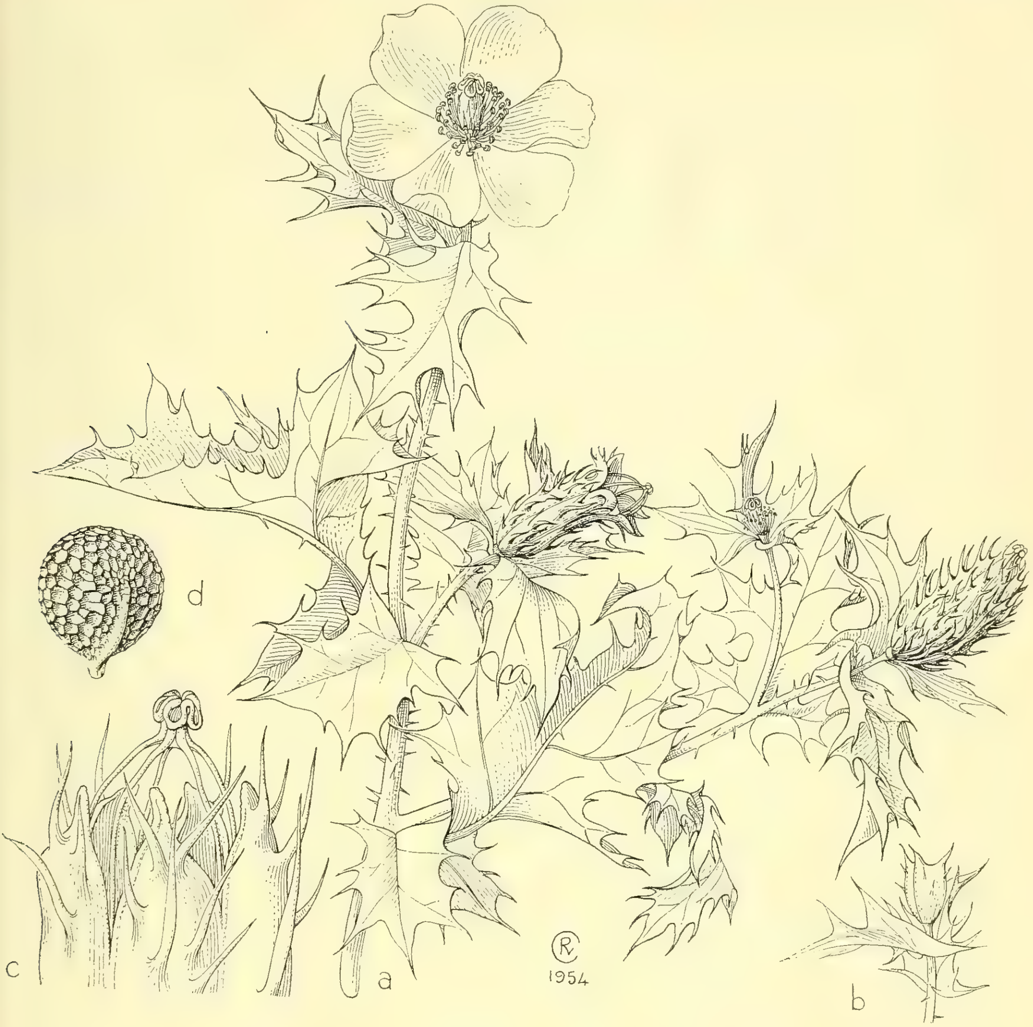

Fig. 1. *Argemone mexicana* L. *a*. Twig with flower and fruits, × $^2/_3$, *b*. bud showing 3-tipped calyx, × $^2/_3$, *c*. top of dehisced fruit, showing 5 valves and replum attached to style, × $2^1/_2$, *d*. seed, × 10 (partly after SCHROO, *l.c.*)

Islands (Sumbawa: Bima), Central Celebes (Bone), Moluccas (Ternate, Aru, Key, Ceramlaut = Gèsèr), Philippines (widely distributed), locally common, but on the whole scattered and rare, evanescent, absent from large areas.

According to PRAIN (*l.c.* 325 *seq.*) its introduction to Asia took place via Europe, where it was introduced in 1592. It has neither been mentioned by RHEEDE nor by RUMPHIUS. The first record is apparently by BURMAN (Fl. Ind. 1768, 119) '*habitat in Indiis*', the next one by THUNBERG in Java about 1775 (Florula Javanica 1825, 14), followed, before 1790, by LOUREIRO in Indo-China (*cf.* MERR. Comm. LOUR. 1935, 168). From the Philippines there are no earlier records than BLANCO in 1837 (*cf.* MERR. Bur. Govt Lab. Publ. Manila *no* 6, 1904, 33). It is, therefore, indeed not probable that an independent, inadvertant import took place through the Spaniards to Manila and Indo-China via the Acapulco-Manila route of their galleons which persisted following 1565 for more than 250 years.

Ecol. Only in regions with a pronounced dry season, mostly in the lowland, but up to *c.* 850 (–1000?) m, a ruderal of vacant lots and open waste land, along roadsides, in fields (also of sugar-cane), on railway-yards, and along railway-dikes; *fl.* Jan.–Dec.

According to SCHROO (*l.c.*) the flowers are only open in the morning hours, unfolding rather rapidly between 7 and 8; they persist for about 3 days. Small stingless bees ardently collect pollen and may transfer this partly to the stigma which is mature simultaneously with the stamens. The cotyledons of the seedlings are grass-like, long and narrow.

Uses. According to HEYNE (Nutt. Pl. 1927, 675–676), BURKILL (Dict. 1935, 237–238), and QUISUMBING (Medic. Pl. Philip. 1951, 329–332) the plant is of hardly any use in Malaysia; oil from the seeds might be used in the soap industry; medicinal value consists of doubtful and minor records. The plant is sometimes cultivated as an ornamental.

According to C. T. WHITE (Queensl. Agr. J. 11, 1919, 118–119, t. 10) it is a noxious weed throughout Queensland, where it is mostly represented by the *var. ochroleuca* (see below).

The plant, specially the oil pressed from the seed, is reputed to be poisonous in India (Agric. Ledger of India 1907, *no.* 5). The oil seems to possess drying properties.

Vern. *Mexican poppy*, *prickly poppy*, E, *stekelpapaver*, D, *drudju* (in confusion with *Acanthus*), *tjĕlangkringan*, J; Philippines: *kuchúmba*, standard, *kasúbang-áso*, Ilk., *baruás*, Iv., *diluáriu*, Tag., *kagang-kágang*, C. Bis.

Note. PRAIN records (*l.c.* p. 310) that the early Australian specimens belong to the Chilean form of *var. ochroleuca* (SWEET) LINDL., distinguished by pale yellow, ± stalked flowers, with a distinct style.

2. BOCCONIA

PLUM. *ex* LINNÉ, Gen. Pl. ed. 5 (1754) 223, *no* 569; FEDDE, Pflanzenreich Heft 40 (1909) 217; HUTCHINSON, Kew Bull. (1920) 275.—**Fig. 2.**

Small trees or erect shrubs, with yellow, bitter, fetid latex. *Leaves* large, mostly pinnate-lobed to pinnatifid. *Flowers* in large, terminal, bracteate panicles, proterogynous. *Sepals* 2, ovate to suborbicular, caducous. *Petals* 0. Stamens 8–24, in 4 whorls. *Ovary* stipitate, ovate, compressed; style distinct, persistent; stigmas 2, patent. Ovules 1, rarely 2. Infructescence hanging. *Capsule* fleshy, 1(–2)-seeded, 2-valved, mostly erect on the upcurved gynophore, the 2 valves opening from below upwards, drying up, falling off the gate-like replum from which the arillate, basifixed seed bungles freely on the short funicle (fig. 2).

Distr. About 6 or 9 *spp.* in Central and S. America.

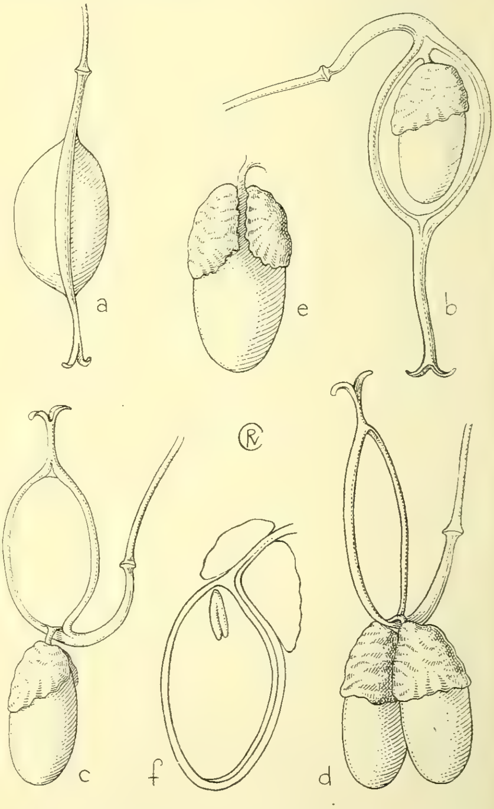

Fig. 2. *Bocconia frutescens* L. *a.* Unopened capsule, *b–d.* dehisced capsule, leaving the seed hanging from the replum on the curved gynophore, *e.* seed showing seed-coat structure, *f.* seed in section (all enlarged, drawn by CORNER).

1. Bocconia frutescens LINNÉ, Sp. Pl. 1 (1753) 505; FEDDE, Pflanzenreich Heft 40 (1909) 218; BACKER, Schoolflora Java (1911) 53; HUTCH. Kew Bull. (1920) 278; BACKER, Bekn. Fl. Java (em. ed.) 4A (1942) fam. 41, p. 3.—**Fig. 2.**

Branched, firm shrub, 2–6 m; stem terete, with thick, white pith. *Leaves* petioled, in outline oblong-obovate, or oblong-lanceolate, with acute, blunt, rounded or subcordate base, and acute, serrate-dentate lobes (incised ± halfway the blade), glaucous, short cripsed-hairy underneath, 10–45 by 4–16 cm. *Panicles* densely branched, pyramidal, 20–60 cm long. Bracts lanceolate, acute, 2–5 mm, the lower ones hairy, upper ones glabrous. Pedicels 1/4–1 cm. *Sepals* erect, elliptic, blunt-acuminate, green, 8–10 mm long, reticulations red. Stamens 8–10; anthers linear, yellow, longer than the filaments, pendent in anthesis. Style 3–5 mm; stigmas at last recurved, already protruding in bud! *Fruit* ± 12 by 7 mm, ripening greyish, internally light-yellow, pulpy, smooth, ± ½ cm stipitate. *Seed c.* 7 by 3–3½ mm, black, smooth, shiny, hard (crustaceous testa), covered in the lower ⅓–½ with the red, pulpy, plicate aril, hanging out of the mostly erect replum on a 1 mm long funicle; endosperm white; embryo small, basal.

Distr. Native of Central and tropical America, in Java sometimes cultivated and run wild along forest borders and thickets in the everwet mountains of West Java (Lembang, Tjinjiruan), locally abundant, 1200–1600 m.

Note. The Javanese material cannot be identified with HUTCHINSON's key. In the Javanese material the leaf-base is cuneate not rotundate but the lobes are acute and not acuminate. There are 9–10 stamens but the bracts vary in one inflorescence from glabrous to crisped-pubescent. It is beyond the scope of this work to make a new revision of the genus.

Cultivated Papaveraceae

Several other *Papaveraceae* are recorded to be or have been cultivated in Java. The following are treated by BACKER, Bekn. Fl. Java (em. ed.) 4A (1942) fam. 41, p. 1–5:

Eschscholzia douglasii WALP. [*E. californica* (*non* CHAM.) LINDL.], *Macleaya cordata* R.BR., *Papaver nudicaule* L., *P. rhoeas* L., and *P. somniferum* L.

About the latter already BLUME (Bijdr. 92–97) reported extensively, but the cultivation of the opium poppy was prohibited in the Netherlands Indies.

BUTOMACEAE (C. G. G. J. van Steenis, Leyden)

Erect, glabrous, rhizomatous, terrestrial, water- and swamp herbs, laticiferous (*Butomus* excepted). *Leaves* radical, sheathing, curvinerved (cauline in *Hydrocleis*), leaf-blades above water (*Hydrocleis* excepted). *Flowers* umbellate (or solitary), actinomorphic, ⚥. *Perianth* 2-seriate. *Sepals* 3, imbricate, mostly persistent, usually green. *Petals* 3, imbricate, usually thin, fugacious (persistent in *Butomus*). *Stamens* 8–9 or ∞, rarely less, sometimes the outer ones staminodial, filaments flattened, free; anthers basifixed, 2-celled, opening lengthwise with lateral slits. *Gynoecium* apocarpous, superior; carpels 6-∞, rarely less by reduction, in a whorl, free or cohering only at the base, dehiscing with an adaxial slit. *Ovules* ∞, anatropous, scattered on reticulately branched placentas. *Fruitlets* ∞-spermous, at last dehiscing along the ventral (adaxial) side. *Seeds* ∞; embryo flat and horse-shoe shaped (elliptic-terete and straight in *Butomus*); endosperm 0.

Distr. Less than 10 *spp.* belonging to 5 genera, in temperate and tropical regions, absent from Africa S of the equator, in *Malaysia* one native and one introduced genus both represented by one species.

Morph. On their dorsal (abaxial) base the leaf-sheaths are provided with exceedingly thin scales of various shape already described by IRMISCH (*cf.* BUCHENAU, Bot. Jahrb. 2, 1882, 467) (*squamulae intravaginales*), examined anatomically by Miss ARBER in *Butomus* (Ann. Bot. 39, 1925, 172). I found them also in *Tenagocharis* and *Limnocharis*. According to PICHON (Not. Syst. 12, 1946, 170–183) *Butomaceae* ought to be confined to *Butomus*, the residual being referred as a special tribe to a widened concept of *Alismataceae*.

KEY TO THE GENERA

1. Leaves lanceolate to obovate-oblong, (3–)5-nerved. Corolla white. Stamens 8–13. Staminodes 0. **1. Tenagocharis**

1. Leaves rounded to ovate or obovate, about 9–13-nerved. Corolla yellow. Stamens more than 15, surrounded by a whorl of staminodes . . . . **2. Limnocharis**

1. TENAGOCHARIS

HOCHSTETTER, Flora (Regensb.) 24 (28 June 1841) 369; BUCHENAU, Pfl. Reich Heft 16c (1903) 6.—*Butomopsis* KUNTH, En. Pl. 3 (Juli 1841) 164; MICHELI, in DC. Mon. Phan. 3 (1881) 87.—*Elattosis* GAGN. Bull. Soc. Bot. Fr. 86 (1939) 301; Fl. Gén. I.-C. 6 (1942) 1208, f. 115 (6–12). — **Fig. 1.**

Erect annual, 8–55 cm. *Flowers* in long-peduncled, 2–16-flowered, umbelliformous inflorescences exceeding the leaves, sometimes 2 whorls above another. Pedicels triangular. *Stamens* 8–9, sometimes less. *Ovaries* 4–9 (or by reduction less); style short. *Fruitlets* with their tips exserted from the calyx. *Seeds* broad-oblong, compressed, smooth; embryo folded.

Distr. Monotypic, Africa, tropical Asia through Malaysia to N. Australia, in *Malaysia* exceedingly rare.

Note. A new genus *Elattosis* was described from Indo-China by GAGNEPAIN differing from *Tenagocharis* by absence of petals, and 5 stamens. The type has appeared to represent a poor, deficient specimen of *Tenagocharis latifolia*, apparently beyond anthesis, when the petals have disappeared. Similar specimens have been found in India and Africa.

1. Tenagocharis latifolia (D. DON) BUCHENAU, Abh. Naturw. Ver. Bremen 2 (1868) 2, 3, 6; Pfl. Reich Heft 16c (1903) 7, f. 3; BACKER, Handb. Fl. Java pt 1 (1925) 56; Onkruidfl. Jav. Suiker. (1928) 21, Atl. t. 27. — *Butomus latifolius* D. DON, Prodr. Fl. Nep. (1825) 22.—*Butomopsis latifolia* KUNTH, En. Pl. 3 (1841) 165.—*Butomus lanceolatus* ROXB. Fl. Ind. ed. CAREY 2 (1832) 315; ROYLE, Ill. Bot. Him. 2 (1839) t. 95, f. 1.—*Butomopsis lanceolata* KUNTH *l.c.*; MICHELI, in DC. Mon. Phan. 31 (1881) 87; BAILEY, Queensl. Fl. pt 6 (1902) 1704; BISWAS & CALDER, Water & Marsh Pl. Ind. (1936) 79; GAGN. Fl. Gén. I.-C. 6 (1942) 1208.—*Elattosis apetala* GAGN. Bull. Soc. Bot. Fr. 86 (1939) 301; Fl. Gén. I.-C. 6 (1942) 1208, f. 115 (6–12).—**Fig. 1.**

Leaf-blades glaucous, oblong to oblong-lanceolate or oblanceolate, base acute, apex acute or obtuse, tipped by a hard blunt mucro at the underside of which is a large hydathode, with (3–)5 main nerves and an intramarginal one, (2½–) 4–15 by (½–)1¾–3½ cm; secondary nerves many, thin, parallel, obliquely ascending, reticulations dense; petiole (3–)5–15 cm. *Peduncle* (5–)25–30 cm. Umbels (1–2–)4–12(–15)-flowered. Pedicels thin, erect, elongate in fruit, (1–)5–14 cm. Bracts outside and between the flowers, reticulately veined, acute-triangular-lanceolate, decreasing in size inwards, the largest 1¼ by ½ cm at the base, scarious, acute, ovate, 1–1½ cm long. *Sepals* broad-elliptic to obovate, apex rounded or slightly emarginate, reticulately veined, margin scarious, 4–6 by 3½ mm. *Petals* white, exceeding the sepals in size, after anthesis withering and disintegrating into a mucilaginous mass. Filaments 2–3 mm; anthers narrow, 1–1½ by ⅓ mm. *Ovaries* reticulately veined, 4–5 by 1¾–2 mm; stigma yellow. *Fruitlets* 10–13 mm long, adaxial wall membranous. *Seeds* hardly ½ mm, elliptic, shiny, brown.

Distr. Tropical Africa to SE. Asia (India, Assam, Laos), through Malaysia to N. Australia (N. Territory & Queensland), in *Malaysia:* West Java (near Djakarta) and Madura Island (E off Java).

Near Djakarta (Mr Cornelis) for the first time collected by Dr Weehuizen (1917), later also in the same place by Backer (1919) and by Bakhuizen van den Brink Sr and the author (1929–1930), in Madura Island collected in 1933.

Ecol. In Malaysia in wet rice-paddies, but apparently very rare, though locally common in both localities mentioned, 10–50 m; *fl.* May, July.

No pollinating agent is known to me. In bud the anthers are not yet opened; beyond anthesis the petals shrivel over the then opened anthers and bring them close to the stigmas forming with these a sticky mass, similar as in *Drosera* and *Turnera*. The stigmas are then thickly covered with yellow pollen, thus ensuring pollination.

Part of the seeds I found already germinated in the follicles (fig. 1*j*).

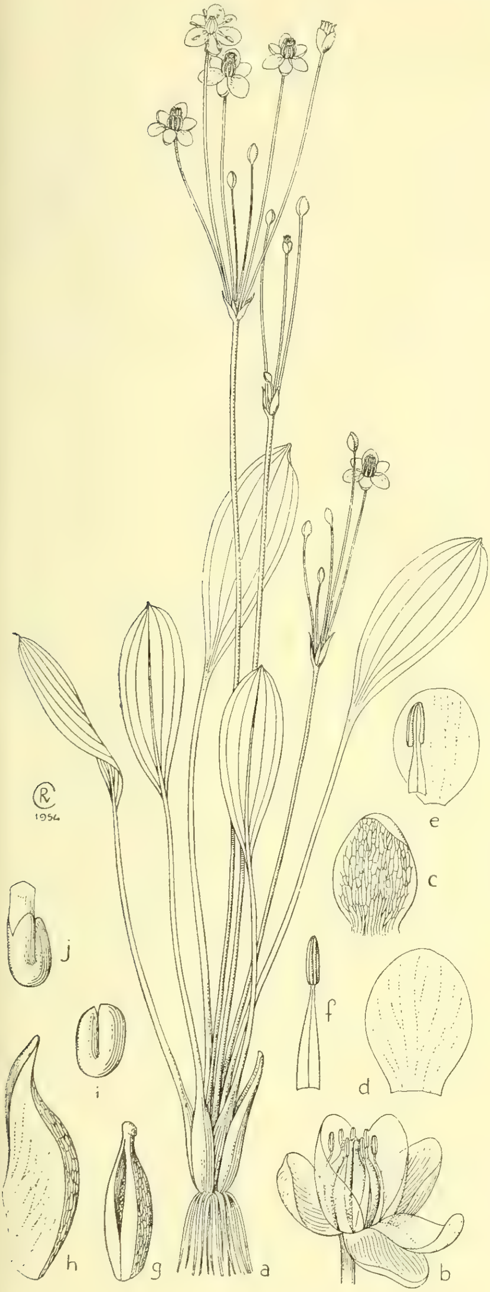

Fig. 1. *Tenagocharis latifolia* (D. Don) Buchenau. *a*. Plant, × ⅖, *b*. open flower, × 2½, *c*. sepal, showing nervation, × 2½, *d*. petal, *ditto*, × 2½, *e*. petal and stamen from bud, × 5½, *f*. full-grown stamen, × 5, *g*. developed carpel with slit on adaxial side, × 6½, *h*. empty follicle, × 2½, *i*. seed, × 17, *j*. *ditto*, germinated in the follicle.

2. LIMNOCHARIS

H.B. & K. Pl. Aequin. 1 (1807) 116.

Flowers in umbelliformous, peduncled inflorescences. *Stamens* ∞, surrounded by a whorl of staminodes. *Ovaries* ∞, strongly laterally compressed, free, densely set, seemingly forming one ovary. Stigmas sessile, lineate. *Fruitlets* semi-circular, in a head, dorsal wall thick. *Seeds* ∾, small, horse-shoe shaped; testa spongy.

Distr. Monotypic, tropical and subtropical America, in Asia and in *Malaysia* introduced.

1. Limnocharis flava (L.) BUCHENAU, Abh. Naturw. Ver. Bremen 2 (1868) 2; Pfl. Reich Heft 16c (1903) 9, f. 4, incl. *var. indica* BUCHENAU; MICHELI, in DC. Mon. Phan. 3 (1881) 89; BACKER, Ann. Jard. Bot. Btzg Suppl. 3 (1909) 406; Trop. Natuur 1 (1912) 129–135, f. 1–6; Handb. Fl. Java pt 1 (1925) 57; HEYNE, Nutt. Pl. (1927) 139; BACKER, Onkruidfl. Jav. Suiker. (1928) 22, Atl. t. 28; OCHSE & BAKHUIZEN VAN DEN BRINK, Ind. Groenten (1931) 87, f. 51; STEEN. Arch. Hydrobiol. Suppl. Bd 11 (1932) 272, f. 41; BURKILL, Dict. (1935) 1347; BISWAS & CALDER, Handb. Water & Marsh Pl. Ind. (1937) 80; VAN DER PIJL, Trop. Natuur 27 (1938) 136–138, f. 1–2; SENARATNA, Trop. Agric. 94 (1940) 362; Ceylon J. Sc. (A. Bot.) 12 (1945) 164.—*Alisma flava* LINNÉ, Sp. Pl. 1 (1753) 343.— *L. emarginata* H. B. & K. Pl. Aequin. 1 (1807) 116, t. 34; MICHELI, in DC. Mon. Phan. 3 (1881) 89; KOORD. Nat. Tijd. Ned. Ind. 60 (1901) 380; J. J. SMITH, Teysmannia 13 (1902) 66.—*L. plumieri* RICH. Mém. Mus. Hist. Nat. Paris 1 (1815) 370, t. 19, f. II, t. 20; TEYSM. & BINNEND. Cat. Hort. Bog. (1866) 26; EDELING, Nat. Tijd. Ned. Ind. 31 (1870) 297; HUB. WINKLER, Bot. Jahrb. 44 (1910) 518; MERR. En. Born. (1921) 37.

Leaf-blades ovate to broad elliptic or suborbicular, inrolled when young, with blunt, rounded or even emarginate base, acutely tapering into the petiole, apex rounded or emarginate, light-green, at the underside of the tip with a purple-margined, active hydathode, 6–28 by 4½–20 cm; main nerves 9–13 and a marginal one; secondary nerves very numerous, parallel, nearly perpendicular to the midrib, reticulations dense, very fine; petiole thick, triangular, 20–65 cm. *Peduncles* 1–4, axillary, flattened at the base, higher triangular, 20–90 cm. *Umbels* 2–15-flowered, sometimes with 1–2 leaves between the flowers. Bracts roundish to broad elliptic, the (largest) outer 1½–2 by 1–1½ cm, lengthwise fine parallel-nerved. Pedicels 2–7 cm. *Sepals* green, obtuse, 1¾–2½ by 1–1½ cm. *Petals* pale-yellow, with darker base, broad-ovate to orbicular, lengthwise folded in bud, apex rounded, 2–3 by 1–2 cm. *Fruitlets* enclosed by the calyx, forming a rounded whole *c.* 1½–2 cm diam. *Seeds* with thin, transverse ridges, brown or black-brown 1 mm long.

Distr. Native of tropical America, introduced into SE. Asia (Siam, S. Burma, Ceylon) and *Malaysia:* Sumatra (incl. also Enggano Isl.), Malay Peninsula, Java, Anambas Isl., Borneo, apparently still absent from many islands.

Ecol. Shallow swamps, ditches, pools, and specially common on wet rice-paddies, always it seems in more or less stagnant fresh water, most abundant below 700 m, but found up to 1300 m[1]; *fl. fr.* Jan.–Dec.

Apparently an escape from the Botanic Gardens, Bogor, where the species was recorded in 1866 to be cultivated; for the first time mentioned 'as a newly introduced alien' in 1870 by EDELING (*l.c.*) from the banks of the river Tjiliwung near Djakarta, which same river flows also through the Botanic Gardens, Bogor.[2] Soon afterwards becoming gradually a common rice-paddy plant in the environs of Bogor and now spread all over West Malaysia. In Siam it has been introduced about 40 years ago (BURKILL, *l.c.*) and in Ceylon about 1930 (SENARATNA, *l.c.*)

Biol. The flowers open in the morning and close after a few hours, after which the stamens and corolla disintegrate into a mucilaginous mass. There is no record of any pollinating agent in Malaysia. Various authors have observed that the fruiting peduncle bends downward (by weight or active curving?) and produces leaves and roots in the mud, in which way a vegetative reproduction is established.

VAN DER PIJL (*l.c.*) observed in experiments details about the dispersal of the seeds which are reproduced in great quantities. The seeds themselves are hardly buoyant, but the fruitlets are for some days. Then the adaxial margin of the fruit shows a slit, which widens through an active curving of the narrow, thicker, green, dorsal (abaxial) side; through this pressure the thin, lateral sides of the fruitlets bulge, causing the slit to open wider and permitting the seeds to escape. Later the dorsal side curves back again, and the slit of the emptied fruitlet closes.

BACKER states that the species is perennial, but can turn annual through desiccation of the habitat.

Uses. In West Java juvenile specimens represent one of the commonest estimated vegetables. OCHSE recommends to plant it in places where rice does not grow well. He states that it could replace spinach or endive. In many places the excellent edible qualities of the plant are yet unknown. In the Toba Lands (N. Sumatra) used as fodder for pigs (HEYNE).

Its occurrence would indicate a fertile soil.

Vern. *Gele sawahsla*, D, ètjèng, M, S, *sabèr*, *bang-èng*, *gèndot*, S, *gèndjèr*, S, J, *anggrè*, *bèrèk*, *bĕngok*, *gunda wèwèhan*, *tĕmpukjung*, *tjèntongan*, J (the latter word meaning rice-spoon, alluding to the shape of the leaves), *haléjo*, *lumbur*, Batak, *jinjir*, Mal. Pen.

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(1) KOENS claims to have found *L. flava* at 2000 m, in Kawa Bertjek, W. slope of Mt Guntur, Preanger Reg. (W. Java) (Trop. Natuur 2, 1913, 111).

(2) The introduction in the East of *Eichhornia crassipes* SOLMS took place in the same way (*cf.* vol. 4, p. 260).

PENTAPHYLACACEAE (C. G. G. J. van Steenis, Leyden)

1. PENTAPHYLAX

GARDNER & CHAMPION, in Hook. J. Bot. & Kew Gard. Misc. 1 (1849) 245; CHAMPION, Trans. Linn. Soc. Lond. 21 (1853) 114, t. 12; MATTFELD, in E. & P. Pfl. Fam. 20 b (1942) 13.—**Fig. 1.**

Evergreen, subglabrous shrubs or trees. Twigs lengthwise grooved and ridged. Buds perular. *Leaves* simple, entire, penninerved, spirally arranged; midrib and petiole sulcate. Stipules absent. *Flowers* bisexual, actinomorphic, rather small, in ± sessile, bracteate, axillary pseudo-spikes or -racemes whether or not provided with reduced leaves at the apex and later terminating into a foliate twig, flowering from the base upwards; exceptionally some flowers or some inflorescences in twos, the upper flower expanding first. Bracteoles 2, appressed to the calyx, persistent, ± carinate, ciliate. *Sepals* 5, slightly unequal, roundish, imbricate, ciliate, persistent, sometimes splitting (retuse) later. *Petals* 5, white, thickish, obovate-oblong, rounded or shallowly emarginate, imbricate in bud, free but coherent mutually and with the stamens, dropping often together. *Stamens* 5, basifixed, inflexed in bud, later erect, alternating with the petals and shorter than these; filaments thickish, flattened in the middle, narrowed towards the anther; anther-cells 2, free, roundish, each cell with a minute appendage representing a terminal pore. Disk absent. *Ovary* superior, 5-celled, ovate. Ovules 2 in each cell, collateral, pendent, attached at the inner angle, feebly campylotropous, apotropous, with 2 teguments and a dorsal raphe. *Style* 1, long-persistent, cylindric; stigma broadened, feebly or distinctly star-shaped by 5 acute, minute to distinct stigmatic arms. *Capsule* ellipsoid, loculicidally dehiscent in the upper half or down to the base, valves long persistent, each bearing a septum along the middle; exocarp either freed and withering or disruptured along the midrib of the carpels, midribs persistent, representing 5 additional narrow 'valves'; endocarp and septa woody, after dehiscence leaving a persistent, ± 5-angular columella. Endocarp and seedcoat showing a peculiar transverse-fibrous tissue. *Seeds* elongated, resembling thin, narrow lemon-sectors, sometimes thin above (in the basal part) so as to appear seemingly ± winged, but sometimes appearing to be empty. Embryo horse-shoe-shaped; radicle terete; albumen scarce.

Distr. Two *spp.* in SE. Asia (Hongkong, Hainan, Kwantung, and Tonkin) and *Malaysia:* Malay Peninsula, N. Sumatra. Fig. 2.

Ecol. Rain-forests and subalpine brushwood, in Malaysia and Indo-China exclusively above 1200 m altitude.

Uses. Sometimes cultivated for ornamental purposes.

Taxon. The taxonomic affinity of this mono-generic family is still not unanimously agreed on. HOOKER (J. Bot. *l.c.*) assumed it to belong to the *Theaceae*, in a rather isolated position possibly approaching the *Gordonieae*. This view was shared by BENTHAM (J. Linn. Soc. Bot. 5, 1861, 59 and Fl. Hongk. 1861, 28), who placed it in close proximity to *Eurya*, by CHOISY (Mém. Soc. Phys. & Hist. Nat. 14, 1855, 169), maintained by BENTHAM & HOOKER (Gen. Pl. 1, 1862, 183), and is still upheld by HUTCHINSON (Fam. Fl. Pl. 1, 1926, 174).

On the other hand BAILLON (Hist. Pl. 4, 1873, 245) does not accept it as theaceous.

ENGLER assigned it in the rank of a family and arranged it within the *Celastrales* next to the *Corynocarpaceae*, *Aquifoliaceae*, and *Celastraceae* (Pfl. Fam. Nachtr. 1, 1897, 214, 350). He notes that the habit may be theaceous and that the fruit resembles that of *Clethra*, as do the porous anthers; *Clethra*, however, possesses 2 whorls of stamens and many ovules per cell. His view was shared by VAN TIEGHEM (in Morot, J. Bot. 14, 1900, 193); it differs from *Celastraceae* proper in several points *viz* by the absence of stipules, by a different structure of the ovule, and in the inflorescence. ENGLER maintained his view (Pfl. Fam. Nachtr. 3, 1908, 197), which is also accepted by MERRILL (Lingn.

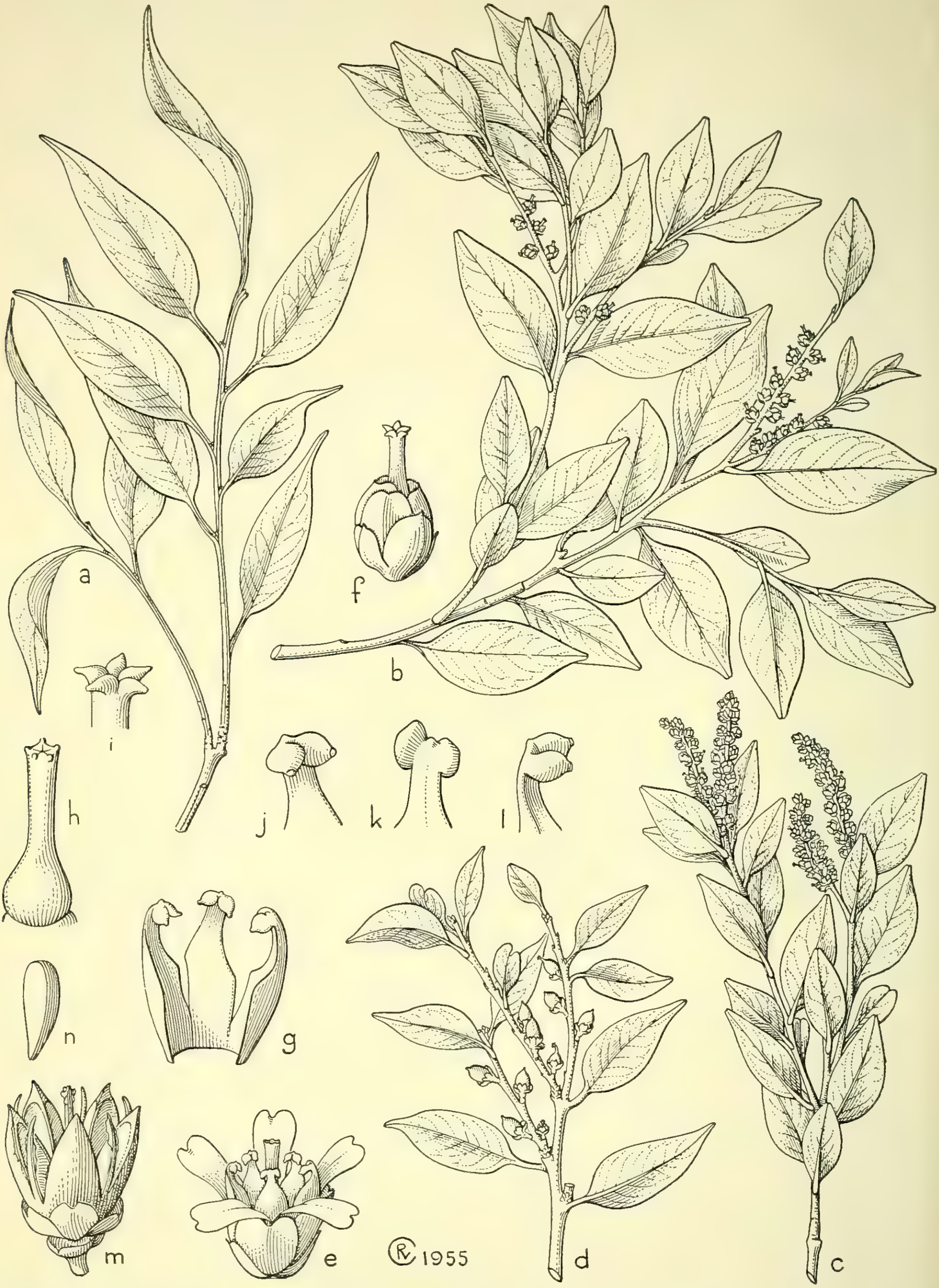

Fig. 1. *Pentaphylax euryoides* GARDN. & CHAMP. *a.* Sterile twig, N. Sumatra, × ²/₃, *b.* flowering, Malaya, × ²/₃, *c. ditto*, × ²/₃, *d.* fruiting, N. Sumatra, × ²/₃, *e.* flower, × 5, *f.* flower beyond anthesis, × 5, *g.* stamens, × 6, *h.* pistil, × 6, *i.* stigma, × 18, *j–l.* anthers, × 13, *m.* dehisced fruit, × 3, *n.* seed, × 3 (*a.* after bb 3819, *c.* H. C. ROBINSON, *d.* VAN STEENIS 8984, *e–f.* Herb. Bog. 55404, *m.* SF 20617.

Sc. J. 5, 1927, 115), by LEMÉE (Dict. Descr. 5, 1934, 134), by MAURITZON (Bot. Notiser 1936, 187, fig. 7A–C), by PULLE (Compend. 1938, 294), by MATTFELD in the new edition of the Pflanzenfamilien (20b, 1942, 13–21), and by GAGNEPAIN (Fl. Gén. I.-C. Suppl. 1, 1943, 333). METCALFE & CHALK (Anat. Dict. 1, 1950, 207) basing themselves on wood-anatomical data of BEAUVISAGE and of HEIMSCH also assume the genus related to *Cyrillaceae* and consider it better placed in the *Celastraceae* or *Theaceae* than in the *Terebinthales*. Dr KOBUSKI (*in litt.*) is of opinion that it should be excluded from the *Theaceae*.

HALLIER (Beih. Bot. Centr. Bl. 39, ii, 1921, 133, 176) inserts the genus in *Linaceae* as a special tribe *Pentaphylaceae*.

The structure of the pollen apparently does not furnish a clue for a decision of the affinity; ERDTMAN (Pollen Morph. 1952, 317–318, fig. 185A) remarks that more or less similar pollen grains are found in *Clethraceae*, *Cyrillaceae*, and *Theaceae* (*Eurya*).

Identification with HUTCHINSON's key (Fam. Fl. Pl. 1, 1926) leads to *Cyrillaceae*, although in this book *Pentaphylax* is arranged under *Theaceae*. This is possibly due to his (erroneous) drawing of anthers with slits in RIDLEY's Flora of the Malay Peninsula.

Though I dare not say whether the genus deserves indeed the merit of family rank, it deviates in several ways so remarkably from other plants, that it seems convenient to treat it separately.

Morph. The colour of the dried leaves often reminds of *Eurya* and *Symplocos* apparently due to the accumulation of alum according to HALLIER (Beih. Bot. Centr. Bl. 39, ii, 1921, 128) and CHENERY (Kew Bull. 1948, 176).

The inflorescences (spikes or racemes) are really twigs; they often end into a leafy continuation and later develop into normal twigs leaving the remains of the dehisced fruits laterally on bracteate twig parts lower down. This character is variable, however, as in some flowering specimens, described as *P. malayana* and *P. spicata*, the leafy continuation is not present.

VAN TIEGHEM (*l.c.*), followed by MATTFELD (*l.c.*), suggests the existence of 10 valves in the capsule, 5 of which would be sterile and narrow and be represented only by the midribs of the carpels. I assume this interpretation is wrong, as the midribs take always with them an irregular portion of marginal tissue of the exocarp. In some cases the whole pericarp remains standing after dehiscence, the midribs withstanding withering best.

In one of the type specimens of *P. spicata* twin-flowers and twin-spikes occur, but on the same specimen both solitary flowers and solitary spikes are present as well.

Notes. The species described are very closely related and for this reason I felt necessitated to revise the whole genus. There is a great range in the variability of the size of the leaves, their texture, and in the size of the plant, no doubt at least in part correlated with habitat. Diagnostic characters appear to be feeble. All specimens from different localities differ mutually in minor details. After a careful scrutiny of the rather scarce flowering materials hitherto collected I have come to the conclusion that there is only one taxon deserving specific rank. See further under the species.

1. **Pentaphylax euryoides** GARDNER & CHAMPION, in Hook. J. Bot. & Kew. Gard Misc. 1 (1849) 245; BENTH. Fl. Hongk. (1861) 28; CHAMPION, Trans. Linn. Soc. Lond. 21 (1853) 116, t. 12; MERR. Lingn. Sc. J. 5 (1927) 115; MATTFELD, Pfl. Fam. ed. 2, 20b (1942) 21, fig. 5; GAGNEPAIN, Fl. Gén. I.-C. Suppl. (1943) 333.—*P. malayana* RIDL. J. Linn. Soc. Bot. 38 (1908) 305; Fl. Mal. Pen. 1 (1922) 206, fig. 21; STEEN. Bull. Bot. Gard. Btzg III, 17 (1948) 404.—*P. arborea* RIDL. Fl. Mal. Pen. 5 (1925) 291.—*Theacea gen. nov.* ENDERT, Med. Boschb. Proefst. 20 (1928) 216. —*P. racemosa* MERR. & CHUN, Sunyatsenia 1 (1930) 66, *incl. P. montana* RIDL. *errore*; J. Arn. Arb. 19 (1938) 41.—*P. spicata* MERR. J. Arn. Arb. 19 (1938) 40; GAGNEP. Fl. Gén. I.-C. Suppl. (1943) 333, fig. 32 (9–16).—**Fig. 1.**

Bush or small tree, 2–9–12 m or medium-sized tree 24–38 m by 30–60 cm (unbranched part 10–17 m). Twigs often dark-coloured. Innovations sometimes slightly puberulous, red (RIDLEY). *Leaves* chartaceous to thick-coriaceous, very different in shape, oblong, elliptic, ovate-lanceolate, or lanceolate, sometimes oblique or even falcate, 3–8 by 1–2$^3/_4$ cm; base cuneate to feebly rounded; apex tapering to distinct- or even long-acuminate, rarely blunt, tip blunt to rounded; nerves *c.* 6–8 pairs, obliquely ascending and arching, not much more prominent beneath than are the tertiary veins; venation prominent on both sides, but less so in thick leaves; petiole $^1/_2$–1 cm. *Pseudo-racemes* or *-spikes c.* 2$^1/_2$–5 cm. Bracts small, roundish to triangular *c.* 1 mm. Pedicels 0–2 mm. Bracteoles small, oblong to triangular or roundish, sometimes acutish, 1$^1/_2$–2$^1/_2$ by $^1/_2$–2 mm, *c.* $^1/_4$–$^1/_2$ times as long as the calyx. *Sepals* roundish, 1$^1/_2$–3 by 1$^3/_4$–2$^1/_2$ mm. *Petals* 4$^1/_2$–5 by 2 mm. Filaments 3–4 by 1$^1/_4$–1$^1/_2$ mm. Anthers *c.* $^1/_2$ mm. Style 1–2 mm. *Capsule* ellipsoid, rounded at both ends, sometimes slightly apiculate, *c.* 5–9 by 4–5 mm, at last black, taste astringent. *Seeds* linear-oblong, with slightly rounded outer margin, cuneate in cross-section, 4$^1/_2$–6$^1/_2$ by 1$^1/_2$–2 mm, rounded at both ends, red-coated.

Distr. SE. Asia (Kwantung: Lok Chang; Tonkin: Chapa, massifs of Fan Tre Pam & Tam Dao and Annam: Bach-ma pr. Hué, Bana pr. Tourane; Hainan, Hongkong), in *Malaysia:* Malay Peninsula (G. Tahan; Kluang Terbang; G. Mekuang Lebah; G. Ulu Kali; Fraser Hill) and N. Sumatra (Gajo Lands: VAN STEENIS 8421, 9089, 8984; Tapanuli: bb 3819, 5231, 5266). Fig. 2.

Ecol. Mountain forests and subalpine scrub-forest, 1200–3000 m, *fl.* Jan.–Febr., April–July, *fr.*

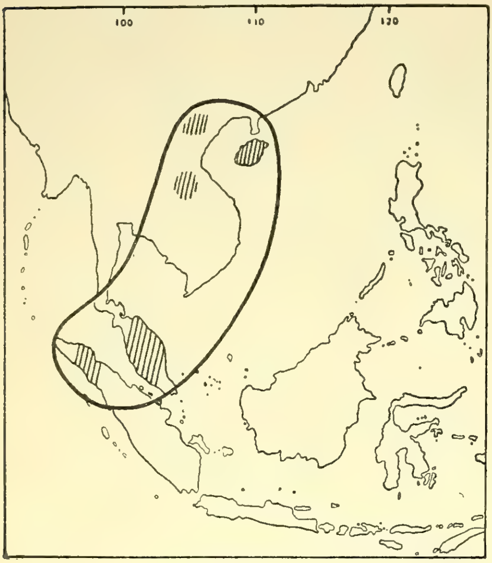

Fig. 2. Area of the genus *Pentaphylax.*

July–Sept. and (in Gajo Lands) Jan.–Febr.. In tall mountain forests this appears a tall tree with thin leaves; on exposed crests it is a gnarled, crooked treelet or bush with thick leaves.

Vern. *Madang lasiak*, *api-api*, Batak.

Notes. Originally I had the impression that two taxa were involved, one characterized by sessile flowers in defoliate spikes (*malayana*, *spicata*), the other having foliate racemes (*euryoides*, *racemosa*, *arborea*), but I can find no correlation with other characters (length of style, shape and size of bracteoles, size of the tree, *etc.*). There is quite some degree in variation of minute details in different specimens. In one specimen of *P. malayana* I found the lower flowers pedicelled and the upper flowers in the same inflorescence sessile and there are also specimens with sessile flowers in foliate spikes, necessitating the distinction of one taxon only. This is corroborated phytogeographically, as specimens with sessile and those with pedicelled flowers have exactly the same area. As to *P. racemosa*, MERRILL himself suggested reduction to *P. euryoides.* As to *P. spicata*, I saw of PÉTELOT 3213 an excellent flowering duplicate (BO); the leaf size is on the average somewhat larger and broader (5–10 by 2½–5 cm) than that in W. Malaysia, but nerves, leaf-shape and flowers agree.

MALPIGHIACEAE (M. Jacobs, Leyden)

Usually *lianas*, sometimes shrubs or small trees, provided with characteristic unicellular hairs which are generally centrally attached (fig.11). *Leaves* opposite, rarely subopposite or in whorls of 3, mostly petioled, simple and mostly entire, often provided with superficial glands beneath, especially at the base. *Stipules* mostly present, variable. *Inflorescences* simple or slightly paniculate at the base, bracteate, raceme-like; pedicels articulated, bracteolate. *Flowers* often conspicuous, bisexual, but often parts of the gynoecium or androecium abortive, or rarely polygamous, actinomorphic to zygomorphic. *Sepals* 5, free or slightly connate, persistent, calyx outside sometimes provided with 1–10 distinct glands. *Petals* 5, free, imbricate, mostly cochlear, nearly always clawed, margin often ciliate, dentate or fimbriate. *Disk* inconspicuous, sometimes accrescent. *Stamens* (in Mal.) 10, sometimes unequal; filaments often connate at the base; anthers basifix or dorsifix, introrse, sometimes with enlarged connective, 2-celled, dehiscing lengthwise. *Ovary* superior, with generally 3 (in extra-Mal. *spp.* rarely 2, 4 or 5) carpels, cells, and lobes. Styles as much as carpels, persistent, free, with a terminal, sometimes little developed stigma. Ovules 1 per cell, hemi-anatropous, hanging from an almost axillary placenta. *Fruit* a schizocarp of which the mericarps may dehisce dorsally, mericarps mostly winged in various ways (*samara*), seldom fleshy and forming a drupe (in extra-Mal. *spp.* a capsule or berry may occur). *Seed* with a large and mostly straight, rarely curved, embryo; endosperm none.

Distr. About 57 genera and 700 *spp.*, almost entirely confined to the tropics. The bulk of the family occurs in the New World; in a general way, the distributional frontiers of the larger taxa often coincide with important geographical demarcations.

Notes. The exocarp may show outgrowths, wing- or crestlike which often serve as important specific characters.

The classification of the family now generally accepted was first proposed by NIEDENZU in 1890 (Ber. Deut. Bot. Ges. 8: 190) and formed the basis of his recent monographs in the Pflanzenreich (Heft 91, 92 & 94, 1928). In this classification the structure of the fruit provides the most important taxonomical characters. In principle, the wings of a mericarp may develop into 2 planes: in the median plane through each cell a dorsal wing (crest) may arise, in the tangential plane of the cell a lateral wing. The degree of development of the wings in each plane is variable with the groups.

The subfamily of the *Pyramidotorae* is characterized by a more or less pyramidal receptacle and winged fruits.

In the tribe *Hiraeeae* the lateral wing is much developed and the dorsal wing less so: in *Aspidopterys* the wing is simple and surrounds the whole mericarp as a disk (fig. 1), in *Hiptage* the lateral wing is divided into a bigger, median part and 2 smaller, lateral parts, sometimes the dorsal wing is present as a small crest (fig. 7d), in *Tristellateia* the lateral wing is divided into a number of stellately expanded lobes, the dorsal wing differing slightly from the other lobes (fig. 9c).

In the tribe *Banisterieae* the dorsal wing is far surpassing the lateral one in size: in *Ryssopterys* this is very conspicuous, sometimes 2 abortive remnants of the lateral wing can be observed (fig. 9d), in *Brachylophon* only a more or less distinct dorsal crest on the mericarps is present (fig. 9a–b).

The subfamily of the *Planitorae* with a flat or slightly hollow receptacle has wingless fruits; the cultivated *Galphimia* and *Malpighia* belong here.

Except the two species here described, *viz Galphimia gracilis* and *Malpighia coccigera*, a few others are incidentally cultivated in *Malaysia: Byrsonima coriacea* KUNTH *var. spicata* (L. C. RICH.) NIEDENZU, *Malpighia glabra* L., *Sphedamnocarpus pruriens* (E. MEYER) SZYSZYL., and *Stigmaphyllon ciliatum* (LAMK) JUSS.

The *species* of *Hiptage* can be identified by the structure of the gland at the outside of the calyx, in other genera, especially in *Aspidopterys*, fruits are essential for identification.

Ecol. In the Bogor Botanic Gardens I saw ants visiting vividly the glands of young *Hiptage* and *Ryssopterys* leaves.

KEY TO THE GENERA

1. Fruit bearing wing(s) or a crest.
  2. Stipules connate with the base of the petiole.
    3. Leaf blade glandless. Nodes of the young twigs densely haired around just above the leaf insertions. Styles 3. Fruit with an acute dorsal crest, not winged. Shrub. . . . . **4. Brachylophon**
    3. Leaf blade at the base with 2 glands beneath. Young twigs glabrous. Style 1, rarely 2. Samaras stellate. Climber . . . . **3. Tristellateia**
  2. Stipules free, inserted on the twig between the petioles, sometimes reduced or wanting.
    4. Flowers zygomorphic. Style 1. Leaf base mostly acute. Samara with 1 long median wing and 2 shorter lateral wings . . . . **2. Hiptage**
    4. Flowers actinomorphic. Styles 3. Leaf base rounded, truncate or cordate.
      5. Leaf margin with small glands beneath. Petiole at the top with 2 distinct, dish-shaped glands. Samaras only with a dorsal wing. . . . . **5. Ryssopterys**
      5. Leaf and petiole glandless. Samara surrounded by a disk-like lateral wing. **1. Aspidopterys**
1. Fruit smooth. Cultivated shrublets with small leaves ± 1–5 cm.
  6. Leaves herbaceous, entire, with 2 glands at the base. Calyx glandless . . . . . **6. Galphimia**
  6. Leaves coriaceous, mostly thorny-dentate, glandless. Calyx with distinct glands . . **7. Malpighia**

1. ASPIDOPTERYS

JUSSIEU, Ann. Sc. Nat. II, 13 (1840) 266; Arch. Mus. Hist. Nat. Paris 3 (1843) 508, repr. 254; HUTCHINSON, Kew Bull. (1917) 91-102; NIEDENZU, Pfl. R. Heft 91 (1928) 19.—*Aspidopteryx auct.*—**Fig. 1–2.**

Lianas. *Leaves* and petioles glandless. Stipules on the twig between the leaf insertions, very small and caducous, or wanting. *Inflorescences* axillary, rarely terminal, panicle-like, flowers crowded at the top of the opposite lateral branches, sometimes only few buds developing into flowers, the others immaturely caducous. Bracteoles mostly inserted below the articulation of the pedicel, upper portion of the pedicel often lengthened in fruit. *Flowers* bisexual, actinomorphic, as a rule white. *Sepals* small, glandless. *Petals* ± oblong, not clawed, recurved after anthesis, thin, entire, glabrous, somewhat cucullate at the top. Filaments thin, sometimes connate at the base, glabrous; connective little developed and only dorsally visible. *Ovary* mostly glabrous, with 3 flat, already more or less winged sides; styles 3, free, diverging, slightly shorter than the petals, terete, persistent, stigmas capitate. *Disk* inconspicuous, later growing bowl-shaped with 3 acute lobes. *Samaras* often attached to a longer or shorter carpophore, the latter persistent, sustained by the disk-lobes at its base; lateral wing of each mericarp developed into an orbicular or oblong, membranous or coriaceous disk, with radial venation towards the margin; dorsal wing little developed; seed straight and linear.

Distr. About 15–20 *spp.* centering in Bengal and Further India (north to Nepal and Sikkim, few *spp.* going west to Kumaon and Malabar, south to the Andaman Islands), Yunnan, S. China, and Hainan, in *Malaysia:* as yet unknown from the Moluccas and New Guinea, and ?Lesser Sunda Islands.

KEY TO FLOWERING SPECIMENS

1. Axis of the inflorescence glabrous. Petiole glabrous or thinly pale- and appressed-haired.
  2. Leaves herbaceous, ovate to obovate, top acuminate . . . . **1. A. elliptica**
  2. Leaves coriaceous, ovate, top acute . . . . **2. A. celebensis**
1. Axis of the inflorescence haired. Petiole densely set with often dark-coloured hairs.
  3. Leaves tomentose on the whole lower surface. Flower buds obovate-elliptic . . **4. A. tomentosa**
  3. Leaves glabrous below, at least between the nerves. Buds subglobular or ovate-elliptic. **3. A. concava**

KEY TO FRUITING SPECIMENS[1]

1. Seed in the centre of the wing. Carpophore distinct, 1–2 mm long. Fig. 1e–g. . . . **1. A. elliptica**
1. Seed acroscopically situated in the wing.
  2. Seed 3–5 mm long. Carpophore almost wanting. Fig. 1a–d. . . . . **3. A. concava**
  2. Seed $^1/_2$–1 cm long. Carpophore 2–5(–7) mm long. Fig. 1h–j. . . . . . . **4. A. tomentosa**

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(1) Of 2. *A. celebensis* the fruits are not known.

1. Aspidopterys elliptica (BLUME) JUSSIEU, Ann. Sc. Nat. II, 13 (1840) 266; Arch. Mus. Hist. Nat. Paris 3 (1843) 509, repr. 255; MIQUEL, Fl. Ind. Bat. 1, 2 (1859) 586; BACKER, Schoolfl. (1911) 167; HUTCHINSON, Kew Bull. (1917) 99; MERRILL, En. Philip. 2 (1923) 380; NIEDENZU, Pfl. R. Heft 91 (1928) 25; BACKER, Bekn. Fl. Java (em. ed.) 4c (1943) fam. 110, p. 3.—*Hiraea elliptica* BLUME, Bijdr. (1825) 225.—*Ryssopteris ovata* TURCZ. Bull. Soc. Nat. Moscou 36 (1863) 583.—*A. helferiana* (*non* KURZ) KING, J. As. Soc. Beng. 62, ii (1893) 195, *pro stirp. andaman.*—*A. ovata* MERR. & ROLFE, Philip. J. Sc. 3 (1908) Bot. 106; MERR. En. Born. Pl. (1921) 324.—*Combretum sexalatum* MERR. Philip. J. Sc. 1 (1906) Suppl. 73, 212, *quoad fruct.*—*A. sp.* VIDAL, Phan. Cum. Philip. (1885) 99.—*A. concava var. philippinensis* NIEDENZU, Arb. Bot. Inst. Braunsberg 6 (1915) 7; Pfl. R. Heft 91 (1928) 24.—*A. concava var. helferiana* NIEDENZU, Arb. Bot. Inst. Braunsberg 6 (1915) 7, Pfl. R. *l.c.* 24, *quoad specim. philip.*—*A. andamanica* HUTCHINSON, Kew Bull. (1917) 99.—**Fig. 1e–g, 2.**

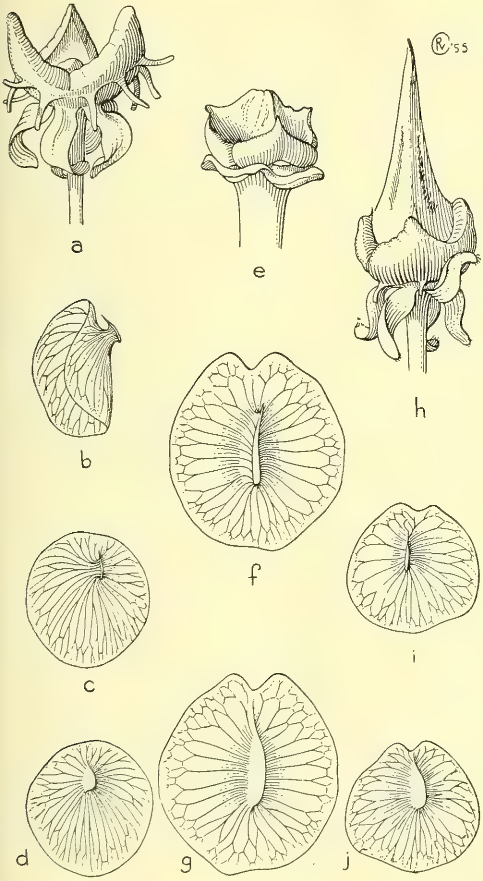

Fig. 1. Carpophores with disk lobes (× 8) and samaras (×$^2/_3$) of *Aspidopterys. a–d. A. concava* (WALL.) JUSS., *e–g. A. elliptica* (BL.) JUSS., *h–j. A. tomentosa* (BL.) JUSS.

Climber, up to about 10 m high. Young parts sparsely and appressedly pale-haired, quickly glabrescent. Twigs terete, internodes (3–)5–15(–20) cm. *Leaves* ovate or ovate-elliptic to obovate-oblong, *c.* $1^1/_4$–$1^3/_4$ times as long as broad, 8–13 (–17) by 5–$8^1/_2$(–11) cm, herbaceous; base rounded or slightly cordate; top rounded and longer or shorter acuminate; surfaces glabrous, except sometimes the basal part of the midrib; nerves 4–7 pairs, flat above, prominent beneath; petiole 1–2(–3) cm. *Inflorescences* (5–)10–20 cm long, glabrous. Bracts minute. Pedicels 1–3 cm. Buds ovate-elliptic. *Flowers* white, sometimes yellow-green, only few setting fruit. *Sepals* 2–3 by 1–$1^1/_2$ mm, thin, oblong, top rounded and sometimes a bit ciliate, further glabrous. *Petals* oblong with rounded top, 5–7 by 2–3 mm. Filaments $1^1/_4$–$1^1/_2$ mm, anthers *c.* $1^1/_2$–2 by 1 mm. *Carpophore* pyramidal, 1–2 mm high; wing suborbicular, mostly emarginate, approximately flat, (3–)$3^1/_2$–5 (–6) cm long, (2–)3–$4^1/_2$(–$5^1/_2$) cm broad, pale-translucent to shiny brown and coriaceous; dorsal wing distinct but narrow. *Seed* in the centre of the wing, linear, $^3/_4$–1 cm long.

Distr. ?China, ?Indo-China, Andaman Islands, in *Malaysia:* Sumatra (rare), W.-E. Java, Borneo (rare), Philippines (common). Fig. 3.

Ecol. Light, forested habitats, from the lowland up to 600 m; *fl.* Dec.–Jan. (Java), June–July (Philippines) but in the latter islands also in other months.

Vern. *Aroy tattaruman, aroy babilandak*, S, *ojot mlati rambat*, J, *yodou, ga angaän, kait*, N. Born.; Philippines: *laplapsot*, Ilk., *lampei*, Mbo, *mayetbong, tanag-amó*, Tag.

Notes. The plants of this species with pale, thin and comparatively small fruits are all Philippine.

In the Kew Herb. there is a specimen coll. MORSE 406 from China which might belong to *A. elliptica*. If *A. macrocarpa* DOP (Fl. Gén. I.-C. 1, 1911, 603; ARÈNES, *ibid.* Suppl. 1, 1945, 540) is conspecific, the species would also occur in Indo-China.

2. Aspidopterys celebensis ARÈNES, Reinwardtia 3 (1954) 73.

Twigs with thickened leaf scars, glabrous. *Leaves* more or less opposite, ovate, coriaceous, 12–15 by 6–8 cm; base rounded to subcordate, top narrowed and acute; midrib flat above, prominent below; nerves 6–9 pairs, slightly prominent; surfaces entirely glabrous, shiny and reticulate above; margin a little revolute; petiole 1–$1^1/_2$ cm. *Inflorescenses* axillary, up to *c.* 12 cm long, lax-flowered, glabrous. Pedicels filiform, 1–$1^1/_2$ cm. *Flowers* pale green. Buds elliptic. *Sepals* elliptic, $1^1/_2$ by 1 mm. *Petals* oblong to obovate, somewhat cucullate at the top, 5 by 2 mm. Filaments 2 mm, anthers 1–$1^1/_2$ mm. Ovary glabrous, styles 3 mm. *Fruit* unknown.

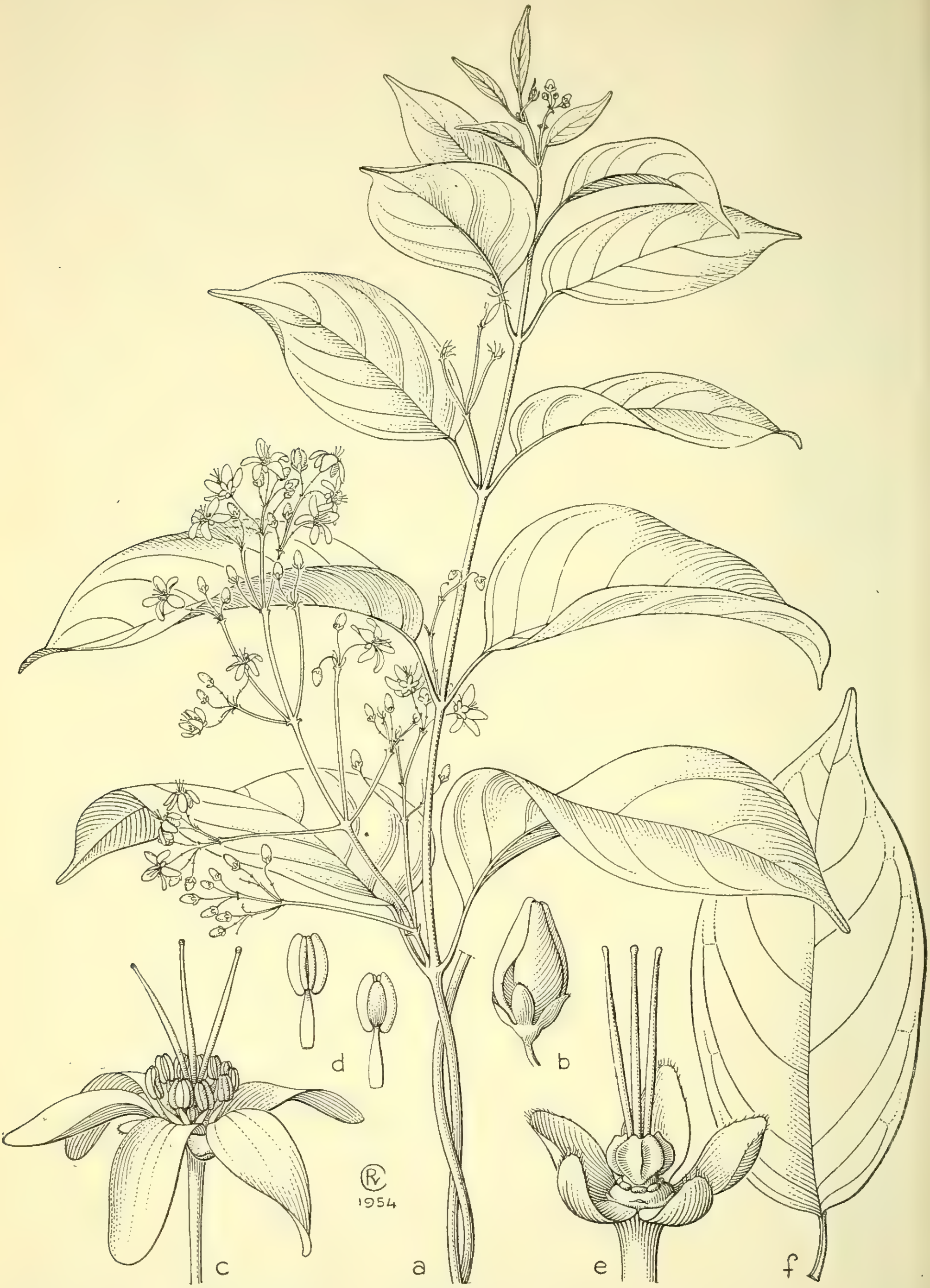

Fig. 2. *Aspidopterys elliptica* (Bl.) Juss. *a*. Flowering branch, × 2/3, *b*. bud, × 5, *c*. flower, × 5, *d*. unopened stamens, the left one from the adaxial side, × 7, *e*. calyx and gynoecium, torus thickened with faint scars of petals and along inner margin scars of (5) detached stamens visible, disk hardly visible inside these scars, × 7, *f*. a leaf, × 2/3.

Distr. *Malaysia:* NE. Celebes (once collected, Koorders 19642, Bo, L, 2–III–1895). Fig. 4.

Ecol. Rain-forest, 50 m.

Note. Closest resembling *A. elliptica* but distinctly differing in leaf-shape and texture.

3. Aspidopterys concava (Wall.) Jussieu, Ann. Sc. Nat. II, 13 (1840) 266; Arch. Mus. Hist. Nat. Paris 3 (1843) 509, repr. 255; Hook. *f.*, Fl. Br. Ind. 1 (1874) 420; Kurz, J. As. Soc. Beng. 43, ii (1874) 137; For. Fl. Burma 1 (1877) 175; King, J. As. Soc. Beng. 62, ii (1893) 195; Hutchinson, Kew Bull. (1917) 98; Ridley, Fl. Mal. Pen. 1 (1922) 329; Blatter, J. Ind. Bot. Soc. 9 (1930) 145, *pro parte*; Arènes, Fl. Gén. I.-C. Suppl. 1 (1945) 532.—*Hiraea concava* Wallich, Pl. As. Rar. 1 (1830) 13.—*A. concava var. sumatrana* Niedenzu, Arb. Bot. Inst. Braunsberg 6 (1915) 7; Pfl. R. Heft 91 (1928) 25, *pro parte*.—**Fig. 1a–d.**

Liana, up to *c.* 20 m long. Young parts dark red-haired, twigs angular when young, more terete when older, leaf scars somewhat thickened; internodes (5–)7–10(–15) cm, with irregular, longitudinal ridges and few lenticels, glabrous, dull brown. *Leaves* subcoriaceous, ovate-elliptic to ovate-oblong, 1¼–2½ times as long as broad, (5–)7–10(–12) by 3–5(–8) cm; base rounded to acute, rarely subcordate, top mostly obtusely acuminate, rarely cuneate-emarginate or wholly rounded; surfaces glabrous, but basal part of the midrib below haired as is the petiole; nerves 4–7 pairs, slightly prominent; petiole ¾–1½(–2) cm. *Inflorescences* (2–)5–10 cm long; axes thin, terete and dark red-brown haired. Pedicels thin, glabrous except below the bracteoles, in flower 1–1½ cm, in fruit 3–5 cm, articulated in the lower half. Bracteoles alternate below the articulation. *Flowers* white, ovate-elliptic in bud. *Sepals* 2 by 1 mm, glabrous, top rounded. *Petals* oblong, 3½–6 by 1½–3 mm, glabrous, with rounded top. Ovary glabrous, styles 3–4½ mm. *Carpophore* almost absent, disk lobes forming a sort of cup (fig. 1a). *Samara:* main wing suborbicular, ovate or transverse-elliptic, concave outside, 2–3½ by 2½–4 cm, scarious and pale-translucent; dorsal wing distinct but small, broadest at the base. *Seed* acroscopically situated in the wing, linear, 3–5 mm long.

Distr. Lower Burma, Martaban, Tenasserim, in *Malaysia:* Malay Peninsula (Western lowlands & Singapore), Sumatra (Lampong Distr., once coll.). Fig. 3. Warburg 17248 from Bima (Sumbawa) was recorded by Niedenzu under *var. sumatrana* which I think doubtful *(non vidi)*.

Ecol. In forests, below 500 m. *Fl.* (mostly) Jan.–Feb., *fr.* March–April. It seems that during flowering and fruiting often a good deal of the leaves have fallen.

Vern. Malacca: *akar ulan*, Djambi: *talau.*

4. Aspidopterys tomentosa (Blume) Jussieu, Ann. Sc. Nat. II, 13 (1840) 267; Arch. Mus. Hist. Nat. Paris 3 (1843) 514, repr. 260; Miq. Fl. Ind. Bat. 1, 2 (1859) 586; Kurz, For. Fl. Burma 1 (1877) 175; Backer, Schoolfl. (1911) 167; Niedenzu, Pfl. R. Heft 91 (1928) 21; Blatter, J. Ind. Bot. Soc. 9 (1930) 145; Backer, Bekn. Fl. Java (em. ed.) 4c (1943) fam. 110, p. 2.—*Hiraea tomentosa* Blume, Bijdr. (1825) 225.—*Ryssopteris rufescens* Turcz. Bull. Soc. Nat. Moscou 36 (1863) 583.—*A. helferiana* Kurz, J. As. Soc. Beng. 43, ii (1874) 137; For. Fl. Burma 1 (1877) 176, *descr.*; King, J. As. Soc. Beng. 62, ii (1893) 195.—*A. concava var. sumatrana* Niedenzu, Arb. Bot. Inst. Braunsberg 6 (1915) 7; Pfl. R. Heft 91 (1928) 25, *pro parte.*—For further synonyms see under the varieties.—**Fig. 1h–j.**

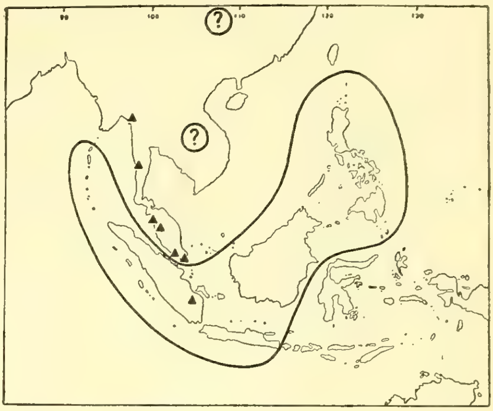

Fig. 3. Distribution of *Aspidopterys elliptica* (Bl.) Juss., the question marks indicating doubtful records from continental Asia, and localities of *A. concava* (Wall.) Juss. (triangles).

Liana, 10 m or longer. Twigs with long persistent, ferrugineous to dark red-brown hairs, older twigs with irregular longitudinal ridges and few lenticels; internodes (4–)10–15(–20) cm long. *Leaves* opposite, seldom subopposite or in whorls of 3, subcoriaceous, very variable in shape, suborbicular to ovate, elliptic or obovate, 1–2 times as long as broad, 6–13 by 4–8(–11) cm; base rounded to subcordate; top variable (see the varieties), upper surface glabrous, glaucous when dry, nerves often sulcate, lower surface dark ferrugineous to fulvous-haired, nerves prominent, mostly darker haired; nerves 4–7 pairs; petiole 1–2½(–3) cm, densely haired. *Inflorescences* many-flowered, 10–20 (–30) cm long, except the pedicels dark brownish red-haired. Bracts acute, to 5 mm long. Pedicels *c.* 1½–2½ cm, terete, thin, glabrous above the bracteoles. Bracteoles inserted below the articulation, often not opposite, articulation below the middle of the pedicel. *Flowers* white, elliptic-obovate in bud. *Sepals* 1½ by 1 mm, glabrous, sometimes ciliate. *Petals* obovate, *c.* 5 by 2½ mm, glabrous, top rounded. Filaments 2–2½ mm, terete, sometimes connate at the base, glabrous; anthers 1–1¼ mm, somewhat narrowed towards the top. Ovary glabrous, styles 3–4 mm. *Samaras* on a 2–5(–7) mm long acute carpophore; wing ovate, (2½–)3–4 by 2½–3 cm, pale greenish and translucent, glabrescent, approximately flat;

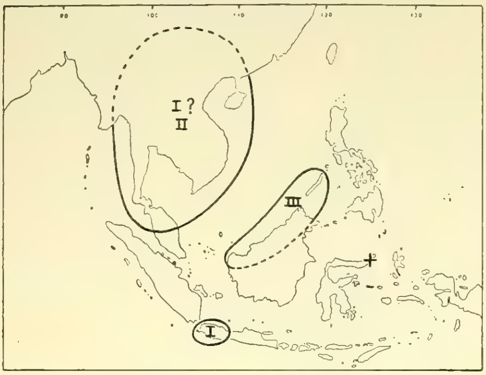

Fig. 4. Distribution of *Aspidopterys tomentosa* (BL.) JUSS.: I, var. *tomentosa*; II, var. *obcordata* (HEMSL.) NIED. (Andamans should be included); III, var. *longirostris* (ARÈNES) JACOBS; locality of *A. celebensis* ARÈNES (+).

dorsal wing small, broadest at the base. *Seed* acroscopically situated in the wing, *c.* ³/₄ cm long.

Distr. Burma (Martaban, Tenasserim), Andaman Islands (according to KURZ, Rep. Veg. And. Isl. 1870, 32; variety uncertain), in *Malaysia:* Malay Peninsula, Java, Borneo, Philippines. Fig. 4.

Notes. NIEDENZU considered *A. helferiana* KURZ to represent a variety of *A. concava*. An investigation of the (fruiting) type specimen (HELFER 923) showed that the samaras agree with those of *A. tomentosa*. The only difference with typical *A. tomentosa* is the absence of an indument on the leaves, except in the basal part of the midrib below. In my opinion KURZ's species belongs to *A. tomentosa*, representing perhaps an undescribed infraspecific taxon.

KING (1893) erroneously regarded as the type a specimen of WALLICH (Cat. 1057) from Phanoë, which I cannot identify with certainty because fruits are lacking. KING also referred to *A. helferiana* his Andaman specimens which have been described later by HUTCHINSON as *A. andamanica*, here considered conspecific with *A. elliptica*.

Provisionally the species can be segregated into the following three varieties:

var. **tomentosa.**

Leaves elliptic-obovate, top shortly narrowed to rounded, abruptly acuminate-cuspidate.

Distr. Probably in Further India, in *Malaysia:* W. Java. Fig. 4.

Ecol. In rain-forests, up to 1000 m; *fl.* Aug.–Nov. Sometimes on calcareous soil.

Vern. *Ojot sella kuda, aroy kipeusing*, S.

var. **obcordata** (HEMSLEY) NIEDENZU, Pfl. R. Heft 91 (1928) 22.—*A. obcordata* HEMSLEY in HOOK. Ic. Pl. 27 (1900) t. 2673; CRAIB, Fl. Siam. En. 1 (1926) 204; ARÈNES, Fl. Gén. I.-C. Suppl. 1 (1945) 540.

Leaves elliptic to obovate, short-acuminate-cuspidate; top truncate to emarginate, in the latter case the tip protruding from a wide, apical sinus, so that the leaf appears three-topped.

Distr. Yunnan, Siam, Burma, in *Malaysia:* Malay Peninsula (Kedah, once collected, RIDLEY *s.n.*, SING). Fig. 4.

var. **longirostris** (ARÈNES) *comb. nov.*—*A. concava* (*non* JUSSIEU) MERR. En. Born. (1921) 324, *pro specim. born.*—*A. longirostris* ARÈNES, Not. Syst. 11 (1943) 75.

Leaves ovate-elliptic, 6–9 by 3–5 cm, acute to acuminate with narrowed top. Samaras on carpophore 5–7 mm long, wing suborbicular, 2¹/₂ cm in diam.

Distr. *Malaysia:* Philippines (probably Palawan, type loc.), ?Borneo (Sarawak). Fig. 4.

Note. Although I am not certain about the two specimens collected in Sarawak by HAVILAND (3732 & 2857), I tentatively assume them to belong to this variety; MERRILL's record of *A. concava* in Borneo is solely based on these 2 numbers. Their flowers agree very well with those of *A. tomentosa*, but fruits are wanting.

Doubtful

A. glabriuscula (WALL.) JUSS. *var. subrotunda* NIEDENZU was mentioned by NIEDENZU, Pfl. R. Heft 91 (1928) 30, on account of a specimen WARBURG 13393, from Arrayal, Luzon. As no material was available to me I am not able to state anything about the occurrence of this SE. Asiatic species in the Philippines.

2. HIPTAGE

GAERTNER, Fruct. 2 (1791) 169; JUSSIEU, Ann. Sc. Nat. II, 13 (1840) 268; NIEDENZU, Pfl. R. Heft 91 (1928) 67; ARÈNES, Reinwardtia 3 (1954) 72.—**Fig. 5–7.**

Stout shrubs, scandent or arborescent. *Stipules* minute, glandlike, or wanting, if present inserted on the twig between the petioles. *Leaves* elliptic to oblong, subcoriaceous, short-stalked, in most cases glabrescent, base generally with 2 glands beneath, margin often with smaller, scattered glands beneath. *Inflorescences* terminal or axillary, raceme-like, short-haired, scattered along the rhachis. Calyx outside posteriorly provided with one dark-coloured *gland* often adnate to the pedicel (rarely the gland is wanting, or in extra-Mal. *spp.* more glands may be present). *Flowers* bisexual, zygomorphic, light-coloured. *Calyx* deeply incised.

Petals more or less unguiculate, somewhat different in shape, outer one more elliptic, inner (posterior) one more orbicular and often provided with 2 basal outgrowths. Stamens unequal, anterior one being 2–3 times as long as the other 9, of which the posterior is the shortest. Ovary 3-lobed, with the initial wings visible, haired; one style slightly longer than the long stamen, coiled inwards in bud, stigma acute, 2 styles abortive. *Samaras* consisting of a globular mericarp with 3 laterally developed coriaceous wings, middle one the longest and at right angles to the 2 lateral ones; dorsal wing incidentally developed into a bigger or smaller crest between the lateral 3 wings.

Distr. About 20–30 *spp.*, centering in Further India, from Ceylon to NW. India, the Himalaya, S. China, Formosa, in *Malaysia:* east to the Philippines, Celebes and Timor, one *sp.* in Fiji. *H. benghalensis* occupies most of the generic area.

Notes. The structure of the calycinal gland(s) has been accepted as being of primary importance for the distinction of sections and of species. The genus has been divided into:

Sect. Archihiptage (NIED.) ARÈNES: 5 small glands on the calyx (4–7 *spp.* in Further India).

Sect Metahiptage (NIED.) ARÈNES: calycinal gland absent (one *sp.* in Malaya and 1–5 in China and Further India).

Sect. Hiptage: one large calycinal gland (4 *spp.* in Malaysia, *c.* 9 *spp.* in Further India, 1 in Formosa, and in Fiji *H. myrtifolia* A. GRAY (*cf.* A. C. SMITH, J. Arn. Arb. 31, 1950, 288).

KEY TO THE SPECIES

1. Calyx glandless (fig. 5a). Petals only outside at the base haired. *Sect. Metahiptage* **1. H. burkilliana**
1. Calyx with a distinct gland (fig. 5b–e). Petals outside entirely haired. *Sect. Hiptage.*
 2. Calycinal gland sunken in the tissue of the apex of the pedicel (fig. 5b). Youngest parts densely tomentose . . . . **2. H. sericea**
 2. Gland distinctly inserted on the surface of the calyx (and eventually on the pedicel) (fig. 5c–e). Youngest parts appressedly haired.
  3. Calycinal gland convex, elliptic to linear, decurrent on the pedicel (fig. 5c). Sepals roundish, haired outside all over . . . . **3. H. benghalensis**
  3. Calycinal gland concave, orbicular-elliptic, not or scarcely decurrent on the pedicel (fig. 5d–e).
   4. Adult leaves quite glabrous. Sepals haired chiefly in the centre . . . . . . **4. H. luzonica**
   4. Adult leaves densely haired below. Sepals haired all over . . . . **5. H. pubescens**

1. Hiptage burkilliana ARÈNES, Reinwardtia 3 (1954) 68.—**Fig. 5a.**

Climber, up to 10 m; twigs terete, internodes 4–7 cm, light brown, glabrous, with numerous lenticels. *Leaves* oblong, twice as long as broad, 7–12 by 3½–5(–6) cm; base acute to rounded, without or with 2 small glands; top distinctly acuminate; nerves 4–5 pairs; surfaces both glabrous; petiole ¾ cm. *Inflorescences* at the ends of the twigs, terminal and axillary, sparsely fulvous-sericeous haired, sometimes secondarily branched, (6–)10–15 cm long; rhachis stout, terete, 1½–2 mm in diam. at the base. Bracts small and acute, mostly caducous, or wanting. Pedicels 1½–2½ cm, articulated somewhat above the middle, the articulation marked by a whorl of appressed hairs, upper portion thickened towards the flower. Bracteoles sometimes caducous, inserted halfway the lower portion of the pedicel. *Flowers* pink. *Sepals* triangular-elliptic, 2–3 by 1–2 mm, top obtuse-rounded, outside densely fulvous-sericeous, inside glabrous. *Petals* 5–10 mm long including the distinct claw, 4–6 mm broad, entire to subcrenulate, except the claw and lower portion of the midrib outside petals quite glabrous, inner one nearly without basal outgrowths. Filaments terete, longer one 7–8, other ones about 3 mm. Style glabrous, acute. *Samaras:* middle wing 2½ by 1 cm, lateral wings 1½ cm long.

Distr. *Malaysia:* Malay Peninsula (Pahang), twice collected.

Note. The material is too scarce to form a final opinion on the taxonomic affinity with *H. minor* DUNN from Yunnan; there is doubtless a great similarity. In *H. minor* the leaves are quite glandless, the pedicels are only 1–1½ cm and thinner, the flowers are smaller in all parts and white or pale yellow.

Except the type specimen (BURKILL & HANIFF 16940, Pahang, 12–XI–1924, Bo, SING), a second specimen, with mature fruit, has also been collected in Pahang (BURN-MURDOCH 219, Kuantan, 22–VI–1913, SING).

2. Hiptage sericea HOOK. *f.*, Fl. Br. Ind. 1 (1874) 419; KING, J. As. Soc. Beng. 62, ii (1893) 194; RIDLEY, Fl. Mal. Pen. 1 (1922) 328; NIEDENZU, Pfl. R. Heft 91 (1928) 81; BLATTER, J. Ind. Bot. Soc. 9 (1930) 149.—*Clerodendron sericeum* WALL. Cat. (1829) *no* 1814, *pro parte, nom. nud.*—**Fig. 5b.**

Climber, *twigs* terete, densely brown short-tomentose, glabrescent, internodes (1½–)2–4(–6) cm. *Leaves* oblong, 2–2½ times as long as broad, 4–5½(–8) by 1½–2½(–3½) cm; base acute to rounded, glands at the base and margin sometimes wanting; top acuminate; nerves *c.* 4 pairs; surfaces densely haired in the youth, glabrescent except the basal part of the midrib, shiny above; petiole 5(–9) mm, densely fulvous-pubescent, glabrescent. *Inflorescences* mostly axillary, 4–7 cm long, dense-flowered, strongly haired. Bracts are thickly haired pimples. Pedicels $1^1/_2$–2 cm, halfway articulated, lower part with the minute or abortive bracteoles, upper part thickened towards the flower, with the oblong, 1–3 mm long gland sunken in it, often a bit curved around the gland (fig. 5b). *Flowers* white. *Sepals* elliptic-ovate, *c.* 2 by $1^1/_2$ mm, with rounded top, outside densely haired, inside glabrous. Outer *petal* elliptic, inner one orbicular, 6–8 by 4–5 mm, margin irregularly fimbriate, outside densely haired, inside glabrous. Long filament 10–12, other ones 5–7 mm long. Style glabrous, acute. Central wing of the *samara* (2–)3–4 by $^3/_4$–$1^1/_4$ cm, lateral wings $1^1/_2$–2 cm long, all variable in shape.

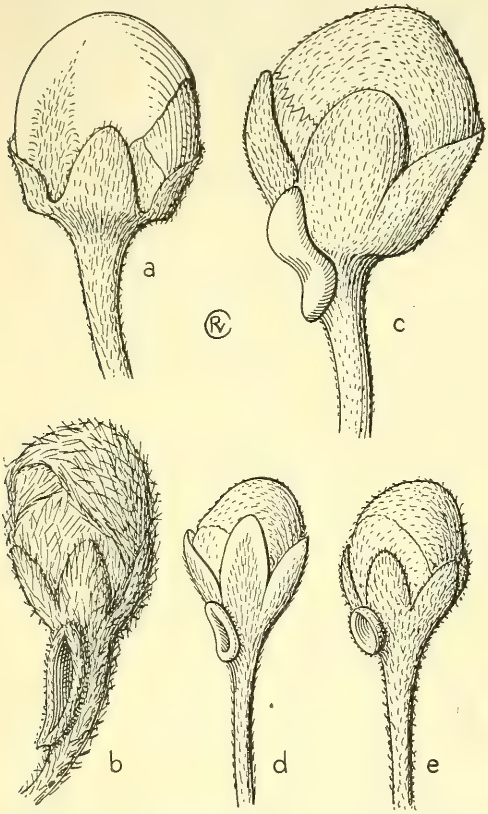

Fig. 5. Buds in *Hiptage*, all × 5, *a. H. burkilliana* ARÈNES, *b. H. sericea* HOOK. *f.*, *c. H. benghalensis* (L.) KURZ, *d. H. luzonica* MERR., *e. H. pubescens* MERR.

Distr. China (Cape Syngmoon, *cf.* NIEDENZU), ?India (WIGHT 358), Lower Siam, in *Malaysia:* Malay Peninsula, probably rare.

Ecol. According to HENDERSON in open places and on river-banks.

Vern. Malaya: *Akar dĕdalu bukit, a. kirai, a. kulupus, a. papina, sarunchi.*

Notes. Much resembling *H. detergens* CRAIB from Siam, but that *sp.* has a superficial (not immersed), suborbicular gland.

The origin of WIGHT's specimen (mentioned in his Prodromus as *H. parvifolia,* but certainly belonging to *H. sericea*) is not exactly known. WIGHT himself says it came from Ceylon, but HOOKER *f.* calls this an error; on the label is written: 'Pen. Ind. Or'; this would be the only record from India.

3. Hiptage benghalensis (L.) KURZ, J. As. Soc. Beng. 43, ii (1874) 136; CRAIB, Fl. Siam. En. 1 (1926) 201; NIEDENZU, Pfl. R. Heft 91 (1928) 77, *incl. f. longifolia* NIED., *f. typica* NIED., *pro parte, f. cochinchinensis* PIERRE (*non vidi*), *f. macroptera* (*vide infra*); BLATTER, J. Ind. Bot. Soc. 9 (1930) 149; BACKER, Bekn. Fl. Java (em. ed.) 4c (1943) fam. 110, p. 4.—*Banisteria benghalensis* LINNÉ, Sp. Pl. 1 (1753) 437.—*Molina racemosa* CAV. Diss. 9 (1790) 435, t. 362.—*H. madablota* GAERTN. Fruct. 2 (1791) 169, t. 116; JUSSIEU, Arch. Mus. Hist. Nat. Paris 3 (1843) 502, t. 16, repr. 248; MIQ. Fl. Ind. Bat. 1, 2 (1859) 585; HOOK. *f.*, Fl. Br. Ind. 1 (1874) 418; KURZ, For. Fl. Burma 1 (1877) 173; KING, J. As. Soc. Beng. 62, ii (1893) 194; BACKER, Schoolfl. (1911) 167; DOP, Fl. Gén. I.-C. 1 (1911) 598; KOORD. Exk. Fl. Java 2 (1912) 449; RIDLEY, Fl. Mal. Pen. 1 (1922) 328; ARÈNES, Fl. Gén. I.-C. Suppl. 1 (1945) 515.—*Gaertnera racemosa* (CAV.) ROXB. Pl. Corom. 1 (1795) 19, t. 18.—*Gaertnera obtusifolia* ROXB. Hort. Beng. (1814) 32, *nom. nud.*—*H. obtusifolia* (ROXB.) DC. Prod. 1 (1824) 583; NIEDENZU, Pfl. R. Heft 91 (1928) 79.—*Ban(n)isteria javanica* THUNB. Fl. Jav. (1825) 16, *nom. nud.*—*H. javanica* BLUME, Bijdr. (1825) 224; JUSSIEU, Arch. Mus. Hist. Nat. Paris 3 (1843) 502, repr. 248; MIQ. Fl. Ind. Bat. 1, 2 (1859) 586; HOCHR. Bull. Inst. Bot. Btzg 19 (1904) 44, *incl. f. rubella, l.c.*; BACKER, Schoolfl. (1911) 167; KOORD. Exk. Fl. Java 2 (1912) 449; NIEDENZU, Pfl. R. Heft 91 (1928) 76, *pro parte.*—*H. parvifolia* WIGHT & ARNOTT, Prod. 1 (1834) 107, *pro parte*; HOOK. *f.*, Fl. Br. Ind. 1 (1874) 419; NIEDENZU, Pfl. R. Heft 91 (1928) 79, *quoad ssp. typica* NIED.—*H. sumatrana* MIQ. Fl. Ind. Bat. Suppl. 1 (1860) 512.—?*H. tetraptera* MERR. Philip. J. Sc. 5 (1910) 188; En. Philip. 2 (1923) 382.—*H. macroptera* MERR. Philip. J. Sc. 5 (1910) Bot. 189; En. Philip. 2 (1923) 382; NIEDENZU, Pfl. R. Heft 91 (1928) 79, *pro forma.*—*H. pinnata* ELMER, Leafl. Philip. Bot. 5 (1913) 1810; MERR. En. Philip. 2 (1923) 382.—*H. malaiensis* NIEDENZU, Arb. Bot. Inst. Braunsberg 6 (1915) 39; Pfl. R. Heft 91 (1928) 76.—*H. teysmannii* ARÈNES, Reinwardtia 3 (1954) 69.—**Fig. 5c, 6, 7d.**

Climber, up to 30 m, rarely shrub-like; internodes *c.* 5–7 cm; epiderm at first densely short fulvous-haired to glabrous, later crazed and scaling off, bark dull brown to shiny brownish black, often lenticellate. *Leaves* variable, pink or reddish and short-haired when young, getting green and subcoriaceous when older, *c.* 2–3 times as long as broad, (8–)10–15(–20) by (3–)4–6(–10) cm; base acute to rounded, mostly with 2 glands; margin often with glandular dots below; top acuminate, rarely acute or rounded; midrib slightly prominent above, more prominent beneath, nerves (4–)6–7 pairs, irregularly curved towards the top, smaller nerves sometimes sunken; upper surface often shiny and nearly always glabrous, lower surface glabrous, rarely very densely set with minute, appressed hairs or glabrescent; petioles 7–10 mm, dark-coloured. *Inflorescences* (4–)10–20 (–35) cm long, fulvo-sericeous haired, rhachis stout, terete and 2–3 mm thick below, angular above. Bracts acute, 2–5 mm long. Pedicels terete, mostly thickened towards the flower, articulation about the middle, 2-bracteolate, 1–2 cm, in fruit up to 3 cm. *Gland* convex, elliptic to lanceolate, 2–5(–6) mm long, about half on the calyx and half decurrent on the pedicel. *Flowers* 1–2½ cm in diam., very fragrant, varying in colour between pink and sordidly white, the inner one or more petals partly yellow. *Sepals* ovate to elliptic, slightly subcoriaceous, top about truncate-rounded, 2–5(–8) by 1½–3(–4½) mm, outside always fulvous sericeous, inside often so, or glabrous. *Petals* orbicular to elliptic, (3–)6–12 by (2–)5–10 mm, more or less clawed, inside glabrous, outside haired, margin mostly fimbriate and glabrous, the inner petal with 2 outgrowths at the base. Short filaments 2–4(–10) mm, the long one 8–12(–18) mm long, mostly glabrous, anthers 1–2 mm. Style terete, with acute top. *Samaras* variable in size and shape, dark reddish when fresh, shiny brown when dry, glabrescent, middle wing elliptic or obovate, top obtuse, acute, or rounded, sometimes divided into 2 lobes, (3–)5–6(–7) by 1(–2) cm, lateral wings 2–3 by ½–1(–1½) cm; dorsal crest sometimes present.

Distr. Ceylon, throughout India, NW to the Punjab, in the Himalayas up to 1000(–1500) m, Further India, Nicobar and Andaman Isl., S.China, Formosa, in *Malaysia:* Sumatra, Malay Peninsula (all the provinces, according to Henderson perhaps not wild S of Perlis), Java, Madura, Kangean Arch., Lesser Sunda Islands (Bali, Alor, Timor), Borneo, Philippines (Palawan, ?Mindanao), Celebes (incl. Saleijer Isl.). Cultivated in Malaysia and in some other tropical countries because of its pretty, fragrant flowers.

Ecol. On several kinds of soil in secondary forest, clearings, forest edges, teak-forest, both under everwet and periodically dry conditions, from sea-level up to 1000(–1500) m; *fl.* throughout the year.

Uses. According to Gorter (*vide infra*) a decoction of the root is sometimes given to bulls in Java; it would have aphrodisiacal properties. From the bark of the root a remarkable glucosid, hiptagin, has been isolated by this author (Bull. Jard. Bot. Btzg III, 2, 1920, 187–202).

In Alor Isl. the bark is pounded and put on fresh wounds; the wood is said to be used as ridge-pole of pyramidal house roofs.

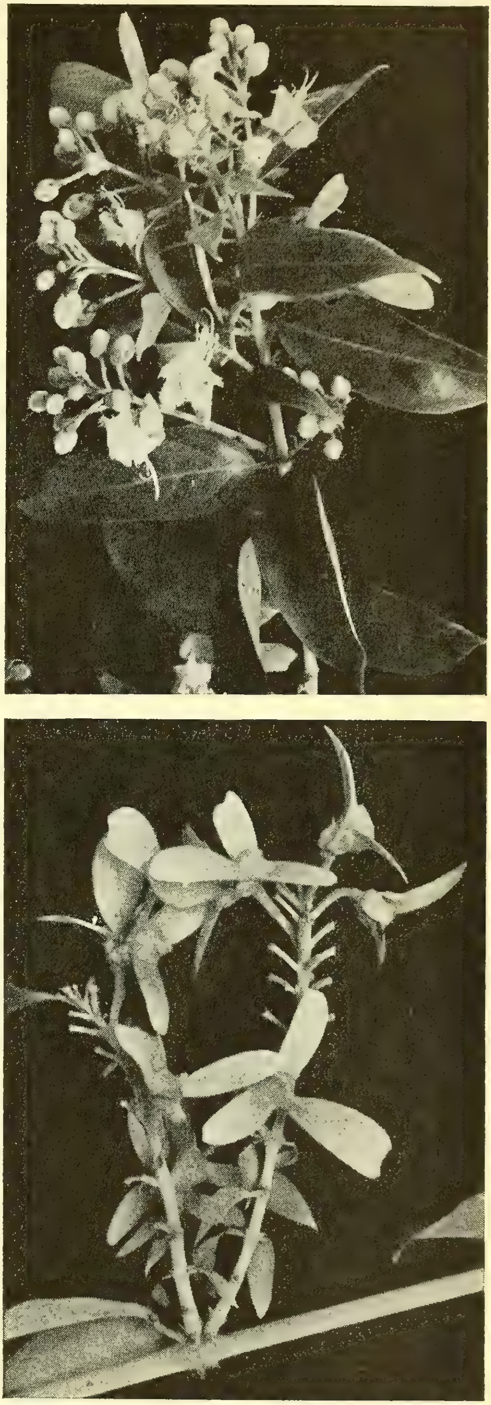

Fig. 6. *Hiptage benghalensis* (L.) Kurz. Flowering and fruiting branches, Singapore Botanic Gardens, July 1955 (photogr. G. H. Addison).

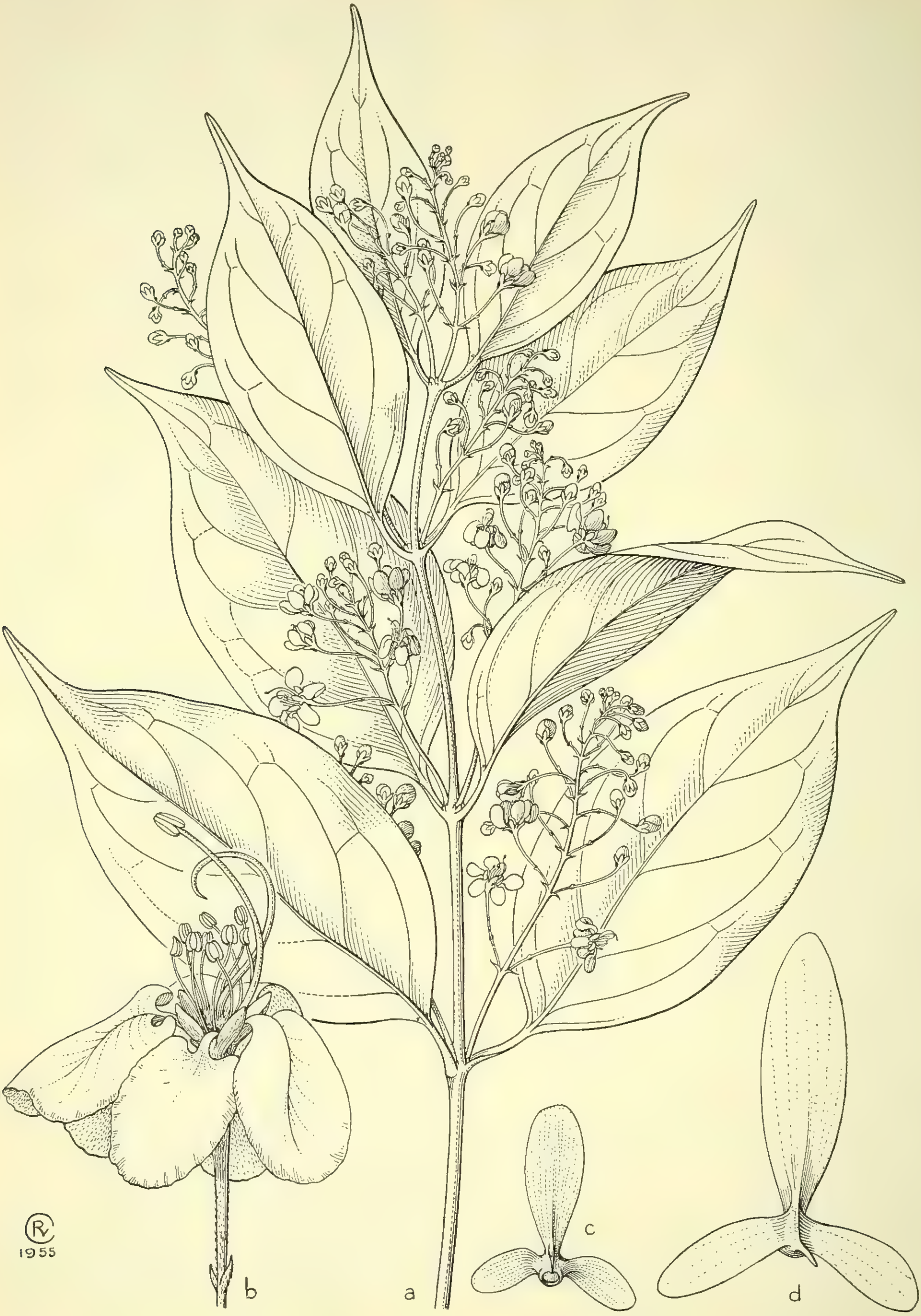

Fig. 7. *Hiptage luzonica* MERR. *a.* Flowering branch, × ²/₃, *b.* flower, × 4¹/₂, *c.* samara, ventral side, nat. size, *d. H. benghalensis* (L.) KURZ, samara, dorsal side with small crest, nat. size.

According to BRANDIS (For. Fl. 1874), the bark is bitter.

In India the leaves are used externally in cutaneous diseases.

Morph. According to SUBRA RAO (Curr. Sc. 6, 1937, 281): 'almost all the embryo-sacs show more than one embryo and the number of embryos in one embryo-sac may go up to eight'.

DOCTERS VAN LEEUWEN described several kinds of galls (Zoocecidia 1926, 270).

Vern. Java: *Aroy burrie*, *a. beurit*, *kibodas*, *ojot ki kupu kupu*, S, *kakas*, *djaranan*, *ojot-prawan*, *kròsòk*, *lo alas*, J; Palawan: *tagabu*, Tagb.

Notes. This species has been described under various names, all representing slight variations on a common specific pattern of a widely diffused population. These forms are, however, connected by a number of transitional specimens. It has appeared impossible to delimit them in a satisfactory way and the only reasonable solution appears to me to merge them into one whole, without distinguishing subspecies or varieties.

The structure of the gland and the sepals provide the best characters to separate the species from *H. luzonica* and others.

Of *H. tetraptera* MERR., from Palawan, no material was available; from its description I conclude it is a *benghalensis* specimen with a very big dorsal crest on its samaras. Of *H. macroptera* MERR. from Mindanao, no material was available; it is tentatively referred here. *H. teysmannii* ARÈNES represents a narrow-leaved form.

4. Hiptage luzonica MERR. Govt Lab. Publ. Philip. *no* 35 (1905) 33; En. Philip. 2 (1923) 381; NIEDENZU, Pfl. R. Heft 91 (1928) 75.—*Triopteris jamaicensis* (*non* L.) BLANCO, Fl. Filip. (1837) 350.—*H. madablota* (*non* GAERTN.) F.-VILL. Nov. App. (1880) 32; VIDAL, Sinopsis Atlas (1883) 17, t. 22; Rev. Pl. Vasc. Filip. (1886) 73.—*H. cebuensis* ELMER, Leafl. Philip. Bot. 2 (1910) 683.—*H. cumingii* MERR. Philip. J. Sc. 5 (1910) 190.—*H. javanica* (*non* BL.) MERR. Philip. J. Sc. 5 (1910) Bot. 190; En. Philip. 2 (1923) 381; NIEDENZU, Pfl. R. Heft 91 (1928) 76, *pro stirp. philip.*—*H. reticulata* MERR. Philip. J. Sc. 5 (1910) Bot. 186.—*H. loheri* MERR. Sp. Blanc. (1918) 213.—*H. parvifolia ssp. cumingii* NIEDENZU, Verz. Vorl. K. Ak. Braunsberg (1924) 14, *incl. var. megaphylla*, *glandulosa et eglandulosa*; Pfl. R. Heft 91 (1928) 80.—*H. benghalensis* (*non* KURZ) NIEDENZU, Pfl. R. Heft 91 (1928) 75, *pro parte*.—?*H. beccariana* ARÈNES, Reinwardtia 3 (1954) 70.—*H. brachybotrys* ARÈNES, Reinwardtia 3 (1954) 67.—*H. vidalii* ARÈNES, Reinwardtia 3 (1954) 70.—**Fig. 5d, 7a–c.**

Scandent or shrub-like, only youngest parts fulvous-sericeous, quickly glabrescent; *twigs* greyish brown with many lenticels; internodes 3–4(–7) cm long. *Leaves* ovate-elliptic, *c.* 2(–4) times as long as broad, (4–)6–12(–15) by $2^1/_2$–$4^1/_2$(–6) cm; base acute to rounded, basal glands mostly present, marginal glands mostly wanting; top distinctly acuminate; nerves 4–6 pairs; surfaces quickly glabrescent, latest on the basal part of the midrib, adult leaves often shiny above, firmly herbaceous to subcoriaceous; petioles $^1/_2$–1(–$1^1/_2$) cm, dark-coloured. *Inflorescences* mostly axillary, 3–10(–14) cm long, fulvous-sericeous, rhachis at the base 1–$1^1/_2$ mm in diam. Pedicels 1–$2^1/_2$ cm, slightly thickened towards the flower, articulation often below the middle. Bracteoles on or below the articulation. *Gland* orbicular to elliptic, concave, dish-shaped, $1^1/_2$–$2^1/_2$(–3) mm long, not or scarcely decurrent on the pedicel. *Flowers* pinkish or greenish, 1–2 cm in diam. *Sepals* ovate to elliptic-oblong, 2–3 by 1–2 mm, top obtuse, rarely acute; inside as a rule glabrous, outside haired, mainly in the centre, less so at the margin. *Petals* 4–9(–10) by 3–5(–6) mm, oblong to suborbicular, base cordate, sometimes rounded, claw often distinct; inside glabrous, outside haired, margin irregularly subcrenulate. Stamens 2–4 mm, the odd one 6–10 mm long, filaments glabrous. Style glabrous. Middle wing of *samaras* obovate, incidentally elliptic, 2–$2^1/_2$(–3) by ($^3/_4$–)1–$1^3/_4$ cm, top mostly rounded; lateral wings $^3/_4$–$1^1/_2$ cm long; no dorsal crest.

Distr. *Malaysia:* throughout the Philippines (incl. also Palawan), Celebes (N. peninsula).

Ecol. *Fl.* Feb.–March (mostly), *fr.* March–April.

Vern. *Baka-baka*, Bis.

Notes. The description of *H. parvifolia var. eglandulosa* NIED. contains an error; in the type specimen I found distinct calycinal glands.

H. beccariana ARÈNES, from N. Celebes, is here referred to *H. luzonica*. Besides the type there are 3 sheets collected by J. J. SMITH (633, 635, 636, Bo) from Gorontalo, all with equally insufficiently developed flowers as in the type. There are slight differences with *H. luzonica*; the leaves are not so acuminate and very finely reticulate and the sepals are hairy inside. Otherwise the specimens agree very well with *H. luzonica* and the mentioned characters do not seem important enough to distinguish *H. beccariana* as a separate species. Additional complete material from Celebes is desirable to verify this point.

In the diagnosis of *H. brachybotrys* ARÈNES the leaves are described as loosely pubescent; an examination of the type specimen showed that crystals of corrosive sublimate are responsible for the haired appearance.

H. detergens CRAIB, from Lower Siam, reminds of *H. luzonica*, but can easily be distinguished by its haired twigs, the light-coloured, haired petioles, and less glabrescent, smaller leaves.

H. reticulata MERR. is in its leaves somewhat different from typical *H. luzonica*. No material has been collected again since 1886; the type specimen is unfortunately not in a very good state.

The closest ally is the endemic Fijian *H. myrtifolia* A. GRAY (U.S. Expl. Exp., Bot. 1, 1854, 267, Atl. 1, 1857, t. 21). Though it is hardly different in floral characters, I cannot regard it as conspecific with *H. luzonica*. It can be distinguished by the leaves: petiole (2–)3–5(–6) mm, blade light-coloured, ovate, smaller and less shiny, with less developed basal glands, apex blunt and mucronate to acute; fruit mostly with a distinctly produced dorsal crest. The Fijian sheets are not homogeneous.

5. Hiptage pubescens MERR. Philip. J. Sc. 5 (1910) Bot. 187, *incl. var. lanceolata* MERR. *l.c.*; En. Philip. 2 (1923) 382; NIEDENZU, Pfl. R. Heft 91 (1928) 74.—*?H. curranii* MERR. Philip. J. Sc. 5 (1910) Bot. 188; En. Philip. 2 (1923) 381; NIEDENZU, Pfl. R. Heft 91 (1928) 74.—**Fig. 5e.**

Small tree (or scandent?, see note), 4–5(–9?) m high. Young twigs densely fulvous or greyish haired, often tardily glabrescent; internodes 1–3$^1/_2$ cm long. *Leaves* oblong to lanceolate, 2$^1/_2$–7 times as long as broad, 4–7 by $^3/_4$–2 cm; base rounded, glandless; top acute to slightly acuminate; nerves 7–10 pairs, inconspicuous; upper surface densely fulvous or greyish sericeous when young, shiny and sooner or later glabrescent, lower surface dull, persistently thick-tomentose; petiole $^1/_4$–$^1/_2$ cm. *Inflorescences* axillary, about as long as the leaves, densely haired in all parts. Bracts linear, *c.* $^1/_2$ cm. Pedicels 1–1$^1/_4$ cm. *Flowers* yellow or red; calycinal gland orbicular, cup-shaped with a thickened rim, *c.* 1 mm in diam. *Sepals* obtuse, triangular, haired on both surfaces, 1$^1/_2$–2 mm long. *Petals* as far as known not distinctly clawed, suborbicular to elliptic, entire, haired outside, 4–6 mm long. Long stamen *c.* 3$^1/_2$ mm, the others *c.* 2 mm. Ovary haired; style 3–4 mm. *Samaras* with an oblong central wing $^3/_4$–1$^1/_4$ cm long, the two lateral wings from tip to tip $^3/_4$–1 cm long.

Distr. *Malaysia:* Philippines (a few numbers known only from Luzon), 0–1200 m (MERRILL).

Vern. *Dalúnit, pangardisen, panunianáyen,* Ilk.

Notes. Although no material of *H. curranii* MERR. was available to me, I assume that it belongs to *H. pubescens.* MERRILL himself mentions that the scandent habit of *H. curranii* is the only character really distinguishing it from the arborescent *H. pubescens.* I conclude provisionally that they are conspecific.

Excluded

H. lawsonii ELMER, Leafl. Philip. Bot. 8 (1915) 2751 = *Hippocratea lawsonii* ELMER (*Hippocrateaceae*).

3. TRISTELLATEIA

DU PETIT-THOUARS, Gen. Nov. Madagasc. (1806) 14; repr. in Mél. Bot. & Voy. (1811); JUSSIEU, Ann. Sc. Nat. II, 13 (1840) 269; Arch. Mus. Hist. Nat. Paris 3 (1843) 494, repr. 240; NIEDENZU, Pfl. R. Heft 91 (1928) 57; ARÈNES, Mém. Mus. Nat. Hist. Nat. n.s. 21 (1947) 275.—**Fig. 8, 9c.**

Lianas, mostly glabrous. *Petiole* with 2 small stipules on its base. *Leaf* margin mostly with 2 basal glands. *Inflorescence* raceme-like. Pedicels rather long, 2-bracteolate upon the articulation. *Flowers* actinomorphic, bisexual. *Petals* long-clawed, carinate below, oblong, entire. Filaments unequal, those of the outer whorl the longest and also the broadest at the base. Ovary globose, style 1, exceptionally 2 (the other 2–1 abortive), terete. *Samaras* coriaceo-ligneous, lateral wing (somewhat irregularly) divided into 4–10 rather narrow lobes which stellately expand in one plane, median wing among the lobes and resembling them. (In extra-Mal. *spp.* the median wing may be wanting or the samara may possess irregularly inserted additional appendages.)

Distr. About 22 *spp.* described, all in Madagascar, except *T. africana* in E. Africa and *T. australasiae* in the palaeotropical region E of the Mergui Islands.

Notes. After the characters of the fruit NIEDENZU (Verz. Vorl. K. Ak. Braunsberg, 1924, 7) divided the genus into *sect. Homoiactinia* with regularly lobed samaras, containing *i.a. T. australasiae,* and *sect. Heteractinia* with irregularly lobed samaras.

The pedicels in *T. australasiae* are about decussate, therefore the inflorescence does not represent a purely racemose structure.

1. Tristellateia australasiae A. RICHARD, Sert. Astrol. (1833) t. 15; Voy. de l'Astrolabe, texte (1834) 38, *descr.* (*T. australis*); JUSSIEU, Ann. Sc. Nat. II, 13 (1840) 269; Arch. Mus. Hist. Nat. Paris 3 (1843) 495, repr. 241 (*T. australasica*); MIQ. Fl. Ind. Bat. 1, 2 (1859) 585; BENTH. Fl. Austr. 1 (1863) 286; HOOK. *f.* Fl. Br. Ind. 1 (1874) 418; KING, J. As. Soc. Beng. 62, ii (1893) 193; BAILEY, Queensl. Fl. 1 (1899) 170; SPRAGUE in CURT. Bot. Mag. (1910) t. 8334; DOP, Fl. Gén. I.-C. 1 (1911) 593; MERR. Philip. J. Sc. 7 (1912) Bot. 236; Fl. Manila (1912) 278; Sp. Blanc. (1918) 213; RIDLEY, Fl. Mal. Pen. 1 (1922) 327; MERR. En. Philip. 2 (1923) 380; NIEDENZU, Pfl. R. Heft 91 (1928) 60, incl. *f. typica* NIED. *et f. obtusiuscula* NIED.; BLATTER, J. Ind. Bot. Soc. 9 (1930) 148; BACKER, Bekn. Fl. Java (em. ed.) 4c (1943) fam. 110, p. 3; ARÈNES, Fl. Gén. I.-C. Suppl. 1 (1945) 507; Mém. Mus. Hist. Nat. Paris n.s. 21 (1947) 282.—*Hiraea reclinata* BLANCO, Fl. Filip. (1837) 378, *non* JACQ.—*T. malintana* BLANCO, Fl. Filip. ed. 2 (1845) 267, ed. 3, 2 (1878) 132, t. 435.—**Fig. 8, 9c.**

Liana, up to *c.* 10 m, only youngest parts appressedly short white-haired, quickly glabres-

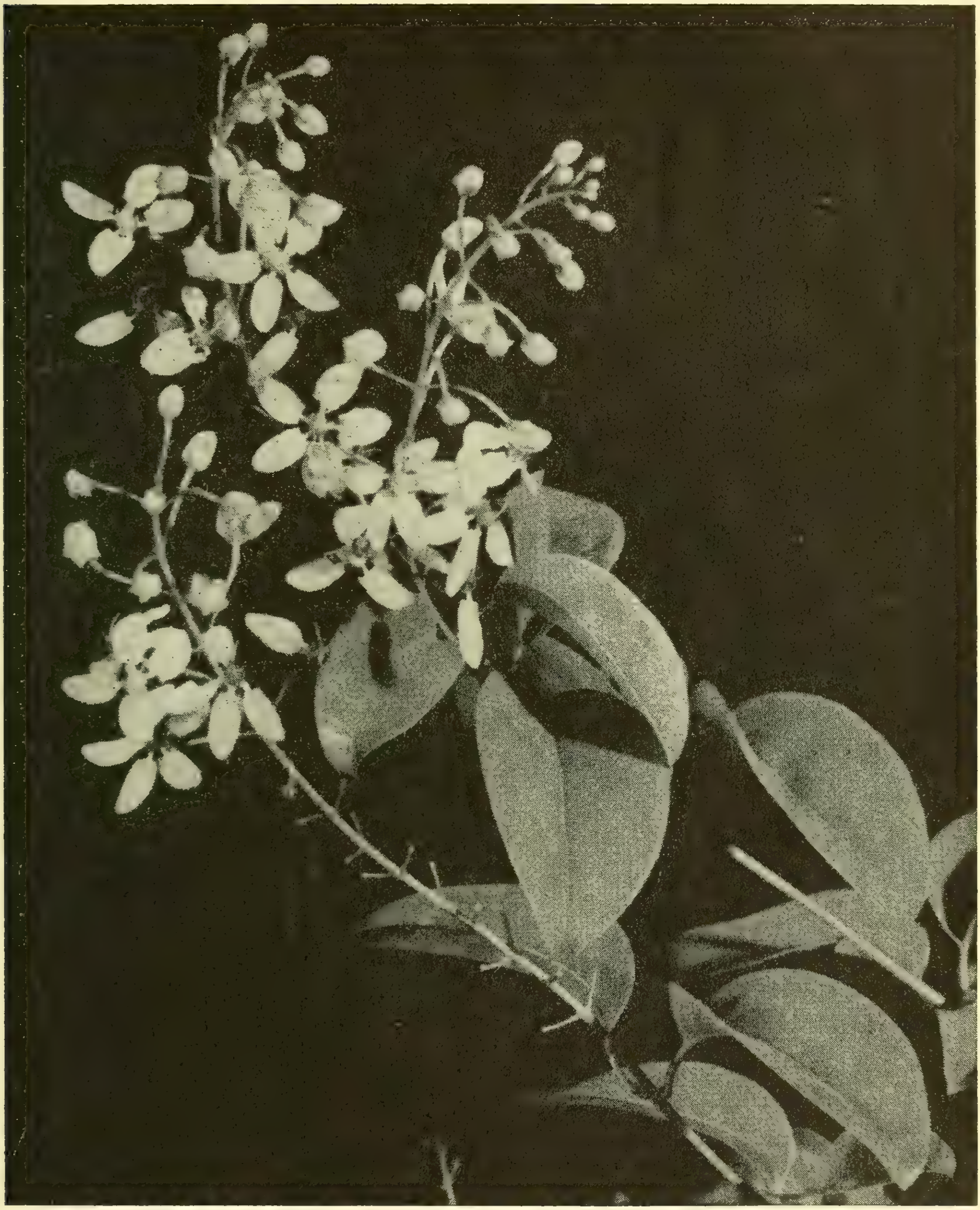

Fig. 8. Flowering branch of *Tristellateia australasiae* A. RICH., × 2/3 (Kebun Raya Indonesia, June 1953).

cent. *Twigs* terete, lenticellate, internodes up to 25 cm, nodes somewhat thickened. *Leaves* rarely subopposite or exceptionally in whorls of 3, ovate to ovate-oblong, 1½–2½ times as long as broad, 6–12 by 4–7 cm, glabrous; base rounded to slightly cordate, seldom acute, 2 glands mostly present; apex narrowed, acute or acuminate; midrib not or slightly prominent above, prominent below, nerves 4–5 pairs; margin somewhat recurved, glandless; petiole about 1–1½ cm, distinctly sulcate, often scarcely haired. *Stipules* linear-lanceolate, 1 mm, acute. *Inflorescences* terminal or on mostly 2-leaved branchlets; rhachis (5–) 10–25 cm long, very scarcely haired. Pedicels about decussate, $1^1/_2$–2(–3) cm long, distinctly articulated below the middle, lower portion persistent. Bracts thin, acute, 1–2 mm. Bracteoles minute. *Flowers* 2–$2^1/_2$ cm in diam., bright yellow. *Sepals* triangular, blunt, glabrous, glandless, about 3 by $1^1/_2$ mm. *Petals* 2–3 mm unguiculate, limb elliptic, 8–13 by 5–6 mm, base truncate to slightly hastate, top rounded. Filaments 3–4 and $1^1/_2$–$2^1/_2$ mm, narrowed upwards, glabrous, at first yellowish, getting red, and when the anthers have fallen brightly red; anthers lanceolate, 2–3 mm long, connective narrow and only dorsally visible. Ovary *c.* 1 mm in diam., short-haired, at 3 sides provided with a whorl of papillae; style terete, 6–7 mm, glabrous. *Mericarps* proper about globular and 2–4 mm in diam., whole *samaras* including the ± 8 appendages 1–2 cm in diam.

Distr. Formosa, Cochinchina, Siam, westwards to the Mergui Islands, eastwards to the Carolines, New Caledonia, New Ireland, and on the Queensland coast, throughout *Malaysia* more or less common along coasts.

Ecol. Plant from brushwood and rain-forest on and beyond sea-shores, in the *Barringtonia* fringe, in the transitional zone between rain-forest and mangrove, in tidal swamps, along littoral creeks and estuaries, more landwards sometimes cultivated. *Fl.* throughout the year.

Vern. Sandakan: *akar pulut pulut*, Brunei: *bagu, bajau*; Banka: *akar kerak*; Celebes, Tjempaga: *duku duku*; Philippines: *bahau*, Sul., *añgasin*, Bik., *bagnit*, Tagb., *bagit*, Bik., Tag., *binusisi, bauing*, Tag., *ibud-ibud*, Bis., *magbuaya*, C. Bis., *sigid*, S. L. Bis., *kaulog-pau*, Bag., *mapinit*, Neg.

4. BRACHYLOPHON

OLIVER in Hook. Ic. Pl. 16 (1887) t. 1566; NIEDENZU, Pfl. R. Heft 93 (1928) 249. —**Fig. 9a–b, 11c.**

Shrubs, glabrous except the base of the internodes. *Leaves* glandless, the base of the short petiole 2-stipulate. *Inflorescence* a raceme (or in an extra-Mal. *sp.* a panicle). Pedicels sustained at the extreme base by a bract and bracteoles. *Flowers* actinomorphic, bisexual. Sepals glandless. Petals unguiculate, oblong, glabrous. Outer whorl of stamens longer than the inner one, anthers glabrous, each theca opening by a short apical slit. Styles 3, free, thin, somewhat shorter than the petals, often curved at the top. Often only 2 or 1 of the 3 *mericarps* developing; exocarp loosening from the endocarp, subcoriaceous, wings not developed except a relatively small, acute, dorsal crest.

Distr. Three *spp.*, one in E. Africa representing *sect. Catosepalis* NIED., 2 others in Indo-Malaya representing *sect. Brachylophon* of which one in Siam, the other in *W. Malaysia:* Sumatra, Malay Peninsula.

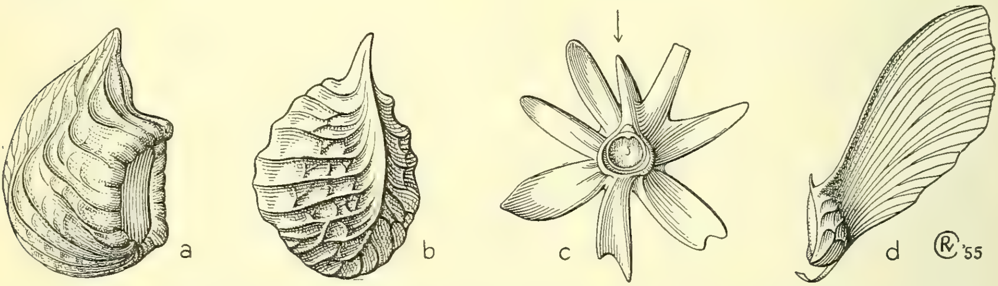

Fig. 9. Mericarps: *a–b.* of *Brachylophon curtisii* OLIV., × $2^1/_2$, *c.* of *Tristellateia australasiae* A. RICH., × $2^1/_2$, the arrow indicating the dorsal wing, *d.* of *Ryssopterys timoriensis* (DC.) JUSS., nat. size.

1. Brachylophon curtisii OLIVER in Hook. Ic. Pl. 16 (1887) t. 1566; KING, J. As. Soc. Beng. 62, ii (1893) 197; RIDLEY, Fl. Mal. Pen. 1 (1922) 329; HENDERSON, Gard. Bull. Str. Settl. 4 (1928) 233; NIEDENZU, Pfl. R. Heft 93 (1928) 250; BLATTER, J. Ind. Bot. Soc. 9 (1930) 150.—*B. hullettii* KING, J. As. Soc. Beng. 62, ii (1893) 196; RIDLEY, Fl. Mal. Pen. 1 (1922) 329, *pro var.*; NIED. Pfl. R. Heft 93 (1928) 252; BLATTER, J. Ind. Bot. Soc. 9 (1930) 150, *pro var.*—*B. scortechinii* KING, J. As. Soc. Beng. 62, ii (1893) 197; NIED. Pfl. R. Heft 93 (1928) 252; BLATTER, J. Ind. Bot. Soc. 9 (1930) 150, *pro var.*—**Fig. 9a–b, 11c.**

Shrub 1–2 m high. Twigs stout, angular when young, terete when older, internodes up to about 10 cm, glabrous except the base which is surrounded by a dense mass of shiny brown hairs, glabrescent when the leaves have fallen. *Leaves* dark green (*ex coll.*), lanceolate, 3–4 times as long as broad, (10–)15–30(–40) by 4–7(–10) cm; base acute, top narrowed and acuminate; midrib more prominent below than above; nerves numerous, parallel; surfaces entirely glabrous except in the very youth; petioles very short, sulcate, base broad and provided with 2 *c.* 2–3 mm long *stipules*. *Racemes* terminal and in the higher axils; rhachis relatively thick, up to 10 cm, angular. Bracts convex, triangular-ovate, acute, *c.* 3 mm long, finely ciliate, mostly persistent. Pedicels with the articulation and 2 bracteoles at the extreme base, 1½–2½ cm, thin, terete, glabrous. Buds oblong. *Flowers* yellow. *Sepals* 2–3 by 1½–2½ mm, with broad base, finely ciliate, otherwise glabrous. *Petals* more or less narrowed into the claw, top rounded, 9–10 by 3–4(–6) mm, very fine ciliate. Filaments 3–5 mm, those of the outer whorl slightly longer and broader than of the inner one; anthers long and narrow, broadest at the cordate base, 3–5 mm long, connective little developed. Ovary ovate, *c.* 1½ mm high, glabrous; styles threadlike, glabrous, stigma not thickened. *Mericarps* with a distinct, dorsal crest elongated in an acute apex, 1–1½ cm long, glabrous, distinctly nerved.

Distr. *Malaysia:* Sumatra (Indragiri, CURTIS 3549, SING), Lingga Archip. (Singkep Isl., BÜNNEMEIJER 7226, BO, L), Malay Peninsula (rare). Fig. 10.

Ecol. Only little is known, most records from plains, highest one from 600 m alt. In bushes, in moist places. *Fl.* March–August.

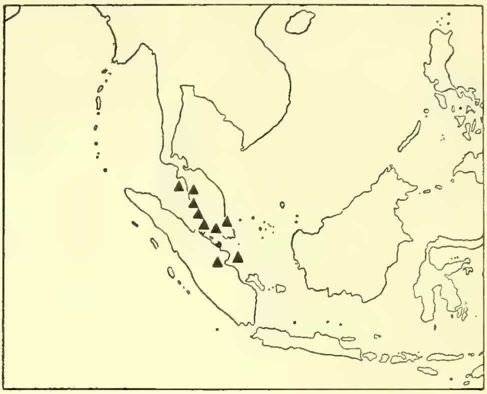

Fig. 10. Localities of *Brachylophon curtisii* OLIV.

5. RYSSOPTERYS

BLUME *ex* JUSSIEU, Ann. Sc. Nat. II, 13 (1840) 286; Arch. Mus. Hist. Nat. Paris 3 (1843) 383, repr. 129; NIEDENZU, Pfl. R. Heft 93 (1928) 281.—*Rhyssopteris*, *Ryssopteris*, *Ryssopteryx auctt.*—**Fig. 9d, 11–12.**

Lianas, rarely shrublike, variable in the vegetative parts, more or less haired. Twigs terete. *Stipules* between the petiolar bases upon the twig, abortive to well-developed, sometimes more collateral accessory stipules. *Leaves* mostly provided with 2 orbicular glands near the insertion of the petiole, often tomentose below, margin below often with small glands. *Inflorescence*s axillary, rarely terminal on small branchlets; rhachis simple or only at the top with 2 opposite branches in the axils of 2 small, haired and base-glanded leaves. Pedicels crowded at the top of the axes, 2-bracteolate, thickened above the articulation; only few pedicels bearing fruit and persistent. *Flowers* androdioecious, actinomorphic, 1–2½ cm diam. *Sepals* roundish. *Petals* sometimes unguiculate, orbicular-elliptic, glabrous. Filaments connate at the base, thin, terete, 2–5 mm long; anthers basifix, connective well-developed and forming the whole dorsal side of the anther. Ovary strigose. Styles 3(–4), free, sometimes coiled, terete, mostly somewhat longer than the anthers, stigmas terminal and a little thickened. Each *samara* outside attached to a basal, tape-shaped, carpophore; only the dorsal wing developed, making the fruit 2–6 cm long, showing resemblance to that of an *Acer*, but with the keel of the wings adaxial; mericarp proper globular; rarely 2 lateral abortive wings visible (fig. 9d).

Distr. Six *spp.* recognized, a few taxa undescribed, mainly developed in New Caledonia, distributed through N. Queensland to *East Malaysia* west as far as Sunda Straits, north as far as Luzon and Formosa. *R. timoriensis* occupies the widest area coinciding roughly with the generic one. Fig. 13.

KEY TO THE SPECIES

1. Connective of the anthers apiculate, exceeding the thecae. Samaras 4–6 cm long. Stipules minute. **1. R. tiliaefolia**
1. Connective not apiculate, not exceeding the thecae. Samaras 2–4 cm long. Stipules often well developed.
  2. Leaves glabrous to greyish haired below . . . . **2. R. timoriensis**
  2. Leaves with a thick, white tomentum below, concealing the small veins **R. timoriensis** *var.* **discolor**

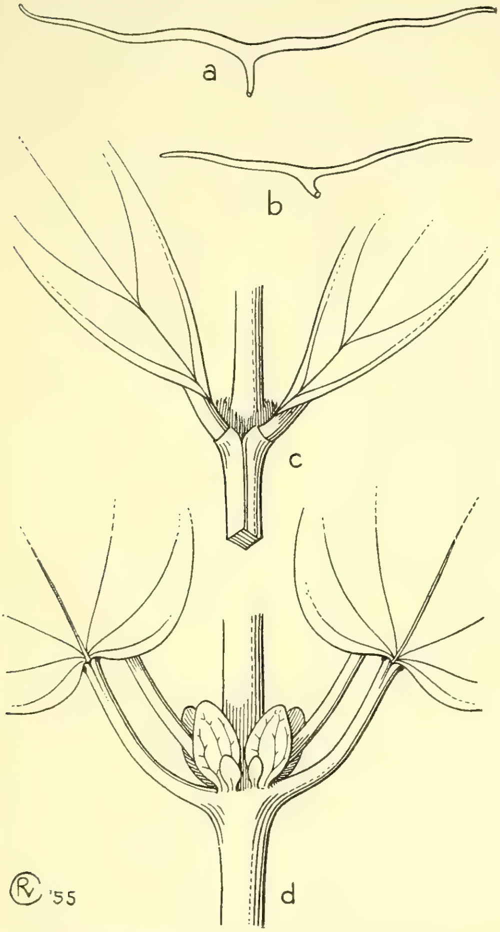

Fig. 11. *a.* Hair of *Ryssopterys timoriensis var. discolor* (GAND.) JACOBS, *b. ditto* of *R. timoriensis* (DC.) JUSS., both enlarged, *c. Brachylophon curtisii* OLIV., showing the hairy node, *d. Ryssopterys timoriensis* (DC.) JUSS., showing insertion of stipules on a flowering node.

1. Ryssopterys tiliaefolia (VENT.) JUSSIEU, Ann. Sc. Nat. II, 13 (1840) 286; Arch. Mus. Hist. Nat. Paris 3 (1843) 384, repr. 130; MIQ. Fl. Ind. Bat. 1, 2 (1859) 583; BACKER, Schoolfl. (1911) 166; NIEDENZU, Pfl. R. Heft 93 (1928) 285 (*tiliifolia*); VON MALM, in FEDDE, Rep. 34 (1934) 277; BACKER, Bekn. Fl. Java (em. ed.) 4c (1943) fam. 110, p. 5.—*Banisteria tiliaefolia* VENT. Choix (1803) 50, t. 50, *non* KUNTH (1821).—*Heteropterys albida* BLUME, Bijdr. (1825) 226.—*R. microstema* JUSSIEU, Arch. Mus. Hist. Nat. Paris 3 (1843) 384, repr. 130, *pro parte*; MIQ. Fl. Ind. Bat. 1, 2 (1859) 583, *pro parte*; *non* F.-VILL. Nov. App. (1880) 32.—*R. chrysantha* HASSK. Hort. Bog. 1 (1858) 133; MIQ. Fl. Ind. Bat. 1, 2 (1859) 584.—*R. albida* MERR. En. Philip. 2 (1923) 382, *quoad nomen*; NIEDENZU, Pfl. R. Heft 91 (1928) 286, *pro stirp. jav.*—**Fig. 12.**

Thin-stemmed liana, up to 25 m. Young parts pale greyish appressedly haired; twigs with few lenticels, at last glabrescent, internodes (5–)7–12 (–25) cm. Stipules deltoid, 1–3 mm long or smaller. *Leaves* ovate (1–)$1^1/_4$–$1^1/_2$(–2) times as long as broad, (6–)8–12(–18) by (4–)6–11(–12) cm; base sometimes acute, mostly rounded to deeply cordate; top narrowed and distinctly acuminate, sometimes more rounded and cuspidate; nerves 4–8 pairs; upper surface glabrous except sometimes the leaf-base, lower surface densely pale tomentose; petiole 3–7(–10) cm, more or less angular, fulvo-tomentose, with distinct glands at the top. Rhachis of the *inflorescence* about 6–10 cm, appressedly pale tomentose. Pedicels $1^1/_2$–2, in fruit to 3 cm long, terete, much haired, articulation below the middle. Bracteoles small. *Flowers* yellow (rarely white?), fragrant. *Sepals* roundish, *c.* 2 mm, densely haired outside, glabrous inside. *Petals* roundish to elliptic, more or less unguiculate, 6–8(–10) mm long, margin entire to subcrenulate. Filaments thin, terete, 2–3 mm long, glabrous; anthers $1^1/_2$ by $^1/_2$–1 mm, glabrous, connective the best developed in ♂ flowers, dark red or purplish when fresh, blackish when dry, more or less cordate at the base, narrowed into the distinctly acuminate top exceeding the thecae. Style 2–3 mm. *Samaras* 4–5(–6) cm long, $1^1/_2$–2 cm broad, wing often narrowed at the base, nerves in the wing curved about 60–90°.

Distr. *Malaysia:* W.-E. Java, ?Lesser Sunda Islands (Sumbawa: Bima; Lombok). Fig. 13.

Ecol. In rain-forest, edges of forests, all sorts of brushwood, numerous or not, sometimes in rather dry places, from sea-level up to 1000 m. *Fl.* throughout the year.

DOCTERS VAN LEEUWEN described several kinds of galls (Zoocecidia 1926, 272).

Vern. Java: *aroy kitapas, a. kibaks, a. kikupu kupu, a. kibaka, a. kikeuëus, a. laitepar, kingkilaban lakalina,* S, *tĕmas, ojod tĕmas, kĕtapangan,* J, *kunjik, konjik,* Md.

Note. The Bima specimen (ZOLLINGER *s.n.*) is inadequate and probably belongs to this species; RENSCH 398 (v. MALM, *l.c.*) from Lombok I have not seen.

2. Ryssopterys timoriensis (DC.) JUSSIEU in DELESSERT, Ic. Sel. Pl. 3 (1837) 21, t. 35 (*timorensis*);

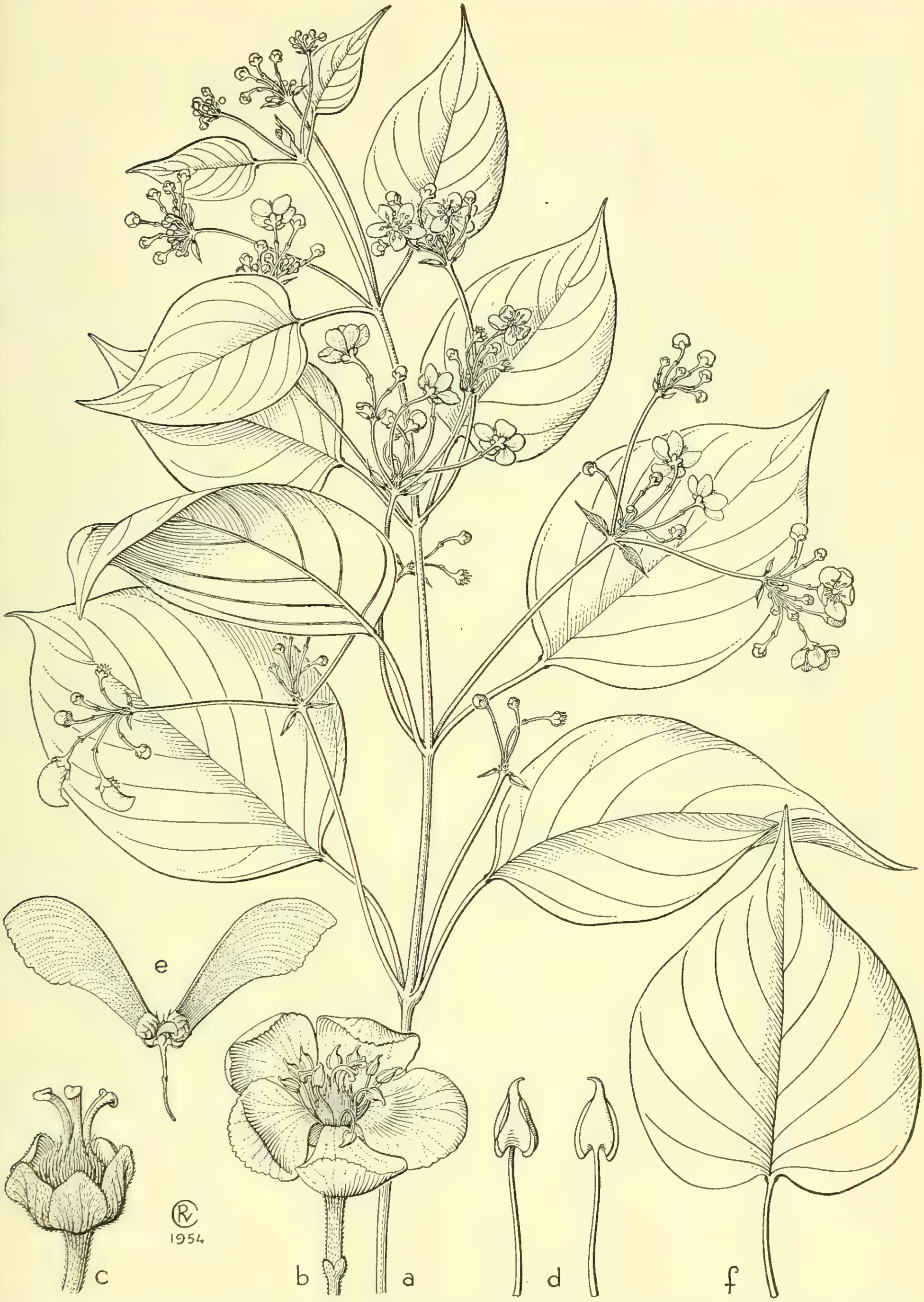

Fig. 12. *Ryssopterys tiliaefolia* (VENT.) JUSS. *a.* Flowering branch, left beneath with very young fruits, × 2/3, *b.* ☿ flower, × 3, *c.* the same, showing calyx and styles, × 6, *d.* stamens, the left one from the adaxial side, × 6, *e.* 2 fully developed samaras, attached to their carpophores, and 1 abortive one, × 2/3, *f.* a cordate leaf, × 2/3.

Ann. Sc. Nat. II, 13 (1840) 287; Arch. Mus. Hist. Nat. Paris 3 (1843) 387, repr. 133, t. 11; MIQ. Fl. Ind. Bat. 1, 2 (1859) 584; BENTH. Fl. Austr. 1 (1863) 285; BAILEY, Queensl. Fl. 1 (1899) 169; NIEDENZU, Pfl. R. Heft 93 (1928) 283, *incl. f. amboinensis* NIED.; GUILLAUMIN, J. Arn. Arb. 12 (1931) 233.—*Banisteria timoriensis* A.P. DC. Prod. 1 (1824) 588; SPANOGHE, Linnaea 15 (1841) 180.—*Hiraea obscura* BLUME, Bijdr. (1825) 226.—*Hiraea ovata* BLUME, Bijdr. (1825) 226.—*R. abutilifolia* JUSSIEU, Ann. Sc. Nat. II, 13 (1840) 286; Arch. Mus. Hist. Nat. Paris 3 (1843) 385, repr. 131; K. SCH. & LAUT. Fl. Schutzgeb. (1901) 387 (*arbutifolia, sphalma*); NIEDENZU, Pfl. R. Heft 93 (1928) 284, *incl. var. intermedia* (HOCHR.) NIED.—*Banisteria dichotoma* (*non* L.) SPANOGHE, Linnaea 15 (1841) 179.—*R. abutifolia auctt.*—*R. cumingana* JUSSIEU, Arch. Mus. Hist. Nat. Paris 3 (1843) 386, repr. 132; MIQ. Fl. Ind. Bat. 1, 2 (1859) 584 (*cumingiana*); F.-VILL. Nov. App. (1880) 32; VIDAL, Phan. Cum. Philip. (1885) 99; MERR. En. Philip. 2 (1923) 382.—*R. dealbata* JUSSIEU, Arch. Mus. Hist. Nat. Paris 3 (1843) 386, repr. 132; MIQ. Fl. Ind. Bat. 1, 2 (1859) 584; F.-VILL. Nov. App. (1880) 32; VIDAL, Phan. Cum. Philip. (1885) 99; MERR. En. Philip. 2 (1923) 382; NIEDENZU, Pfl. R. Heft 93 (1928) 282, *incl. var.* α, β *et* γ.—*R. microstema* JUSSIEU, Arch. Mus. Hist. Nat. Paris 3 (1843) 384, repr. 130, *pro parte*; F.-VILL. Nov. App. (1880) 32.—*R. chrysantha* (*non* HASSK.) HOCHR. Bull. Inst. Bot. Btzg *no* 19 (1904) 43.—*R. timorensis var. tiliifolia* (*non* VENT.) K. SCH. & LAUT. Nachtr. (1905) 283, *pro stirp.*—*R. intermedia* HOCHR. Bull. Inst. Bot. Btzg *no* 19 (1904) 45; Ann. Jard. Bot. Btzg Suppl. 3, 2 (1910) 838.—*R. albida* MERR. En. Philip. 2 (1923) 382, *pro stirp.*, *non Heteropteris albida* BL.; NIEDENZU, Pfl. R. Heft 93 (1928) 286, *pro stirp. philip.* For further synonyms see the variety. —**Fig. 9d, 11b, d.**

Twiner, rarely creeping, up to *c.* 10 m. Young parts densely greyish fulvous-haired; twigs terete, with few lenticels, rather quickly glabrescent, internodes (7–)10–15(–25) cm. *Stipules* variable in shape and size, roundish-obovate to lanceolate, with narrowed base and rounded top, 2–12(–20) by 1–8 mm, often with smaller accessory stipules at the extra-petiolar side (fig. 11d). *Leaves* variable in shape, size and hairiness, ovate (1–)1$^1/_2$–1$^3/_4$ (–2$^1/_2$) times as long as broad, (5–)8–12(–15) by 4–7(–12) cm; base shallowly cordate, rounded, or truncate, top acute, sometimes acuminate or rounded and cuspidate; nerves 4–7(–8) pairs; surface above glabrous, below glabrous, glabrescent or more or less densely greyish tomentose (fig. 10b); petiole (1–)2–7 cm, indistinctly sulcate, sparsely haired to glabrous, with 2 distinct glands at the top. *Flowers* yellow (rarely white?), fragrant. Pedicels 1–1$^1/_2$ cm, densely appressed-haired. *Sepals* roundish, about 2 mm, more or less haired outside, glabrous inside. *Petals* orbicular-elliptic, more or less unguiculate, 6–8(–11) cm long, entire to subcrenulate. Filaments thin, terete, 2–4 mm, rarely the outer whorl 1 mm longer than the inner one, glabrous; anthers 1–1$^1/_2$ by $^1/_2$–1 mm, connective ovate-elliptic, after flowering often dorsally curved, sometimes haired, top obtuse, not exceeding the thecae. Styles (rarely 4), about 3–4 mm long, pink, stigmas pale yellow. *Samaras* (2–)3–3$^1/_2$(–4) cm long, 1–1$^1/_2$ cm broad, wing mostly not narrowed at the base, nerves in the wing curved about 30–60°.

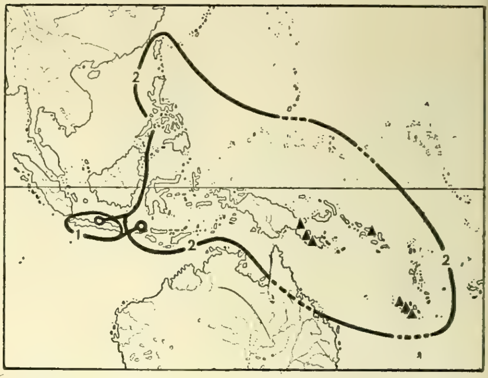

Fig. 13. Distribution of 1. *Ryssopterys tiliaefolia* (VENT.) JUSS. and 2. *R. timoriensis* (DC.) JUSS.; the areas overlap each other with one locality. The triangles indicate the localities of *R. timoriensis var. discolor* (GAND.) JACOBS.

Distr. From Formosa and Micronesia (Carolines) to E. Malaysia, N. Queensland and Melanesia (not in Fiji), in *Malaysia:* Central Java (Tenga Isl. near Djapara), Kangean Archip., Lesser Sunda Isl. (not seen from Bali), Celebes, Philippines (not seen from Palawan), Moluccas, and New Guinea. Fig. 13.

Ecol. Brushwood or forest edges, often in coastal regions, in the inner mangrove zone, often in calcareous soil, not seldom in rather dry habitats, up to 1500 (2000?) m. *Fl.* throughout the year.

Vern. Sumba: *raoaimarinu, kwakatehi*; Timor, Tobaki: *olas meà*; Philippines: *bingkít*, Mindoro, *bugtung-áhas*, Tag., *lagun, laumus*, Bag.

Notes. A very variable species of which a number of extreme or otherwise deviating specimens have been formerly designated specific rank. They are, however, linked by transitional specimens and do not show geographically significant areas. There is one exception, *viz var. discolor*, which shows a typically different indument and a well-defined area (fig. 13).

As to the distribution the 2 Malaysian species of *Ryssopterys* slightly overlap, *i.e.* there is one locality of *timoriensis* in the area of *tiliaefolia* and, reversely, there are 1 or 2 localities of the latter in the area of *R. timoriensis.*

It is true that the species *Hiraea ovata* BL. and *H. obscura* BL. have been described from Java, but the labels of their type specimens read them to have come from Timor! BLUME's data on the origin of these sheets seem to rest on an error.

NIEDENZU mentions a specimen from South Sumatra (Palembang) (WARBURG 1998); I have

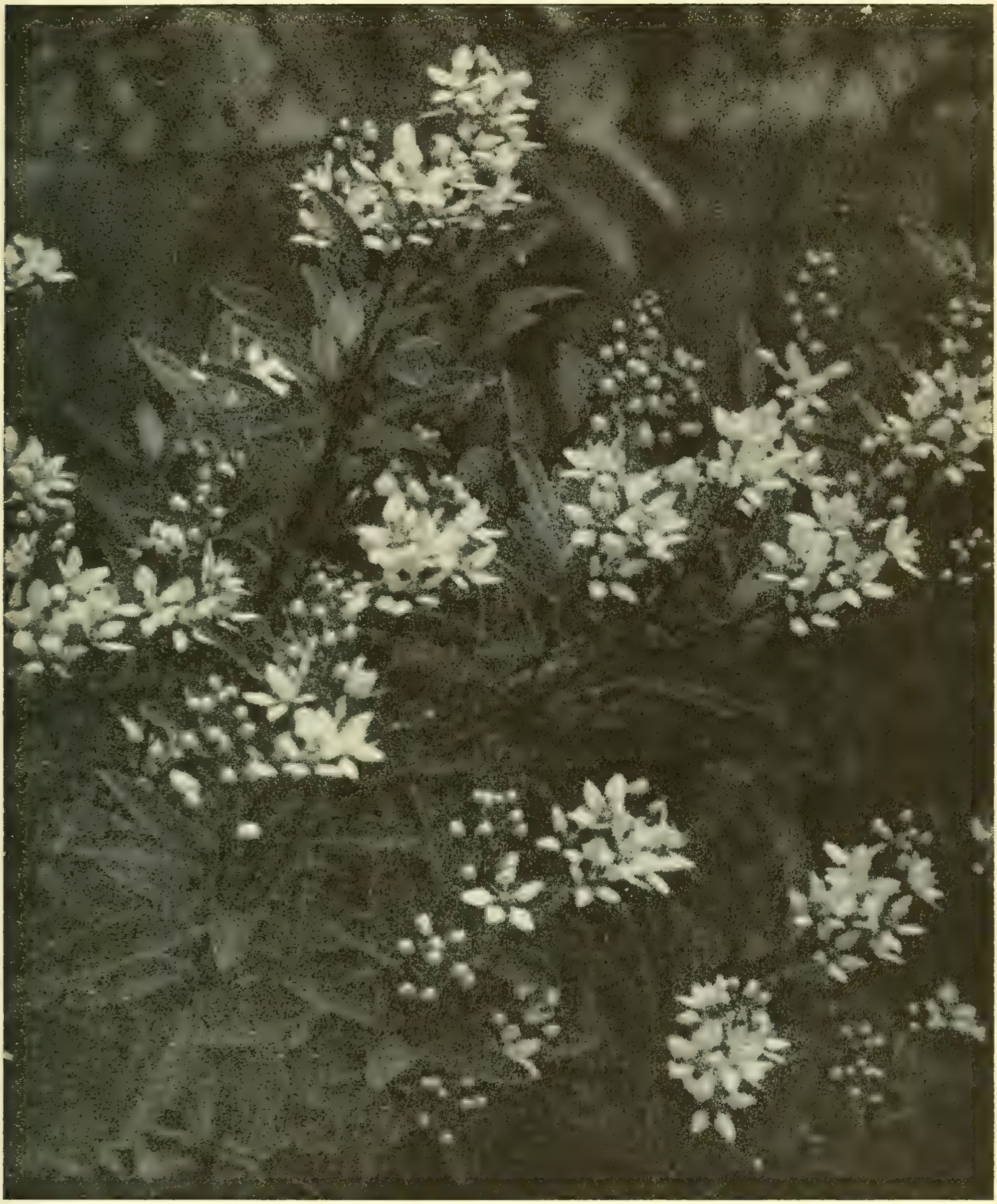

Fig. 14. *Galphimia gracilis* BARTL. in flower (Bogor, May 1939).

not seen it and I have some doubt about this record.

var. **discolor** (GAND.) *comb. nov.*—*R. discolor* GANDOGER, Bull. Soc. Bot. Fr. 60 (1913) 458; NIEDENZU, Pfl. R. Heft 93 (1928) 285, *forma 1 et 3, pro parte*; GUILLAUMIN, Bull. Soc. Bot. Fr. 79 (1932) 515; Fl. Nouv. Caled. (1948) 174.—*R. austrocaledonica* NIED. Arb. Bot. Inst. Braunsberg 6 (1915) 63; Pfl. R. Heft 93 (1928) 287, *incl. var. primaeva, pro parte*.—**Fig. 11a**.

Liana or shrublike. Young parts very densely white-tomentose, twigs later glabrescent, internodes 3–8(–20) cm. *Stipules* variable, not more than 10 mm long, deltoid to lanceolate and cuspidate, densely haired; sometimes more accessory stipules. *Leaves* ovate-elliptic, *c.* 1.4–1.6(–2½) times as long as broad, (3–)4–10 by (2–)3–7 cm; base rounded, sometimes slightly cordate, top often rounded, seldom narrowed, cuspidate; nerves 4–5 pairs; surface glabrescent above, very densely white-haired below (fig. 10a); petiole 1–4 cm, narrowly sulcate above, densely haired, glands at the underside of the leaf base often more or less abortive. *Inflorescence* in all parts white-haired; rhachis often stout, 3–8 cm long. Pedicels 1–3 cm. *Flowers* yellow, fragrant. *Sepals* roundish, *c.* 2–3 by 2 mm. *Petals* orbicular-elliptic, distinctly unguiculate, 7–10 mm long. Filaments 2–4 mm, anthers *c.* 1 mm long. *Samaras* 2–3½(–4) by 1–1½ cm, often slightly smaller than in the species.

Distr. Solomon Islands (Ysabel Isl.), New Caledonia, in *Malaysia:* SE. New Guinea. Fig. 13.

Ecol. About the same as in the *sp.* proper, up to 500 m.

Notes. Some sheets from Queensland are resembling this variety and might appear to belong to it.

The only character really distinguishing it from *R. timoriensis* is the thick, white indument, consisting of hairs which are longer, thicker, and more coiled than in the species. In the leaf-shape many transitional forms exist.

6. GALPHIMIA

CAVANILLES, Ic. Descr. Pl. 5 (1799) 61; JUSSIEU, Arch. Mus. Hist. Nat. Paris 3 (1843) 321, repr. 67.—**Fig. 14.**

Low shrubs. *Leaves* entire, with 2 small glands at the base of the limb. Stipules inserted on the base of the petiole. *Racemes* terminal, bracteate. Pedicels with 2 bracteoles below the articulation. *Flowers* bisexual, almost actinomorphic. *Sepals* 5, mostly glandless, shorter than the petals. *Petals* distinctly clawed, entire. Filaments 10, not or scarcely connate at the base, the episepalous ones the longest. Ovary globular, 3-lobed, often 1 or 2 cells not developing further; styles 3, free, coiled in bud, divergent, acute. *Fruit* dry, smooth, mericarps not winged, dehiscent.

Distr. About 10 *spp.*, from California and Texas to the Argentine, centering in Mexico.

1. Galphimia gracilis BARTLING, Linnaea 13 (1839) 552; BACKER, Schoolfl. (1911) 165; KOORD. Exk. Fl. Java 2 (1912) 450; NIEDENZU, Pfl. R. Heft 94 (1928) 595; BACKER, Bekn. Fl. Java (em. ed.) 4c (1943) fam. 110, p. 5; STEEN. Fl. Sch. Indon. (1951) 236.—*G. glauca* (*non* CAVAN.) MERR. Fl. Manila (1912) 277.—*Thryallis glauca* (KUNTZE *partim*) MERR. En. Philip. 2 (1923) 383.—**Fig. 14.**

Shrub, ½–2 m high. Youngest parts appressedly reddish-haired, older twigs brown, glabrous; internodes 2–4 cm. *Leaves* herbaceous, elliptic-oblong, sometimes ovate, 3–5 by 1–2½ cm; base acute, with 2 glandular pimples, top obtuse to rounded, tip a minute, acute point; nerves 4–5 pairs; petiole *c.* 1 cm, green when young, turning red. *Stipules c.* 3 mm long, linear, acute, red. *Racemes* later overtopped by 2 lateral branches, 6–12 cm, appressedly dark-red short-haired. Bracts 3–4 mm, linear, acute, persistent. Pedicels ¾–1¼ cm, articulated about the middle. Bracteoles at the top of the lower portion. *Flowers* yellow, 1½–2 cm in diam., glabrous in all parts. *Sepals* ovate, slightly carinate and decurrent in the pedicel, 2–2½ by 1–1½ mm, top blunt, sometimes recurved. *Petals* slightly carinate below, two slighty shorter than the others, 2–3½ mm clawed, limb triangular, blunt, *c.* 5 by 3½ mm. Filaments with somewhat broadened base, glabrous, yellow, turning red, persistent, 2½–3 and 4 mm long; anthers 2–2½ mm long, lanceolate, caducous. Ovary 2–3 mm in diam.; styles terete, 5–6 mm long, caducous. *Fruits* brown, globular, *c.* 5 mm.

DISTR. Central America, cultivated widely in the tropics, in *Malaysia:* rather commonly cultivated in gardens below 1000 m. *Fl.* Jan.–Dec.

Uses. Cultivated for ornamental purpose; propagated by seeds or cuttings.

7. MALPIGHIA

PLUMIER *ex* LINNÉ, Gen. Pl. ed. 5 (1754) 194; JUSSIEU, Arch. Mus. Hist. Nat. Paris 3 (1843) 258, repr. 4; SMALL, N.-Amer. Fl. 25 (1910) 152; NIEDENZU, Pfl. R. Heft 94 (1928) 611.—**Fig. 15–16.**

Small trees or dwarf shrubs. *Leaves* shortly petioled, with small, narrow stipules, glandless, sometimes thorny-dentate. *Flowers* solitary or in inflorescences, bisexual, zygomorphic. Calycinal glands distinct, up to 2 at the base of each sepal, 6 being always present in the posterior part, 1–4 incidentally present in the anterior part of the calyx. *Petals* inequal, fimbriate (the larger ones) to entire (the smaller ones), distinctly clawed, glabrous. *Stamens* glabrous, shorter than the petals, 2 opposite ones in the transversal plane different from the other 8. *Ovary* glabrous; styles free, diverging, as a rule 2 well developed, the posterior one abortive. *Fruit* fleshy, separating into drupe-like nuts.

Distr. About 26–36 *spp.* centering in Central America, a few *spp.* north to California and Texas, south to Columbia and Peru.

1. Malpighia coccigera LINNÉ, Sp. Pl. 1 (1753) 426; ed. 2, 1, 2 (1762) 611 (*coccigrya*); JUSSIEU, Arch. Mus. Hist. Nat. Paris 3 (1843) 263, repr. 9; SMALL, N.-Amer. Fl. 25 (1910) 160; BACKER, Schoolfl. (1911) 165; KOORD. Exk. Fl. Java 2 (1912) 450; BACKER, Bekn. Fl. Java (em. ed.) 4c (1943) fam. 110, p. 6; BRUGGEMAN, Ind. Tuinb. (1939) 250; STEEN. Fl. Sch. Indon. (1951) 236.—*M. coccifera auctt.*—**Fig. 15–16.**

Shrublet, $^1/_2$–$2^1/_2$ m high. Twigs terete, when young sparsely set with pale, appressed hairs; internodes 1–$1^1/_2$(–2) cm. *Leaves* either along the twig and then with a few, mucronate, marginal teeth, margin between the teeth revolute, or on dwarf shoots, and then entire, coriaceous, suborbicular to elliptic, 1–$1^1/_2$(–2) by $^3/_4$–$1^1/_4$(–$1^1/_2$) cm; base rounded to truncate; top rounded to slightly notched; petiole and margin sometimes sparsely haired; surfaces glabrous, shiny and with prominent venation above; petiole 1–2 mm. *Stipules* small, linear, near the base of the petioles. *Flowers* on the dwarf shoots, axillary, single or paired, white to pale pink or light red, glabrous, faintly scented. Pedicels *c.* $1^1/_2$ cm, articulation in the lower half, marked by 2 small bracteoles. *Calyx* with 6–10, flat, elliptic glands *c.* $1^1/_2$ mm in diam., sepals 2–3 mm long, blunt. *Petals* slightly differing in size, claw 2–4 mm, limb 5–7 by 3–7 mm. *Filaments* sometimes slightly unequal in length, *c.* 3 mm, 2 opposite filaments thicker and bearing anthers about twice the size of the others. Two styles ascending in a bow, 5 mm, the third one abortive, 2 mm; stigma *c.* 1 mm wide. *Fruit* (not seen) red, 8–10 mm long, only 1–2 mericarps developing.

Distr. Central America (Caribbean area), in *Malaysia:* cultivated chiefly in Java, below 800 m, especially in hedges. *Fl.* throughout the year. Propagation by seeds and cuttings.

Vern. *Japanse Mirt*, D.

Excluded

Triopteris poliandra BLANCO, Fl. Filip. ed. 3, 2 (1878) 133 = *Berrya ammonilla* ROXB. (*Tiliaceae*).

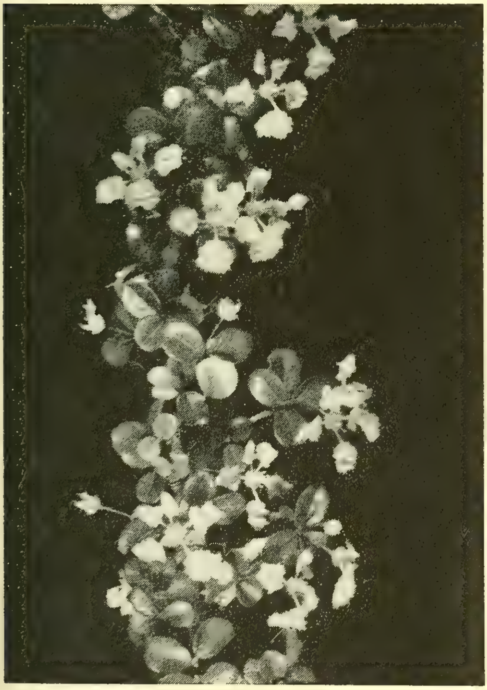

Fig. 15. *Malpighia coccigera* L. Flowering twig with small subentire leaves of dwarf shoots, × $^3/_5$ (Cult. Kebun Raya Indonesia, April 1955).

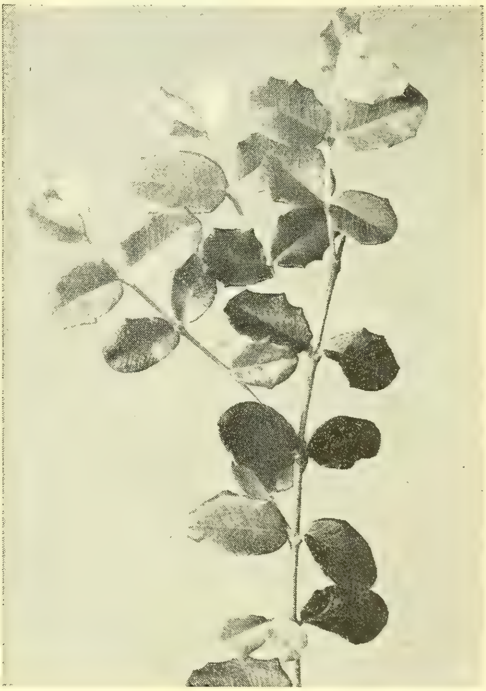

Fig. 16. *Malpighia coccigera* L. Young twig with larger dentate leaves of the same plant as fig. 15, nat. size.

PROTEACEAE (H. Sleumer, Leyden)

Trees or shrubs. Leaves spiral or in pseudo-whorls, sometimes subopposite, generally coriaceous, simple or pinnatisect, often dimorphous, entire or toothed, sometimes spiny. Stipules 0. *Inflorescences* mostly axillary or rami- or cauliflorous, or terminal. *Bracts* (potentially) present but mostly small, often minute and very early caducous or barely visible, sometimes large, accrescent and woody (in cone-like spikes). Bracteoles 0–2, small. *Flowers* in racemes, umbels or spikes, the latter sometimes cone-like, not rarely inserted in twos; pedicels of the pairs sometimes connate to various degree. *Flowers* choripetalous (though segments sometimes remain connate or partly so, sometimes with a spathaceous corolla), actinomorphous, sometimes zygomorphous (by one-sided saccate corolla base, oblique torus, disk glands, stigma), mostly bisexual, rarely only seemingly so and in fact unisexual and dioecious. *Buds* generally cylindric, straight or curved, more or less dilated towards the base, with a mostly clavate or globular apex. *Perianth segments (tepals)* valvate, with a distinctly broadened apex (here called: *limb*), in flower recurved, adhering to each other in the lower portion to various degree, at length mostly entirely free. Torus flat or oblique. *Stamens* 4, epitepalous; filaments connate with the tepals to various degree, sometimes very short; anthers erect, basifixed, 2-celled, introrse, dehiscing lengthwise, connective often prolonged. *Disk* an annular or horseshoe-shaped, flat or oblique gland, or consisting of 4 free or variously united hypogynous glands alternating with the stamens, rarely absent. *Ovary* superior, 1-celled, sessile or stipitate, often oblique; style terminal, thickened at the tip; stigma mostly small, terminal or lateral. *Ovules* solitary or geminate, either orthotropous and pendulous from or nearly from the top of the cell, or anatropous, ascending, inserted at the base of the cell or laterally at the wall, or ovules ∞, biseriate. *Fruit* dehiscent, *i.e.* a coriaceous or woody follicle or a ± dry fruit the pericarp of which splits irregularly into halves to various depth, or indehiscent, *i.e.* a nut or a true drupe, or a ± dry fruit with coriaceous pericarp. *Seeds* solitary or in pairs, or ∞ biseriate, sometimes winged; testa membranous, or coriaceous, sometimes stony; albumen 0; cotyledons thin or thick and fleshy, often unequal; radicle short; inferior.

Distr. About 60 genera, with at least 1300 *spp.* in mostly tropical or subtropical Africa (incl. Madagascar *c.* 350 *spp.*), Central and S. America (*c.* 90 *spp.*), Asia (20 *spp.*), Malaysia (incl. Palau Isl., New Ireland, New Britain, and the Solomon Isl. *c.* 80 *spp.*, 5 of which also in Australia), Australia (*c.* 750 *spp.*, chiefly in W. Australia, 5 of which also represented in New Guinea), New Caledonia (*c.* 50 *spp.*), New Hebrides (2 *spp.*), extending to New Zealand (2 *spp.*), Fiji and Samoa (2 *spp.*), but not represented in Polynesia proper east of the 'Andesite-line'.

In Micronesia (Palau) there is only one species (the widest distributed one) of the genus *Finschia*.

The family is subdivided in *Persoonioideae* and *Grevilleoideae*, the first of which is restricted to Africa and Australia.

All Malaysian representatives belong to *Grevilleoideae*, a subfamily absent from Africa.

Genera are restricted to one continent with the exception of five genera. *Helicia* is centering in Malaysia but possesses species both in SE.-E. Asia and Australia in a continuous generic area. Four others have disjunct areas and occur both in the SW. Pacific area and in South America, *viz Gevuina*, *Oreocallis*, *Orites* and *Lomatia* (fig. 1).

There is very little doubt that *Proteaceae* are among the most ancient of Australian dicotyledonous families and it is tempting to accept the summaries by Berry (U.S. Geol. Surv., Prof. Pap. 91, 1916, 1–353) and Hirmer (Bot. Jahrb. 72, 1942, 424, 502, 528) who suggest that this family was also common on the northern hemisphere at the close of the Lower Cretaceous, becoming practically cosmopolitan in the Upper Cretaceous, and still maintaining this position in many Tertiary floras.

There seems, however, no unanimity of opinion about the exact identification of many fossils assigned to the *Proteaceae*, the factual basis on which the discussion of the geographical history of the family should be based. Modern exact methods may yield interesting results.

Of the 9 genera of the family localized in Malaysia none is endemic.

Helicia is a Malaysian-centered genus extending southeastwards to E. Australia and northwestwards far into SE. and E. Asia, westwards as far as Ceylon and the Western Ghats, northwards to S. Japan.

Heliciopsis occurs in SE. Asia and in W. Malaysia.

Banksia is primarily an Australian genus of which one Australian species is known to occur in New Guinea and the S. Moluccas (Aru Isl.).

Grevillea, *Macadamia* and *Stenocarpus* occur in E. Malaysia, Australia, and New Caledonia.

Finschia with its center of distribution in New Guinea (fig. 7) is apparently absent from Australia, but radiates to the Palau Islands in the north and to the Aru and Solomon Islands and the New Hybrides in the south.

Oreocallis is represented in New Guinea (incl. the Aru Isl.), NE. Australia, Ecuador, and Peru.

Gevuina occurs in NE. Australia, N. New Guinea, and Chile. The latter two both indicate a very old Austral-American connection as do the genera *Orites* and *Lomatia*, which are absent from Malaysia (fig. 1).

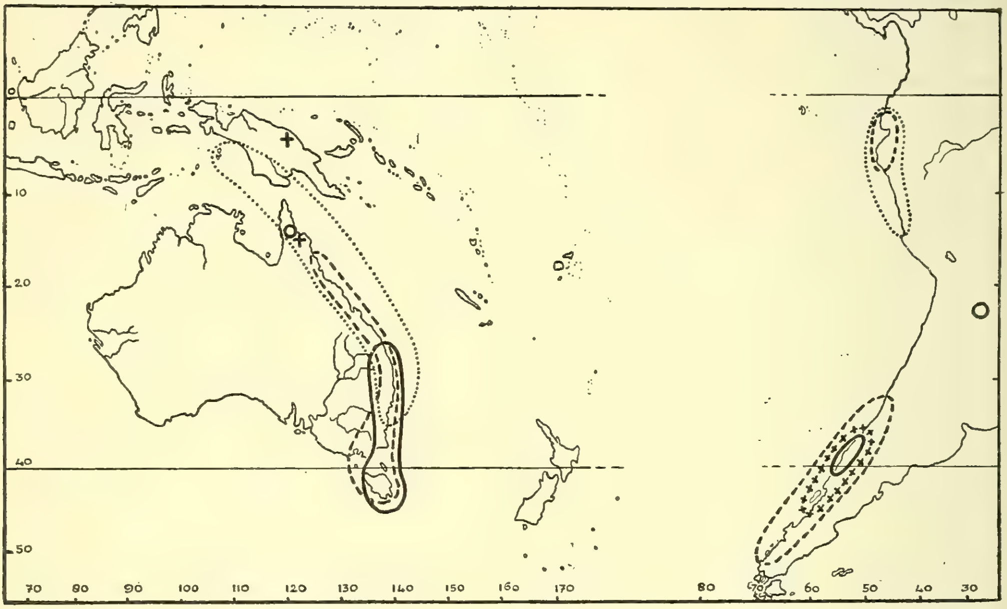

Fig. 1. Distributional areas of the bicontinental Proteaceous *Orites* (————), *Gevuina* (++++), *Lomatia* (– – – –), and *Oreocallis* (. . . . . . .). For convenience part of the Central Pacific is contracted. See for *Helicia* fig. 12–13.

The alliance of Malaysian *Proteaceae* to those of Australia and SE. Asia is not restricted to the generic level, but shows also a few intimate connections to both areas in certain species. *Banksia dentata*, *Grevillea glauca*, *G. pinnatifida*, *Stenocarpus sinuatus*, and *S. moorei* occur both in NE. Queensland and in New Guinea, *Banksia dentata* occurs moreover in Aru. These species are savannah constituents and their occurrence in the drier parts of New Guinea may be due to a relatively recent dispersal. A similar crossing of the Torres Straits line must be assumed for the genus *Gevuina*, of which two rain-forest trees *viz G. bleasdalei* of NE. Queensland and *G. papuana* once found in N. New Guinea, are closely related to each other.

Malaysian *Proteaceae* are connected with those of SE. Asia by two *Helicias*, *viz H. robusta* and *H. excelsa* which range from the Western Ghats respectively E. Bengal through Burma, Indo-China, and Siam as far as the Philippines respectively Borneo. Being true forest elements which presumably cannot migrate over large distances as quickly as savannah-types apparently are able to perform, we must conclude, that their present area indicates a connection of the SE. Asiatic and Malaysian *Proteaceae* in remote epochs as early as the Lower Eocene, when these countries were still coherent.

The majority of the Malaysian *Proteaceae* as far as they occur in forests, seems to have rather limited areas and are scarce; about 40% have been collected only once. Examples of species with a wide range of distribution, apart form *Helicia robusta* and *H. excelsa* mentioned above, are *Finschia chloroxantha* (Palau Isl.–Aru Isl.–New Guinea–Solomon Isl.–New Hebrides), *Helicia attenuata* (S. Lower Burma–

S. Siam–Malay Peninsula–Sumatra–Java–Bali–Borneo), and *Helicia serrata* (Malay Peninsula–Sumatra–Java–Borneo–Ambon).

Ecol. Although *Proteaceae* show a rather great ecological variability both in many genera and in certain species—a fact which facilitates their cultivation—most Malaysian *Proteaceae* are restricted to climatically wet or everwet areas, *i.e.* in primary or secondary rain-forests, where they occur usually scattered and belong to the substage of the forest. Species of dry savannah land, as those mentioned above, are sometimes more frequent locally. This agrees with practically all South African *Proteaceae* and the vast majority of the Australian ones, which are markedly xerophytic.

No Malaysian species is known to reach large dimensions.

As to altitude, most genera and most of the species occur below 2400 m altitude in the tropical and montane zones, the highest altitudes being reached by some species of *Helicia:* 2600 m in Celebes, 2650 m in Java, 2840 in New Guinea, and 3350 m on Mt Kinabalu in N. Borneo.

Some species as *Finschia chloroxantha*, *Oreocallis brachycarpa*, and some *Helicias* are restricted to the tropical lowland.

Species restricted to the seasonal (monsoon) forest area are *Banksia dentata*, *Grevillea glauca*, *G. elbertii*, *G. pinnatifida*, and *Stenocarpus sinuatus.*

Drought-resisting xerophytic *Proteaceae* often show a marked resistance against fire by which they may gain dominance in the savannahs; in Malaysia this has been demonstrated for *Banksia dentata* (fig. 26, 27).

Dispersal. Little is known about the dispersal of fruits or seeds in Malaysian *Proteaceae.* Most of the fruits are rather heavy. Species with edible seeds normally have a hard endocarp (*Finschia*) or stone-hard testa (*Macadamia spp.*). Fruits with holes gnawed in these stony shells by birds or mammals in search for the seed are found in the herbarium. The winged seeds of *Oreocallis brachycarpa*, *Banksia dentata*, and *Stenocarpus spp.* may allow a farther dispersal by wind.

Galls. No galls specific for a distinct genus or species are hitherto known from Malaysian *Proteaceae*, according to DOCTERS VAN LEEUWEN (The Zoocecidia of the Netherlands East Indies 1926, 164–168). He described galls from 3 *Helicias*, some causing deformed flowers, others situated on the leaves or the bark of the twig. Nearly all are formed by *Psyllidae*; the galls show peculiar purple and blue shades such as are rarely met with in cecidology.

Floral morphology. The flowers are mostly bisexual. In *Heliciopsis* they are only seemingly so but in fact unisexual, the plant being dioecious; in that case the ovules are not well developed in the ♂ flowers and the ovary is not swollen as is the case in bisexual flowers; in the ♀ flowers the anthers do not contain pollen, although they seem to be perfect in shape and size.

Detailed observations on the morphology of the peculiar flower structure in Proteaceous plants have been made and pictured by BENTHAM (J. Linn. Soc. Bot. 13, 1871, 58–64). Unfortunately very few additional observations have been made in nature to verify the effect of these structures in flower-biological respect. Experiments are badly needed in order to discriminate between the agents which are necessary for pollination and those which are accidental. There seems to be a most fascinating and promising field for observation here, which may throw some light on the remarkable fact that the number of fruits set per inflorescence is generally very small as compared with the number of flowers present.

The flowers are similar in general appearance in all genera concerned and are mostly arranged in spike-like racemes, rarely in umbels (fig. 23). Cone-like inflorescences are represented in the Malaysian region only in *Banksia.* Variation in the structure of the flowers concerns the presence or absence of a gynophore, the shape and position of the receptacle and the disk, and the number and position of the ovules. The distinction of the Malaysian genera of *Proteaceae* is mainly based on these characters and the nature of the fruit.

Pollination. The flowers generally contain nectar, sometimes even in abundance. The flowers of all species concerned seem to be typically protandrous, the granular pollen being fully mature in bud and temporarily deposited on the upper part of the style or on the not yet receptive stigma, by which self-fertilization is avoided.

Very little is known about the opening mechanism of the flower. In many genera (not in *Helicia*, except the Australian *H. youngiana!*) the style expands as an elastic bow through a lateral slit of the perianth of the mature bud, the stigma still being held in the limb.

In opened flowers the perianth segments are mostly strongly reflexed and the structure strongly reminds of that in the *Loranthaceae* where actually buds open explosively on touch (or pressure by the beak of honey birds) and the granular pollen is dispersed in the act of explosion. The situation in *Proteaceae* is apparently different in degree, as the opening of the bud goes too slowly to call it really explosive, at least in *Grevillea* (*cf.* VOGEL, in TROLL & GUTTENBERG, Bot. Stud. 1954, p. 178 and confirmed by Dr L. VAN DER PIJL).

Flowers in *Grevillea* and some other genera are clearly negative geotropical, and nectar is of thin consistency.

Animals visiting the flowers are apparently sometimes insects (bees, butterflies), but predominantly birds and specially adapted arboreal marsupials (*Phalangeridae*). As far as known to us no detailed observations have been made in Malaysia on any native species. PORSCH summarized data on the birds visiting the mostly conspicuously coloured Proteaceous flowers (Biol. Gener. 7, 1931, 656; Jahrb. Wiss. Bot. 70, 1929, 190) comprising members of the *Nectariinidae*, *Zosteropidae* and *Meliphagidae.*

A good concise view on the flower biology and pollination (mostly by honey-birds) of West Australian *Proteaceae* was given by O. H. SARGENT (Ann. Bot. 32, 1918, 220–222). He also points attention to the relatively few number of seeds produced per shrub as compared *e.g.* with *Eucalyptus*. He calls *Banksia* a very shy seeder.

PORSCH (Biol. Gener. 10, 1934, 673–679) also recorded observations on arboreal dwarf marsupials ('honey-mouse') visiting species of *Banksia, Grevillea, Melaleuca, Eucalyptus, etc.* Representatives of this group are distributed from New Guinea through Australia to Tasmania. Though very small as compared with the average size of mammals, they are for flower visitors of a coarse stature. With their thin, terete tongue they are wholly adapted to feed on honey (and insects for proteins like the honey-birds?). Recently they have been observed on New Guinean *Banksias* (see p. 205 and fig. 28).

In Malaysia frequent visits by several kinds of honey-sucking birds were observed on the cultivated *Grevillea banksii* (DOCTERS VAN LEEUWEN, Verh. Kon. Ak. Wet. A'dam sect. 2, 31, 1933, 113; VAN DER PIJL, Met open ogen door stad en land 1950, 84). According to the latter buds elastically open on touch by these birds, and he suggests a special opening mechanism in which the style acts as a spring. In S. America colibris frequent Proteaceous flowers.

It is most remarkable that the number of fruits set per inflorescence is generally very small as compared with the number of flowers and their visitors. Growth of seed and pericarp is apparently correlated and simultaneous; also young fruits are filled by the seed.

Wood Anatomy. BEEKMAN, Med. Proefstat. Boschw. 5 (1920) 156: *Helicia serrata* BL.; DEN BERGER, Determinatietabel van Malesië, Veenman, Wageningen (1949) 52, Med. Proefstat. Boschw. 13 (1926) 25: *Helicia serrata* BL. (hand lens); BAKER, Hardwoods of Australia, Techn. Ed. Ser. 3 (1919) 348, J. Proc. R. Soc. N.S.W. 52 (1918) 364: *Grevillea robusta* A. CUNN.; METCALFE & CHALK, Anat. Dic. 2 (1950) 1165; MOLL & JANSS. Mikr. 5 (1934) 380.—JANSSONIUS *l.c.* reports large differences between the 3 *Helicia spp.* examined by him, and *Heliciopsis incisa* (K.&V.) SLEUM. (*Helicia incisa* K.&V.) and *Heliciopsis lanceolata* (K.&V.) SLEUM. (*Helicia lanceolata* K.&V.) which facts lend support to the taxonomic recognition of the genus *Heliciopsis*.–C.A.R.–G.

Uses. On account of their showy inflorescences several *Proteaceae* are used as ornamentals in tropical and subtropical countries, but the everwet Malaysian climate is not very well adapted for growing them. *Grevillea banksii* and *Stenocarpus sinuatus* do very well as ornamental shrubs or small trees. BACKER (Bekn. Flora Java em. ed. 4a, 1942, fam. 79) mentions two other cultivated species *viz Grevillea thelemanniana* V. HÜGEL *ex* ENDL. and *Petrophila sessilis* SIEB. *ex* R. & S. I have seen no material from these in Java except from the Botanic Gardens, Bogor. They have apparently been distributed by the Botanic Gardens and occur in the dispatch lists which BACKER accepts as the basis for treating them in his Flora. A few odd specimens therefore, may be found in cultivation, but apparently they have never gained the status of an appreciated garden plant.

Some of the *Proteaceae* possess edible seeds. The Queensland nut, *Macadamia ternifolia* and *M. tetraphylla*, is a good example; it is cultivated in Malaysia and elsewhere. The native *M. hildebrandii* from Celebes may prove to produce also edible seeds. *Finschia chloroxantha* is reported to be cultivated locally by the natives of Bougainville for its edible seeds.

GRESHOFF reported (Kew Bull. 1909, 397–418) the occurrence of cyanogenic substances (glucosides) in seeds of *Macadamia* and SMITH & WHITE (Proc. R. Soc. Queensl. 30, 1918, 87–89) have added positive data from the tissues of other Australian *Proteaceae*. They report that the seeds of *Macadamia whelani*, which are powerfully cyanogenic, are used as food by the aborigines of N. Queensland only after careful preparation. In a later paper (*op. cit.* 32, 1930, 89–91) additional data are communicated; in several species hydrocyanic acid was found to occur in flowers.

From the foresters's point of view *Proteaceae* are not an important family, neither in the composition of the forest nor in yield of timber or adaptability for reafforestation. The only tree used in reafforestation is *Grevillea robusta*; this is also a well-known roadside tree. Some other *Grevilleas* occurring in New Guinea belong to the group called in Australia the 'silky oaks', yielding a valuable timber there.

From Sorong there has been once a rumour that the seeds of *Finschia* would constitute a valuable medicine against leprosy, but no investigations have followed.

The dried leaves of quite a number of Malaysian representatives show distinct yellowish or greenish tinges, characters which are peculiar to aluminium-accumulating plants, and some *Helicias* have in addition blue fruits as found by HALLIER *f.* and later elaborated by E. M. CHENERY (Ann. Bot. n.s. 12, 1948, 121–136; Kew Bull. 1948, 173–183). Flush and galls also show peculiar purple and blue shades.

Taxonomy. The family is divided into two sub-families *viz* the *Persoonioideae* (Africa and Australia) and the *Grevilleoideae* (SE. Asia–Malaysia–Australia–S. America). All Malaysian *Proteaceae* thus belong to the *Grevilleoideae*. This subfamily is further divided into 3 tribes *viz* the *Grevilleeae* with 6 Malaysian genera (*Finschia, Gevuina, Grevillea, Helicia, Heliciopsis, Macadamia*), the *Embothrieae* with 2 Malaysian genera (*Oreocallis, Stenocarpus*) and the *Banksieae*, in Malaysia only with *Banksia*.

No precursory work on Malaysian *Proteaceae* as a whole has been done; for New Guinea revisions have been published subsequently by LAUTERBACH (Bot. Jahrb. 50, 1913, 328), DIELS (*l.c.* 54, 1916, 198) and myself (*l.c.* 70, 1939, 125). The genus *Finschia* was recently revised by WHITE (Pac. Sc. 3, 1949, 187). In connection with the present work a revision of the generic status of all Proteaceous taxa reported from regions adjacent to Malaysia has been undertaken (Blumea 8, 1955, 2–95).

The treatment given here should be regarded as tentative due to inadequate data and material, which in turn is partly caused by the apparently rare occurrence of many species. This is illustrated by the fact that 31 species are known from one specimen only; 27 species have been reduced, 16 have been recognized as new. Critical comparison of closely allied species proved often difficult as in many collections fruits are absent. Adequate field notes are also scarce in the herbarium and in several instances the variation of the leaves, specially in those species with dimorphous foliage, can hardly be ascertained from herbarium specimens. Attention of collectors is drawn to the desirability of collecting complete material and making ample notes.

SCIENTIFIC KEY TO THE GENERA

1. Flowers nearly always pedicelled, in racemes or umbels, spaced on a rather slender rhachis. Styles not hardened and pin-like. Infructescence not cone-like. Bracts small, often caducous or almost absent, never woody with age.
  2. Ovary (in Mal. *spp.*) with 2 ovules close together. Fruit globular, ovoid or ellipsoid, with 1–2 seeds, these either or not winged all round (GREVILLEEAE).
    3. Receptacle very oblique. Disk unilateral, thick, ± horseshoe-shaped, entire or 2-lobed.
      4. Ovary sessile. Ovules orthotropous and pendulous from or nearly from the top of the cell. Fig. 3. **1. Gevuina**
      4. Ovary (in Mal. *spp.*) stipitate. Ovules anatropous, ascending, laterally attached to the wall of the cell.
        5. Fruit indehiscent (drupe). Leaves simple. Nerves *c.* 12–20 pairs, oblique, straight, parallel, ladder-like connected by a distinct, looped intramarginal nerve. Fig. 8 . . . . **3. Finschia**
        5. Fruit dehiscent (follicle). Leaves simple or pinnate. Nerves flabellate or pinnate, ascending, otherwise. Fig. 6 . . . . **2. Grevillea**
    3. Receptacle transverse. Disk actinomorphous, consisting of 4 thick glands either free (distant or approximate) or connate in a cup.
      6. Ovules anatropous and ascendent, inserted at the base of the cell or laterally on the wall. Fruit mostly indehiscent, rarely tardily dehiscent ± lengthwise, pericarp not or very rarely differentiated into 2 strata, then showing an outer part (exocarp), which may be ± fleshy, and an inner one, which is coriaceous or hard (endocarp). Fig. 15–16 . . . . **4. Helicia**
      6. Ovules orthrotropous, hanging from, or nearly from, the top of the cell. Fruit various.
        7. Flowers unisexual; plants dioecious. Pollen-exine strongly reticulate when 500 × enlarged. Drupe; exocarp leathery, rather thin and early dissolved; mesocarp formed by numerous radial ± soft fibres; endocarp hard, woody, irregularly reticular-lacunose outside. Fig. 17–18. **5. Heliciopsis**
        7. Flowers bisexual. Pollen-exine smooth or nearly so when 500 × enlarged. Fruit dry, mostly splitting ± irregularly lengthwise, then showing the seed which may have a thick stone-hard testa; pericarp not or not distinctly differentiated into 2 strata, the inner one never woody. Fig. 20. **6. Macadamia**
  2. Ovary with several ovules superposed in 2 rows. Fruit narrow-oblong, with 4 or more seeds, these ± overlapping each other with their long unilateral wings (EMBOTHRIEAE).
    8. Flowers in manifestly peduncled umbels. Fig. 22–23 . . . . **7. Stenocarpus**
    8. Flowers in racemes. Fig. 24 . . . . **8. Oreocallis**
1. Flowers sessile in closely packed, very rich-flowered thick spikes with a stout rhachis, each flower subtended by a broad, hard, persistent bract. Styles hard, pin-like. Infructescence cone-like by thickened woody bracts (BANKSIEAE). Fig. 25 . . . . **9. Banksia**

ARTIFICIAL KEY TO THE GENERA[1]

1. Leaves with a spiny serrate-dentate margin, simple; underside white-arachnoid-tomentose. Flowers in very dense, erect spikes with persistent, pin-like, wiry styles and hard, persistent, woody bracts. Fig. 25 . . . . **9. Banksia**
1. Leaves either not spiny-dentate or the underside not white arachnoid-tomentose. Bracts not persistent and woody-accrescent.
  2. Leaves at least in part in whorls of 3–7. Fig. 20 . . . . **6. Macadamia**
  2. Leaves not in whorls, only the uppermost ones of a shoot sometimes rather close.
    3. Flowers in peduncled umbels. Leaves simple or dimorphous, either penninerved or flabellinerved. Fig. 22–23 . . . . **7. Stenocarpus**
    3. Flowers in racemes, not in umbels.
      4. Leaves in the pinnate state with a winged rhachis contracted near the insertion of the leaflets. Leaflets sharply dentate, densely ferrugineous-pubescent underneath. Fig. 3 . . . **1. Gevuina**
      4. Leaves simple or, if pinnatifid, the pinnation not contracted at the rhachis nodes, hence the rhachis not winged.

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(1) It is not possible to frame a satisfactory artificial key to the Malaysian genera on vegetative characters only.

5. Leaves simple, with *c.* 12–20 pairs of oblique, straight, parallel nerves more or less ladd connected by one distinct, looped, intramarginal nerve. Fruit indehiscent. Fig. 7 . **3. F chia**
5. Leaves simple or pinnatifid, either flabellinerved or penninerved, either with less nerves or these not all distinctly straight, oblique and parallel and ladder-like connected by one distinct, looped, intramarginal nerve.
    6. Tepals cohering in opened flowers. Pedicels 2–3 cm. Capsule with 2 series of unilaterally winged seeds. Leaves simple. Fig. 24 . . . . **8. Oreocallis**
    6. Tepals free, at least in the lower part. Pedicels at most 15 mm. Fruit 1–(2)-seeded. Seed either not winged or wing surrounding the seed. Leaves simple or pinnatifid.
        7. Receptacle very oblique. Disk unilateral. Seeds flat, surrounded by a wing. Leaves silky-tomentose underneath, simple and/or pinnatifid. Fig. 6 . . . . **2. Grevillea**
        7. Receptacle transverse, flat. Disk not unilateral. Seeds thick, not winged. Leaves not silky-hairy underneath.
            8. Ovules anatropous, inserted basally or laterally. Pericarp not differentiated in an exo- and endocarp.[1] Leaves always simple. Flowers bisexual. Fig. 15–16 . . . . . . **4. Helicia**
            8. Ovules orthotropous, inserted near or at the apex of the ovary, pendulous. Pericarp consisting of three layers. Leaves often (~~always?) dimorphous~~. Flowers unisexual. Fig. 17–18. **5. Heliciopsis**

1. GEVUINA

MOLINA, Saggio Chile ed. 1 (1782) 184, 353; LAMK, Dict. 2 (1788) 712 (*Gevina*); JUSS. Gen. (1789) 424; PERS. Ench. 1 (1805) 118 (*Guevina*); ENDL. Gen. 1 (1837) 340 (*Guevinia*); SLEUM. Bot. Jahrb. 76 (1954) 184; Blumea 8 (1955) 5.—*Quadria* R. & P. Fl. Per. Chil. Prod. (1794) 16, t. 33.—*Bleasdalea* F.v.M. Fragm. 5 (1865) 91, *nom. altern.*; DOMIN, Bibl. Bot. 89 (1921) 32.—*Adenostephanus* (*non* KL.) BENTH. Fl. Austr. 5 (1870) 416.—**Fig. 2–3.**

Trees or shrubs. *Leaves* spiral, simple or imparipinnate (sometimes with transitions on the same specimen), leaflets dentate. *Flowers* in axillary bracteate racemes or panicles, bisexual, sessile in pairs on a stalk (2 fused pedicels); receptacle (torus) oblique, with a broad unilateral, semi-annular, sometimes nearly 2-lobed disk on the lower side. *Perianth* tubular, manifestly recurved at the globular limb, segments revolute, free to the base. *Stamens* sessile or nearly so, connective not or very slightly produced beyond the anther. *Ovary* subsessile, continuous with a very short stipe as thick as is the ovary; style recurved, clavate, with the stigma in the centre of a large lateral swelling. *Ovules* 2, orthotropous, pendulous from the top of the cell. *Fruit* indehiscent, pericarp hard, leathery or corky. Seed mostly solitary, subglobose; testa nearly crustaceous.

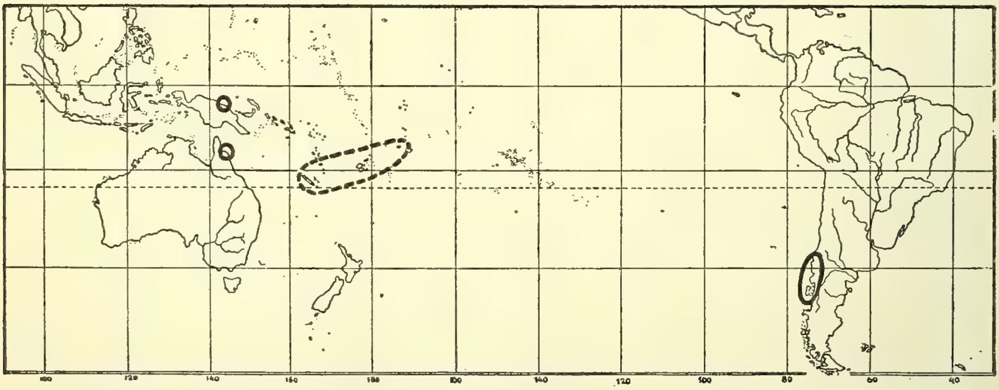

Fig. 2. Distributional area of the genus *Gevuina* MOLINA (————) and the closely allied genus *Kermadecia* BRONGN. & GRIS (– – – –).

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[1] Except in *Helicia uganensis* DIELS.

str. Three *spp.*, *G. avellana* MOL. in Chile, *G. bleasdalei* (F.v.M.) SLEUM. in NE. Queensland, *alaysia* one species. Fig. 1–2.

ote. The distinction between *Gevuina* MOL. and *Kermadecia* BRONGN. & GRIS is based on minor characters only, *i.e.* the not or slightly recurved perianth limb and the apparently terminal stigma of the latter. The area of *Kermadecia* with 7 *spp.* in New Caledonia, 1 *sp.* in the New Hebrides, 2 *spp.* in Fiji (one of them also in Samoa) is situated between the two partial areas of *Gevuina*, as shown in Fig. 2.

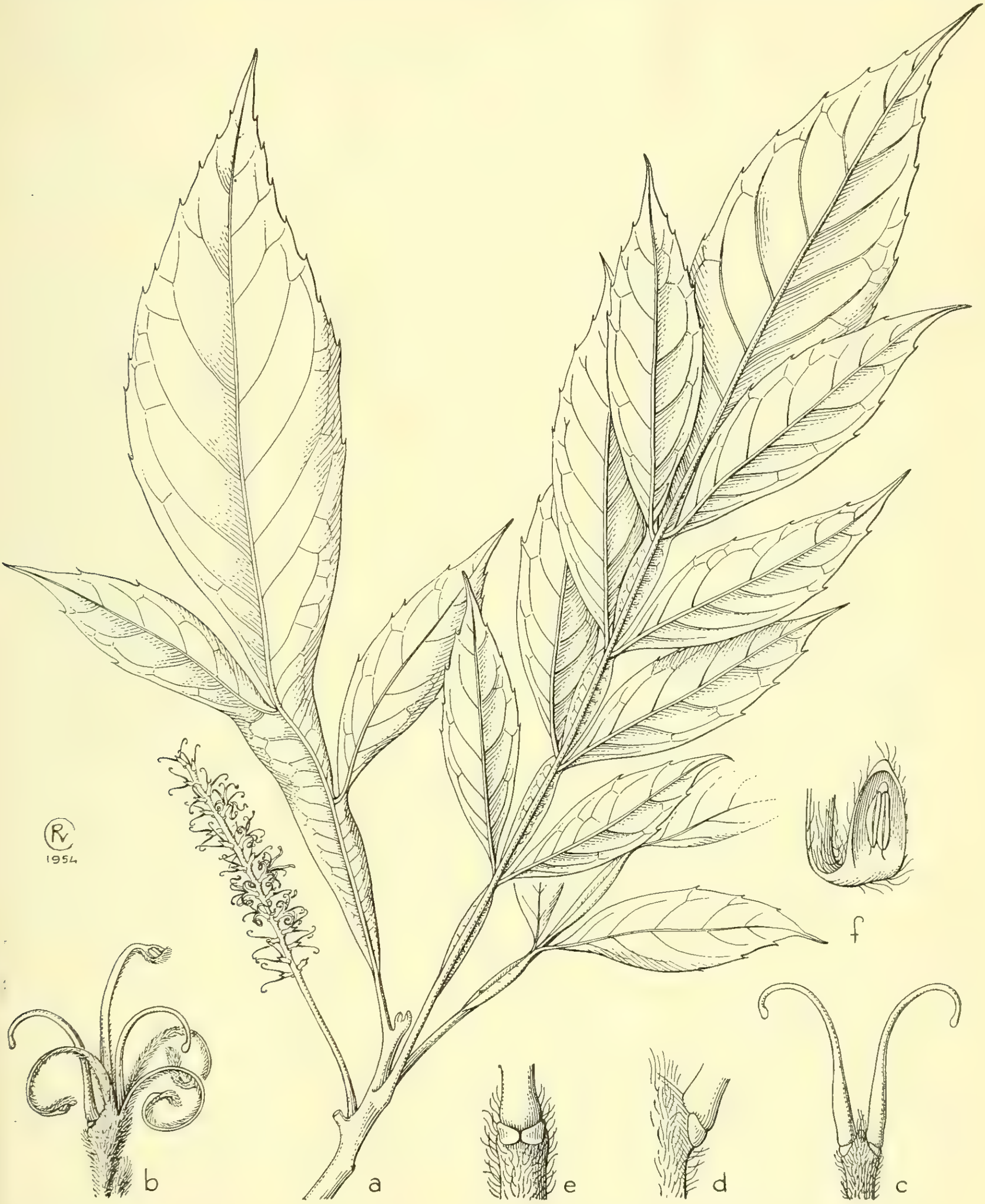

Fig. 3. *Gevuina papuana* (DIELS) SLEUM. *a*. Habit, × 2/3, *b*. pair of flowers, the left one without perianth, the right one complete, × 4, *c*. pair of flowers after anthesis showing the pistils, × 4, *d*. insertion of ovary with disk gland, × 14, *e*. the same, lateral view, *f*. apex of perianth segment (limb) with stamen, × 10 (after LEDERMANN 8412).

1. Gevuina papuana (DIELS) SLEUM. Blumea 8 (1955) 6.—*Euplassa papuana* DIELS, Bot. Jahrb. 54 (1916) 200; SLEUM. *l.c.* 70 (1939) 126, *in nota*; *ibid.* 76 (1954) 195.—*Bleasdalea papuana* (DIELS) DOMIN, Bibl. Bot. 89 (1921) 586 *in nota.*—**Fig. 3.**

Slender tree, 15–20 m; bark brown. Branchlets dark ferrugineous-tomentose. *Leaves* simple near the base of the branchlets, 10–15 by 3–4 cm (*ex* DIELS), higher ones imperfectly 3-lobed, the upper imparipinnate with 4–5, oblong-lanceolate, acuminate leaflets 6–8 by 1½–2½ cm, terminal leaflet 13 by 4 cm, basal leaflets 2 mm petioled, upper leaflets sessile; rhachis winged between the leaflets; pinnate leaf incl. petiole 22–25 cm long, densely ± appressedly rusty-tomentulose beneath in mature specimens, initially so above but very soon glabrescent except the midrib, sharply serrate; lateral nerves (6–)8–10(–12) pairs, ascending and obscurely inarched along the edge, slightly prominent above, distinctly so beneath; veins ± densely reticulate, little raised on both faces. *Racemes* solitary, axillary, erect, 8–9 cm, the rather stout rhachis, the pedicels and perianth densely ferrugineous-tomentose. Bracts small, ± caducous, ± 1 mm. Fused pedicels 2½–3 mm each bearing a very oblique, not thickened torus at the top. *Perianth* 9–10 mm, brownish-yellow, limb globose, recurved, 1½ mm across. Anthers ovate, 1 mm, whitish. Disk 2-lobed. Ovary and style glabrous, blackish when dry. Style 8 mm. Fruit unknown.

Distr. *Malaysia:* N. New Guinea (Sepik region: Hunstein Mts), once found.

Ecol. Open mountain-forest with many epiphytic ferns, 1050 m. *Fl.* Aug.

Note. Certainly close to *G. bleasdalei* (F.v.M.) SLEUM. from NE. Queensland, which differs by its always pinnate leaves, an entire disk and a shorter ± crisped tomentum.

On the only specimen still in existence in the Berlin Herbarium no simple leaves are present.

2. GREVILLEA

R.BR. *ex* KNIGHT, Prot. (1809) 120 (*Grevillia*); Trans. Linn. Soc. 10 (1810) 167.—**Fig. 4–6.**

Trees or shrubs. *Leaves* spiral, simple or pinnate, various in shape, sometimes in one specimen. *Racemes* mostly in a terminal or axillary panicle, or solitary; indumentum consisting of appressed hairs attached in the centre, rarely with spreading hairs forked at the base or clustered. Bracts minute, mostly early caducous, sometimes apparently absent. *Flowers* solitary or in pairs, on free pedicels along the rhachis. *Perianth* tube mostly recurved under the limb or straight, limb ± globular, usually oblique, segments coherent at the limb long after the tube has slit open. *Anthers* ovate, sessile in the base of the limb, *i.e.* in the concave upper part of the segments; connective not or scarcely produced beyond the anthers. Disk annular of semi-annular, mostly entire, sometimes ± bilobed. *Ovary* stipitate or rarely sessile, with 2 anatropous *ovules* laterally attached about the middle of the cell; style filiform, usually long and protruding from the slit on the lower side of the perianth tube before the apex is free from the limb, accrescent during and after anthesis, ultimately straightened and erect, ± dilated at the top into a straight, oblique or lateral disk-like apex bearing the small stigma in its centre. *Fruit* a follicle, usually oblique, coriaceous to nearly woody and opening along the adaxial (ventral) margin, rarely opening in 2 almost free valves. *Seeds* 1 or 2, flat, orbicular or oblong, mostly bordered all round by a membranous wing.

Distr. About 170 *spp.*, mostly in Australia, 9 in New Caledonia, in *Malaysia* 4 native *spp.*, 2 of which endemic, the 2 others also represented in Australia.

Ecol. In Australia mainly xerophytic shrubs or small trees; a few are large trees found in the rainforests of subtropical and tropical E. Australia. The Malaysian representatives occur both in rainforests and in dry savannah-forests, from the lowland up to 1600 m.

Use. The timber of some species which reach large dimensions in the NE. Australian rain-forests is known as 'silky oak'. See further under *G. robusta.*

Note. KNIGHT derived his text from the MS of R. BROWN and wrote consistently *Grevillia*; R. BROWN himself, a year later corrected this to *Grevillea* and as an author he had the right to do so.

KEY TO THE SPECIES

1. Ovary hairy.
  2. Ovary densely villous. Leaves deeply pinnatifid or pinnate with 3–11 broadly linear or lanceolate segments. Perianth *c.* 2 cm long . . . . **1. G. banksii**
  2. Ovary silvery-silky. Leaves simple, 3–5-plinerved, in young specimens or coppice shoots 3–5-lobed. Perianth 6–8 mm long . . . . **2. G. papuana**
1. Ovary glabrous.
  3. Leaves greyish to silvery permanently dense-silky on *both* faces . . . . . . **3. G. glauca**
  3. Leaves glabrous or laxly hairy, finally glabrous above.
    4. Leaves always pinnate, *c.* 11–21 pinnatifid, their ultimate segments up to $1^1/_2$ cm wide. **4. G. robusta**
    4. Leaves simple, if pinnatifid the ultimate segments at least $2^1/_2$ cm wide.
      5. Leaves lanceolate, acute. Fruit *c.* $1^1/_2$–2 cm long. Perianth lobes not carinate, 6–7 by $^1/_2$ mm. Inflorescence evenly silky. Bud terete 1 mm diam. at the base . . . . . **5. G. pinnatifida**
      5. Leaves elliptic-oblong to obovate, blunt, rounded to emarginate. Fruit *c.* $2^1/_2$–3 cm long. Perianth lobes distinctly carinate, *c.* 10–12 by $1^1/_4$ mm at the base. Inflorescence with rusty peltate hairs sprinkled on the silky pubescence. Buds angular and nearly 2 mm diam. at the base. **6. G. elbertii**

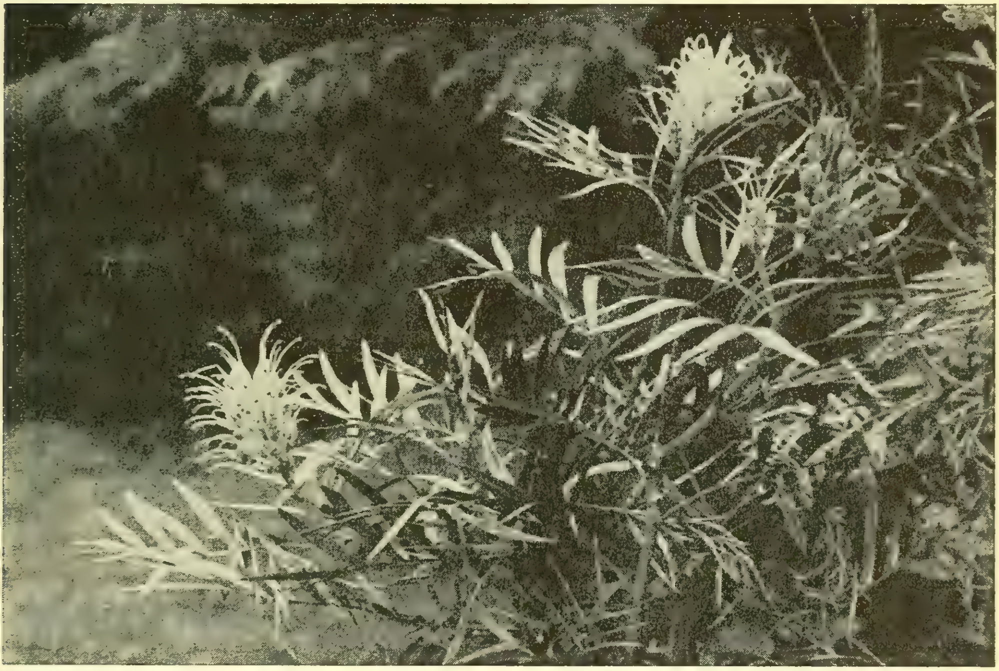

Fig. 4. *Grevillea banksii* R.Br. Flowering and fruiting in the Mountain Garden, Tjibodas, W. Java, Oct. 1936.

1. Grevillea banksii R.Br. Trans. Linn. Soc. 10 (1810) 176; Benth. Fl. Austr. 5 (1870) 434; Bail. Queensl. Fl. 4 (1901) 1336; Buysman, Flora 106 (1913) 11; den Berger, Trop. Natuur 6 (1917) 102, f. 3; Corner, Ways. Trees 1 (1940) 518, f. 175; Back. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 79, p. 3; Bruggeman, Ind. Tuinb. (1940) 240, f. 241.—**Fig. 4.**

A tall shrub or slender tree ($1^1/_2$–)3–8 m; crown lax; branches and inflorescences softly ferrugineous-tomentose. *Leaves* coriaceous, deeply 1-pinnatifid or 1-pinnate (but here and there a small leaf undivided) with 3–11 broadly linear to lanceolate segments, obtuse or mucronate, with recurved margins, glabrous above, ferrugineous-silky underneath, the whole leaf 10–25 cm long incl. the petiole 3–5 cm, segments 5–10 by $^1/_5$–$^2/_3$ cm, midrib prominent, nerves pinnate, rather obscure. *Racemes* terminal, erect, dense, secund, 5–10 cm, solitary or 2–3 on a terminal leafless peduncle. *Flowers* yellowish or almost white, then yellowish near the top, sometimes greenish or red. Pedicels tomentose as is the rhachis, (4–)6–8(–10) mm. *Perianth* tomentose outside, glabrous inside, tube 13–20 by 3–4 mm, contracted under the limb, the segments finally revolute. Torus transverse or nearly so. Disk prominent, semi-annular, ± lobed. Ovary sessile, densely villous; style ± $2^1/_2$ cm at anthesis, accrescent up to 5 cm, glabrous, clavate under the very oblique or laterally convex disk-like stigma. *Fruit* obliquely ovoid, compressed, almost acute, 1½–2½ cm long. *Seeds* narrowly winged.

Distr. A native of Queensland, cultivated in Java and the Malay Peninsula as an ornamental or as a shade tree, 250–2000 m. *Fl.* Jan.–Dec.

Notes. Den Berger says that the shade given by *G. banksii* is too light for cultures of coffee and that lalang grass grows well under it, becoming long and soft. Cyanophoric glucosides are found in the perianth segments, ovaries and capsules.

2. Grevillea papuana Diels, Bot. Jahrb. 54 (1916) 205.—*G. subargentea* White, Proc. R. Soc. Queensl. 34 (1922) 24; J. Arn. Arb. 10 (1929) 209; Sleum. Bot. Jahrb. 70 (1939) 128.

Shrub to medium-sized tree, 7–20 m, with a large, dense crown and erect branches; bark thin, grey or light brown with small brown pustules or vertical fissures; branchlets terete, appressed whitish- or greyish-pubescent at the tips. *Leaves* on coppice shoots or young specimens deeply pinnatifid into 3–5 lobes, *c.* 30 cm long, lobes 1¼–2½ cm broad; blades of adult trees simple or slightly lobed, narrow-oblong to lanceolate or lanceolate-elliptic, sometimes slightly falcate, long-acuminate, tipped by a minute gland, tapering at the base into a somewhat flattened petiole 1½–2 (–2½) cm long, 10–20 by 2½–5(–7) cm, coriaceous to subcoriaceous, glabrous, shining, and green-olivaceous above, the undersurface rufous-silky initially, changing greyish or whitish with age, hairs ± long and appressed, flabelli-5-nerved, veins and veinlets very oblique and prominent-reticulate on both faces. *Panicle* terminal, 10–16 (–20) cm, consisting of several greyish-sericeous, upwards curved peduncled racemes 6–8 cm long. Bracts minute, pubescent, caducous. Pedicels mostly in twos, 3–5 mm. Torus slightly oblique. *Perianth* tubular, globose at the limb (1½ mm), densely silvery appressed-pubescent outside, glabrous inside except the velutinous base, incl. the limb 6–8 mm, sulphur-yellow to greenish-white or -cream. Disk semi-annular, glabrous. Ovary up to 1 mm stipitate, densely whitish-silky, nearly tomentose; style slender, curved, glabrous. *Fruit* compressed-ellipsoid, inequilateral, crowned by the style-base, glabrous, 3–5 mm pedicelled, when ripe *c.* 2½ by 1½–1⅘ cm.

Distr. *Malaysia:* New Guinea (not yet found in the Vogelkop).

Ecol. In mountain-forest or in second-growths on rocky, deforested slopes or dry ridges, also in dry savannah-forests, occasionally common in grasslands, 500–1600 m, descending along stony river-banks of the Rouffaer River to 350 m, once found on coastal sands. *Fl.* (Jan.–)Aug.–Nov.

Use. Wood white to pale straw or pink; rays conspicuous.

3. Grevillea glauca Knight, Prot. (1809) 121; Sleum. Bot. Jahrb. 70 (1939) 128; Rand & Brass, Bull. Am. Mus. Nat. Hist. 77 (1940) 358.—*G. gibbosa* R.Br. Prod. (1810) 380; Trans. Linn. Soc. 10 (1810) 177; Benth. Fl. Austr. 5 (1870) 463; F.v.M. Fragm. 6 (1868) 210; Hemsl. Bot. Chall. 1 (1885) 186; F.v.M. Descr. Not. 2 (1886) 29; Bail. Fl. Queensl. 4 (1901) 1344; Laut. Bot. Jahrb. 50 (1913) 329.

Tall shrub or small tree, 4–8 m; bark hard, rough, blackish; all parts soft-tomentose by very short hairs, silky on the young shoots and persistently so on both faces of the leaf. *Leaves* simple, entire, ovate-lanceolate, acuminate, obtuse at the very apex by a terminal gland, tapering into the petiole, brown when young, grey when adult, in dry state between brown and grey, dull, (8–)10–15 by (2½–)3–4½ cm; midrib somewhat prominent on both faces, nerves pinnate 10–15 pairs, straight, ascending and ± parallel to each other, with numerous oblique indistinct primary veins on both faces; petiole 1–1½ cm, pubescent. *Racemes* dense, 7–15 cm, shortly peduncled, usually 3 together at the end of the branches, forming a loose, ± erect panicle; rhachis slender. Pedicels partly in pairs, 2–3 mm. Bracts narrow, minute, early caducous. *Perianth* tube slender, revolute under the globular limb, yellowish to greenish-white, 4–5 mm long. Torus small. Disk very prominent, semi-cupular, truncate, ± 2-lobed. Ovary glabrous, shortly stipitate; style 6–7 mm, filiform; stigma conical, straight. *Fruit* globular or nearly so, oblique, somewhat applanate, (2½–)3–4½ by 3 cm, dehiscing with 2 woody, hemispherical valves. *Seeds* 1 or 2, broadly winged, 2½ cm diam.

Distr. NE. Queensland; in *Malaysia:* NW. and S. to SE. New Guinea, Moluccas (Aru Islands).

Ecol. In open savannahs of low *Melaleuca*, often associated with *Banksia dentata*, apparently more common in the savannah-forest substage, occasionally common on sour grey soils, at low altitudes. *Fl. fr.* Jan.–Dec.

Uses. Wood dark brown, prettily marked, close-grained and hard, of a greasy nature which prevents it shining when polished.

Vern. *Kawoj*, NW. New Guinea.

4. Grevillea robusta Cunn. *ex* R.Br. Prot. Nov. (1830) 24; Benth. Fl. Austr. 5 (1870) 459; Bail. Fl. Queensl. 4 (1901) 1342; Domin, Bibl. Bot. 89 (1921) 35; Heyne, Nutt. Pl. (1927) 588; Burk. Dict. (1935) 1111; Corner, Ways. Trees 1 (1940) 518; Back. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 79, p. 3; Francis, Austr. Rain-forest Trees (1951) 97.—**Fig. 5.**

Handsome tree, 10–25(–40) m, with robust trunk when old; bark greyish-brown, rugged, fissured; young branches rusty-tomentose. *Leaves* pinnate with about (4–)10–20 pinnatifid pinnae, fern-like, the secondary lobes or segments entire or again lobed, lanceolate or rarely linear, terminal one mostly longer than 2½ cm, margins recurved, upper surface glabrous or sprinkled with appressed hairs and obscurely veined, undersurface brownish-, later whitish-silky; the whole leaf 15–20 cm long and nearly as wide, the 1⅘–7 cm long petiole included. *Racemes* secund, many-flowered, 7–12 cm, solitary or short-paniculate on very short, leafless, tomentulose branches on the old wood; rhachis stoutish, glabrous. Pedicels slender, *c.* 1 cm long, glabrous. *Perianth* glabrous in- and outside, tube *c.* 6–9 mm, scarcely dilated at the base, revolute under the 3 mm ovoid limb, orange to golden-yellow or golden-brown in colour. Torus slightly oblique. Disk prominent, semi-annular. Ovary glabrous, stipitate; style *c.* 1$^1/_2$ cm, the stigmatic disk somewhat oblique with a central cone. *Fruit* broad, very oblique, boat-shaped, pointed, ± 1$^1/_2$ cm long. *Seeds* winged all round.

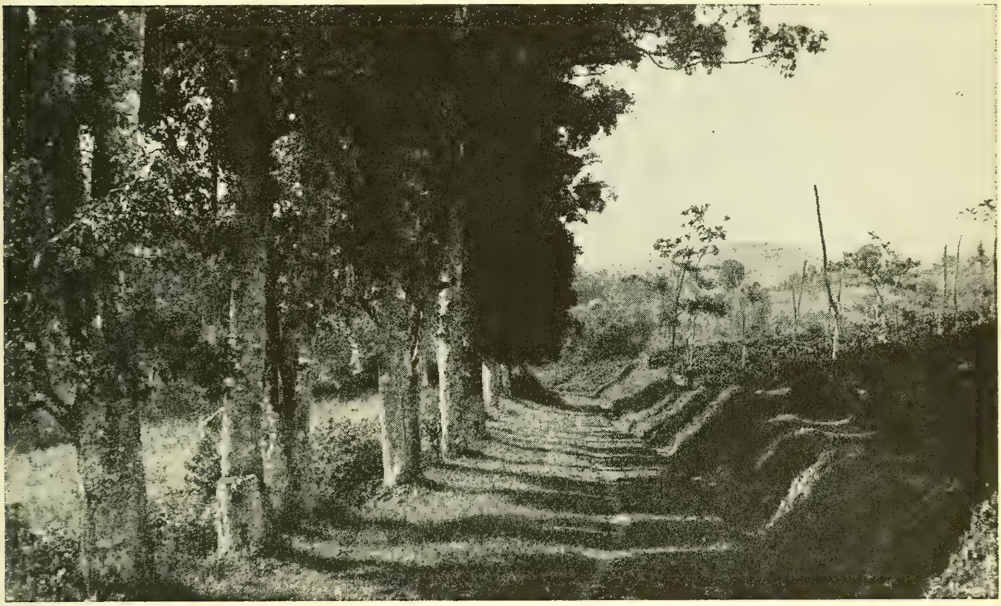

Fig. 5. *Grevillea robusta* CUNN. as a roadside tree along the boundary of a montane plantation (photogr. W. F. WINCKEL).

Distr. A native of E. Australia (Queensland and N. New South Wales), commonly planted all over the tropics and subtropics as roadside or ornamental tree, as a shade-tree and wind-break in tea- or coffee-estates, and in reafforestation.

Ecol. Already long ago introduced in Malaysia and used as a roadside tree. It was formerly also used rather extensively as a shade-tree in tea- and coffee-plantations, but this practice has been abandoned as it is assumed that the roots and stumps left after felling disperse dangerous root fungi. It shows a rapid growth and some resistance against wind which capacities are used by the Forestry Service for reafforestation on bad, bare or eroded soils in the montane zone, either in pure or mixed stands. Results in Bali were rather promising (DE VOOGD, Tectona 28, 1935, 461). The species shows a great adaptability to various climates; COSTER (Tectona 30, 1937, 16) says that whereas it stands severe droughts in Australia it grows also under tropical everwet conditions; at Bogor it was classified as a plant with a rather strong evaporation. On the whole it does best under seasonal conditions at average altitude, preferably 500–1600 m, though cultivation is possible from low altitude to *c.* 2000 m; reported to be frost-resistant on Mt Tengger at 2000 m. Seeds should be soaked one day before being sown to speed up germination which follows in *c.* 2–3 weeks, without soaking beforehand it takes 1$^1/_2$–2 months (DE VOOGD *l.c.* 31, 1938, 241). Growth is quick according to JAPING *c.s.* (*l.c.* 29, 1936, 424–428), depending on the quality of the soil seedlings reach about 14–20 m in 9–11 years. In Djakarta it fails to flower. *Fl.* Jan.–Dec., *fr.* Sept.–Jan.

Uses. Wood with prominent rays, of a light pinkish colour to reddish-brown, light, elastic, durable, easy to work, used for tea-boxes and cabinet-work, excellent for staves of casks, not resistant to termites.

Vern. *Silky oak*, Australia, *salamandar*, S.

Note. Cyanophoric glucosides have been found in the pistil, ovary, and seed.

5. **Grevillea pinnatifida** BAIL. Occas. Pap. Queensl. Fl. (1886) 6; Syn. Queensl. Fl. Suppl. 2 (1888) 52; Queensl. Fl. 4 (1901) 1343, t. 58; WHITE, Proc. R. Soc. Queensl. 34 (1922) 24; J. Arn. Arb. 10 (1929) 209; Contr. Arn. Arb. 4 (1933) 21; SLEUM. Bot. Jahrb. 70 (1939) 128; FRANCIS, Austr. Rain-forest Trees (1951) 389, 394.—*G. edelfeltii* F.v.M. Descr. Not. 2 (1885) 9, *nom. nud.*; LAUT. Bot. Jahrb. 50 (1913) 329.—*Kermadecia pinnatifida* BAIL. Cat. Queensl. Woods

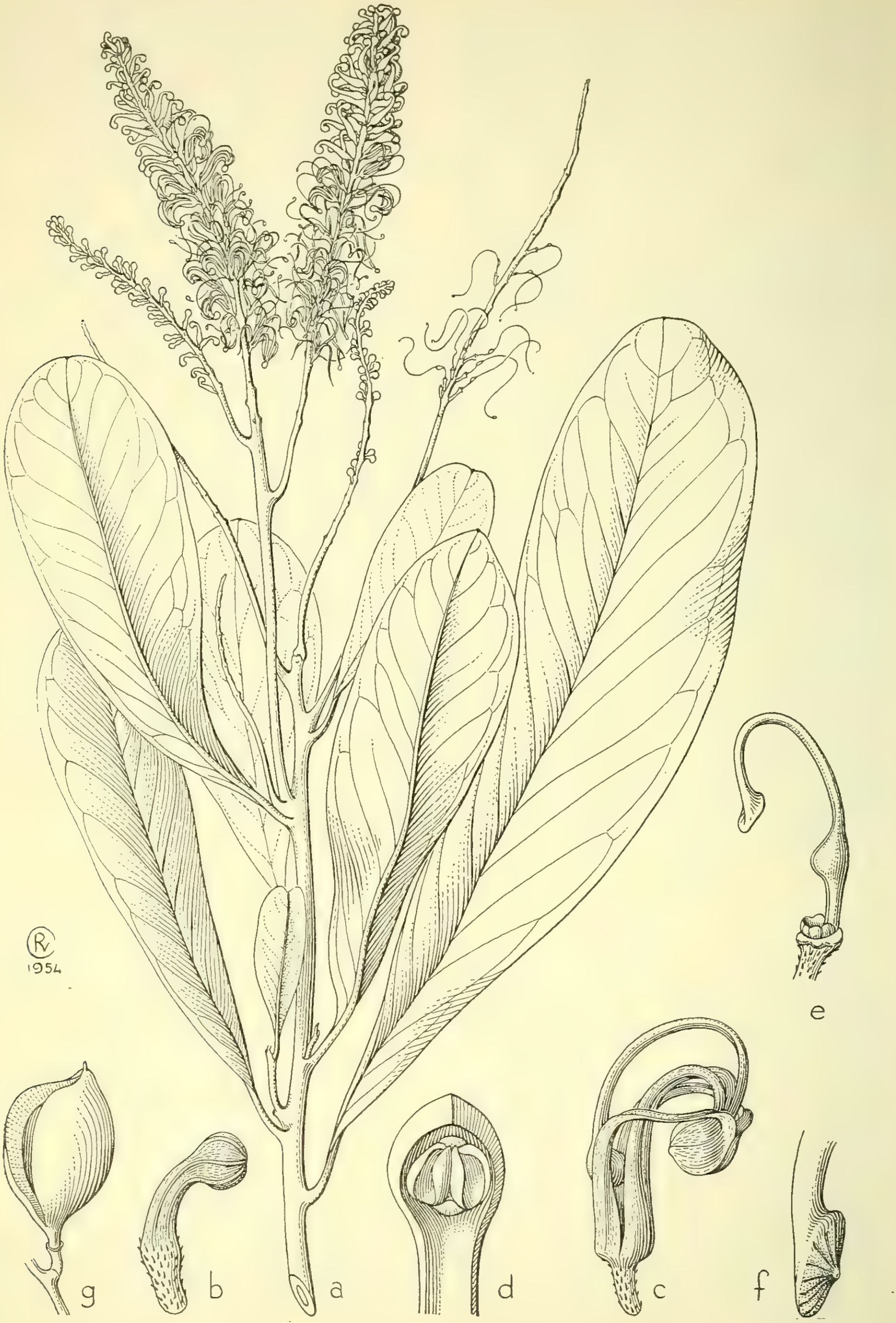

Fig. 6. *Grevillea elbertii* SLEUM. *a.* Habit, × ²/₃, *b.* bud, × 5, *c.* flower, × 3, *d.* stamen in bud, × 10, *e.* pistil, × 3, *f.* apex of the style with punctiform stigma, × 8, *g.* capsule, slightly less than nat. size (*a–f.* after bb. 19710, *g.* after ELBERT 3475).

(Lond. Colon. Ind. Exhib. 1886) 69.—*Grevillea sp.* F.v.M. Vict. Nat. 1 (1885) 168, *nota.*

Medium-sized tree, up to 15 m; bark grey, hard, scaly; branches erect, the tips subangular and velvety with rusty brown hairs. *Leaves* at the twig-ends simple, lanceolate, acute or bluntish-emarginate, tapering into the petiole, *c.* 12–15 by 2½–3½ cm, glabrous above, rusty to dark greyish or silky beneath, with *c.* 10–15 straight, ascending, pairs of nerves prominent reticulate specially beneath; petiole *c.* 1½–2 cm. *Panicle* silky-white, 7–12 cm long; racemes 3–9 cm, bearing 2 mm pedicelled, greenish-white, fragrant solitary or geminate flowers. Bracts not seen, apparently very early caducous. Torus slightly oblique. *Perianth* silky outside, glabrous inside, 6–7 mm, segments ½ mm broad, linear, limb globose. Disk broad. Ovary 1 mm stipitate, glabrous. Style filiform, stigma lateral, somewhat dilated. Follicle oblong, coriaceous, 1½–2 by 1–1¼ cm, compressed, tipped by the style-base. *Seeds* 2, oblong, bordered all round by a membranous wing.

Distr. NE. Queensland; in *Malaysia:* SE. New Guinea (Astrolabe Range; Wassi Kussa River).

Ecol. Both in primary and secondary rain-forest fringing rivers and in dry savannah-forest, common, up to 300 m. *Fl.* Dec., *fr.* Dec.–Jan.

Uses. Wood of a pinkish colour, close in grain and very prettily marked, useful to coopers and cabinet-makers, the larger trees used commercially in NE. Queensland.

Note. BAILEY *l.c.* described from Queensland besides the simple leaves also pinnatifid leaves from young plants and barren shoots with 1–4 pairs of lobes and often exceeding 45 cm in length. These have not yet been collected in New Guinea.

6. Grevillea elbertii SLEUM. Blumea 8 (1955) 2.—**Fig. 6.**

Tree 10–17 m. Branchlets terete, ferrugineous-sericeous at the tips. *Leaves* simple, obovate-oblong or obovate or oblong-elliptic, ± rounded at the apex, sometimes retuse, with a terminal, minute gland, cuneate and tapering into the petiole, coriaceous, glabrous and greenish-olivaceous above when dry, younger ones golden-ferrugineous silky beneath, partially glabrescent at full maturity and then brownish beneath, entire, undulate at the margin, (5–)6–12(–18) by 2½–7 cm, midrib prominent on both sides specially beneath; main nerves 7–9(–10) pairs, rather straight, ascending, anastomosing near the edge, prominent on both faces, additional intermediate ones less distinct, veins and veinlets very oblique, forming a slightly prominent net on both surfaces; petiole stoutish, 1–1½ cm. *Panicles* terminal, short-peduncled, *c.* 12–15 cm, consisting of several divaricate many-flowered short-peduncled racemes, inferior ones of which 6–8(–10) cm, greyish silky sprinkled with additional, peltate, rusty hairs. Bracts minute, very early caducous. Pedicels stoutish, solitary or in twos, 2–3 mm. Torus slightly oblique. *Perianth* light-greenish, greyish-sericeous outside, papillose inside, *c.* 10–12 mm incl. the globose limb, manifestly recurved below the limb, angular by the carinate segments, 1¼ mm broad at the base. Disk semi-annular. Gynophore stout, 3 mm, glabrous as are the ovary and the style; style rather slender, bearing a large, lateral stigma. *Follicle* compressed, obliquely ellipsoid, *c.* 3 by 2 cm, on a 3–5 mm stoutish stipe; fruit-pedicel 4–5 mm.

Distr. *Malaysia:* SE. Celebes (P. Kabaena) and E. Central Celebes (Malili).

Ecol. In dry bush-formation on cristalline slate, from the sea-shore up to 900 m, on hilly ground, said to be scattered and rare. *Fl. fr.* Oct., June.

Uses. The fruit is said to have a bitter taste.

Vern. *Lampia*, Luwu language, Malili.

3. FINSCHIA

WARB. Bot. Jahrb. 13 (1891) 297; WHITE, Pac. Sc. 3 (1949) 187.—**Fig. 7–11.**

Trees, trunk buttressed, often raised on stilt-roots. *Leaves* simple, entire, nerves pinnate, ± straight, parallel, rather numerous, distinctly connected by a ± looped intramarginal vein. *Racemes* axillary or ramiflorous. Pedicels solitary or in twos, free or united in the lower half. Bracts minute, mostly very early caducous. *Perianth* segments soon free, curved, limb subglobose. Stamens sessile or nearly so in the concave limb; connective broad, not produced beyond the anther-cells, the latter slightly divergent towards the base. Torus oblique. Disk fleshy, entire, horseshoe-shaped or nearly annular. Ovary stipitate. Style slender or narrowly clavate, usually long and protruding from the slit in the abaxial side of the perianth tube in the later bud-stage, stigma terminal, pyramidal. Ovules 2, anatropous, laterally attached to the protruding wall. *Fruit* an oblique-globular or compressed-globular drupe; exocarp rather thin, fleshy; endocarp thick, bony, rough. Cotyledons 2, thick and fleshy.

Distr. With 4 *spp.* centering in New Guinea, one extending from the S. Moluccas (Aru Isl.) through New Guinea to Micronesia (Palau) and Melanesia (Solomon Isl. and New Hebrides). Fig. 7.

Note. The genus combines the characters of the flower of *Grevillea* with those of the fruit of *Helicia sect. Cyanocarpus.*

KEY TO THE SPECIES

1. Leaves rufous-tomentose underneath.
  2. Inflorescence rather lax and ± interrupted. Flowers incl. pedicel 16–18 mm long. Petiole rather thick and short, 1–1$^1/_2$(–2) cm by 3–4 mm, nearly winged to the base by the decurrent blade. Intermediate nerves rather distinct . . . . **1. F. rufa**
  2. Inflorescence dense, not interrupted. Flowers incl. pedicel 10–12 mm long. Petiole relatively slender, (1$^1/_2$–)2–3 cm by *c.* 2$^1/_2$ mm, only winged by the decurrent blade in the upper half. Intermediate nerves indistinct or absent . . . . **2. F. carrii**
1. Leaves glabrous from the beginning or nearly so.
  3. Flowers and pedicels ferrugineous-tomentose. Ovary densely hairy . . . . **3. F. ferruginiflora**
  3. Flowers and pedicels laxly ferrugineous-silky in the bud-stage, glabrescent when fully developed. Ovary glabrous . . . . **4. F. chloroxantha**

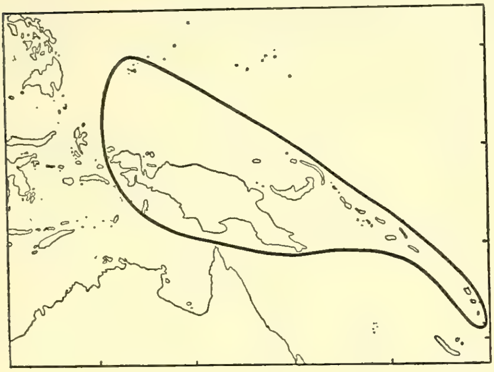

Fig. 7. Distribution of the genus *Finschia.*

1. Finschia rufa WARB. Bot. Jahrb. 13 (1891) 298; K. SCH. & LAUT. Fl. Schutzgeb. (1901) 297; LAUT. Bot. Jahrb. 50 (1913) 334; DIELS, *l.c.* 54 (1916) 205; WHITE, Pac. Sc. 3 (1949) 188.—*Grevillea rufa* SLEUM. Bot. Jahrb. 70 (1939) 128.—**Fig. 8.**

Tree *c.* 15–18 m high; branches terete, densely rufous-tomentose at the tips. *Leaves* broadly oblong to obovate-oblong, obtuse to nearly rounded at the apex, broadly attenuate at the base and almost decurrent to the base of the petiole, coriaceous or subcoriaceous, glabrous except the midrib and greenish-olivaceous above when dry, ± densely rufous-tomentose all over the undersurface specially on the midrib and the nerves, (25–)28–35 by (8–)11–13(–17) cm; midrib very prominent beneath, slightly so above, nerves 15–20(–25) pairs, somewhat prominent above, distinctly raised beneath, with more less distinct ones between them, veins ± oblique or irregular, a little prominent underneath, veinlets dense finely reticulated above; petiole thick (3–4 mm across), rufous-tomentose, 1–1$^1/_2$(–2) cm. *Racemes* pendulous, axillary, mostly ramiflorous, 17–40 cm incl. the 3–4 cm long peduncle, all over rufous-tomentose. Bracts minute, ovate-acuminate, tomentose, subpersistent. *Flowers* laxly, ± interruptedly arranged. Pedicels at anthesis 7–8 mm. *Perianth* golden yellowish-brownish when fresh, glabrous inside, the tube at anthesis 9–10 mm incl. the globose limb (2 mm). Ovary laterally inflated, seated obliquely on a 3–5 mm long stipe, rufous-tomentose as are the stipe and the lower half of the style. Style 7 mm, straight, club-shaped, respectively apically dilated into a straight cone, with a terminal minute stigma. Disk horseshoe-shaped. Fruit unknown.

Distr. *Malaysia:* N. New Guinea (Morobe Distr.: Mt Sattelberg).

Ecol. In forest or open bush, *c.* 840 m. *Fl.* March–April.

Note. Though this species is very close to the next one, the 4 collections known agree exactly.

2. Finschia carrii (SLEUM.) WHITE, Pac. Sc. 3 (1949) 188.—*Grevillea carrii* SLEUM. Bot. Jahrb. 70 (1939) 128.

Tree 12–14 m; bark grey-brown, fissured vertically; branchlets terete, the tips rusty-tomentose. *Leaves* obovate-oblong, ± rounded at the apex, cuneate at the base, but not decurrent on the petiole, subcoriaceous to firmly chartaceous, glabrous above except the midrib, ± dark rufous-tomentose beneath specially on the midrib and the nerves, dark olivaceous above when dry, (13–)18–28 by 6–9(–10$^1/_2$) cm, midrib thick and prominent underneath, a little raised above, nerves 14–24 pairs, veins and reticulate veinlets clearly discernible in dried specimens, all slightly prominent above, more manifestly so beneath; petiole tomentose, (1$^1/_2$–2)–3 cm by *c.* 2–3 mm. *Racemes* mostly ramiflorous, very densely flowered, 24–30 cm incl. a 2–3 cm long peduncle, all over rufous-tomentose. Pedicels mostly in pairs, slender, 4–5 mm. *Flowers* golden-yellow tipped brownish-orange when fresh. *Perianth* segments 7–8 mm long, glabrous inside. Disk very prominent, horseshoe-shaped or almost annular, nearly glabrous. Ovary densely rather long rufous-hairy, on top of a glabrescent 3 mm long stipe. Style glabrous, grooved, gradually thickened towards the top, said to be bright yellow-green when fresh; stigma obtusely pyramidal, deep green alive. *Fruit* ovoid-compressed when nearly ripe, green, ± 3 by 2$^1/_2$–3 cm, *c.* 2 cm thick, on a stout stipe 3 by 2 mm; pedicel 8–10 by 2$^1/_2$ mm.

Distr. *Malaysia:* SE. New Guinea (Koitaki near Port Moresby, and Milne Bay).

Ecol. In rain-forest at *c.* 450 m. *Fl.* April.

Use. Wood creamish to straw-coloured.

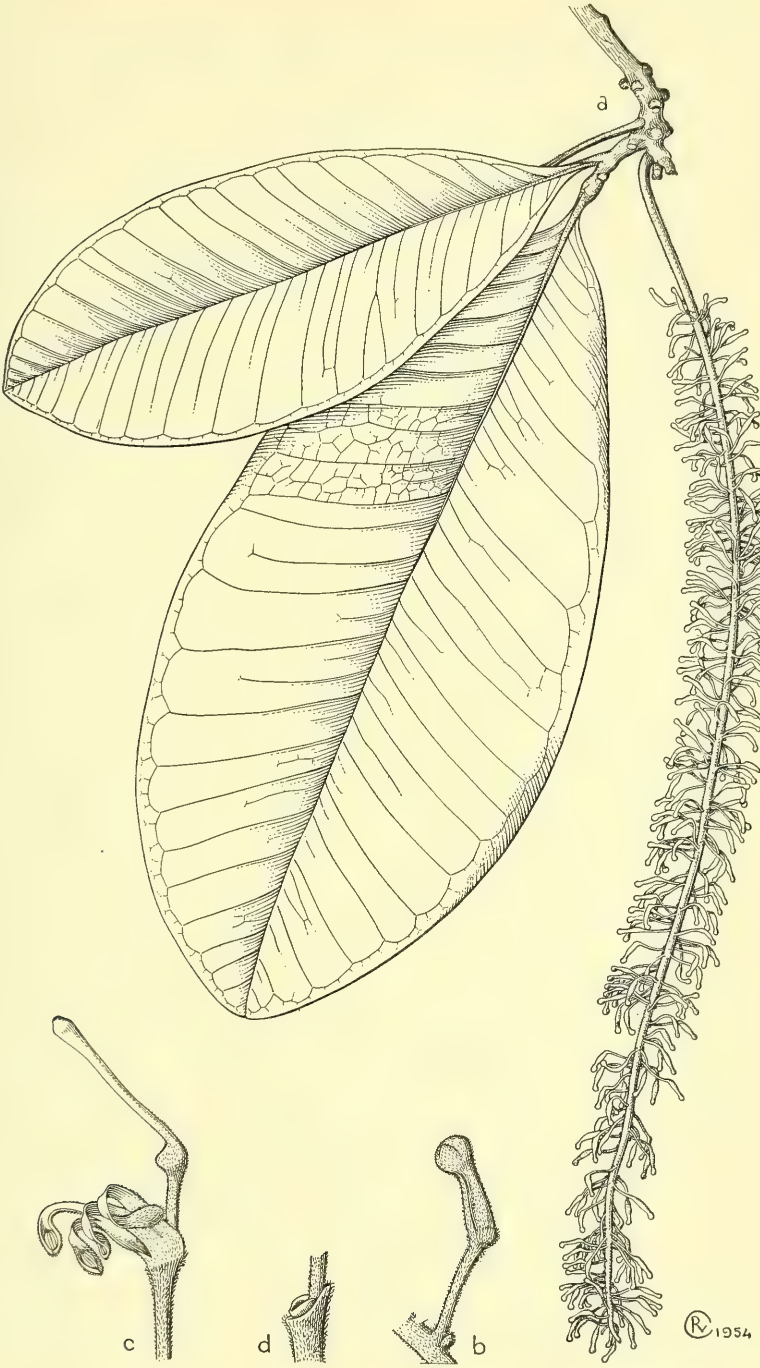

Fig. 8. *Finschia rufa* WARB. *a.* Habit, × 2/5, *b.* bud, × 2, *c.* open flower, × 2, *d.* torus with disk, × 3 (after CLEMENS 2234).

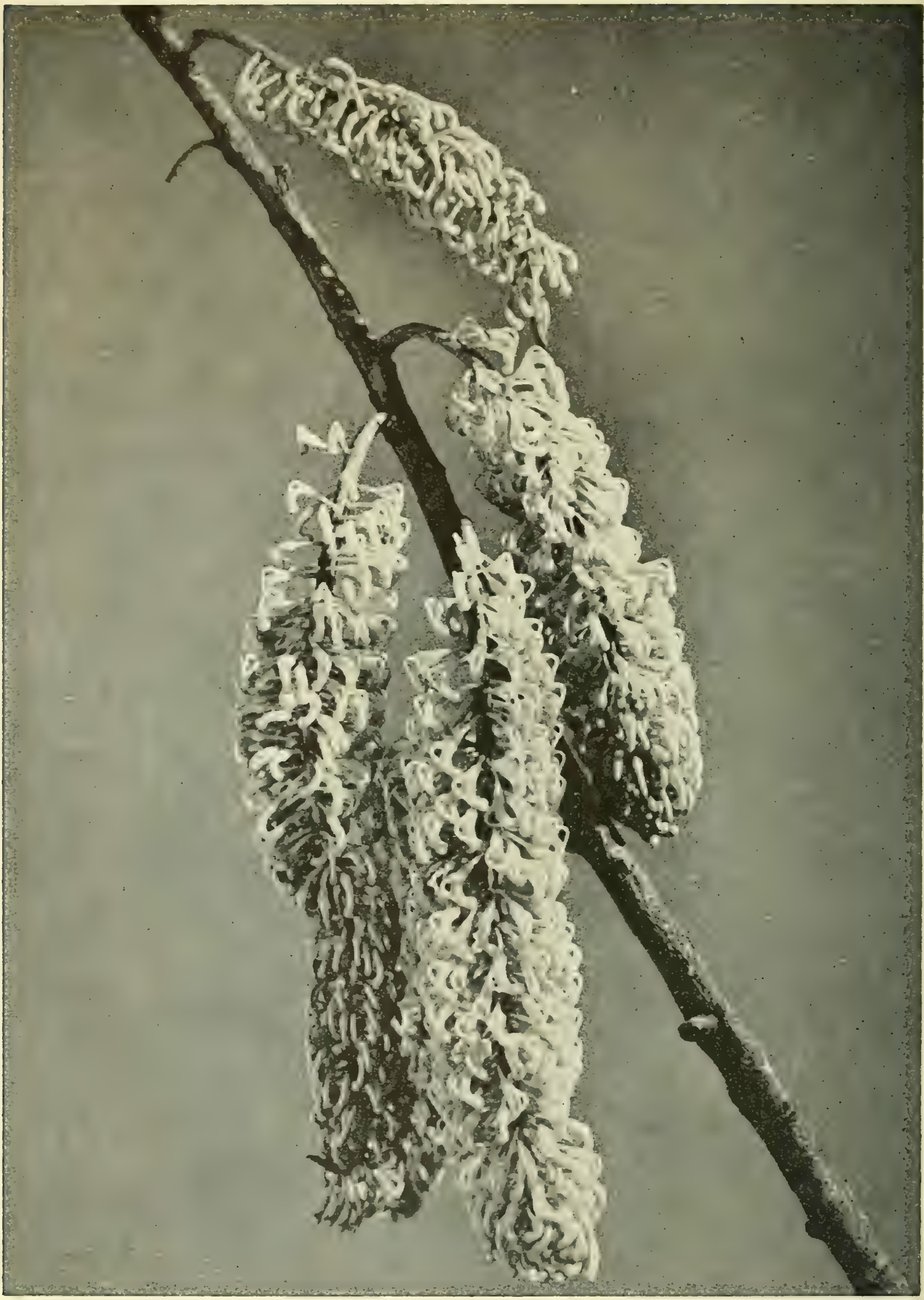

Fig. 9. *Finschia chloroxantha* Diels *var. macrocarpa* Sleum. Racemes in anthesis, flowers orange-yellow (Cult. Hort. Bog. XVI.I.J.4–4a, Jan. 1955).

3. Finschia ferruginiflora WHITE, Pac. Sc. 3 (1949) 190, f. 1.

Tree 30 m, with adventitious roots up to 1½ m above the soil; bark brownish, slightly dotted with pustular lenticels which are sometimes arranged in short longitudinal rows, or bark very finely longitudinally cracked with a few, small, corky scaled patches; innovations ferrugineous-pubescent, soon glabrous. *Leaves* narrow-obovate, rounded at the apex, cuneate at the base, but not decurrent on the stout petiole, subcoriaceous, glabrous, glossy-green above with veins slightly prominent and yellowish when fresh, paler beneath, in dry specimens green above, greyish below, 14–23(–28) by 3½–5(–7) cm; midrib prominent beneath, nerves 18–20 pairs prominent on both faces, veins and veinlets laxly reticulate and somewhat raised above, more distinctly so beneath; petiole 1–1½(–2) cm by 2–2½ mm, glabrous. *Racemes* dense-flowered, axillary, often ramiflorous, incl. the short peduncle 13–20 cm long, ferrugineous-tomentose all over. Pedicels *c.* 1 cm by 1 mm. Disk horseshoe-shaped. *Flowers* rusty-brown when fresh. *Perianth* segments 7–8 mm. Ovary rufous-pilose, on a very or rather short stipe; stipe and style glabrescent. Style and stigma green when fresh. *Fruit* globular, brownish, *c.* 5 cm diam., suture visible; exocarp thin; endocarp bony, 7–8 mm thick. *Seed* 1, round, compressed, *c.* 3 by 1–1⅓ cm.

Distr. *Malaysia:* NE. New Guinea (Central Highlands: Aiyura).

Ecol. In rain-forest, 1500–1800 m alt. *Fl. fr.* Oct.

Uses. The seeds are cooked and eaten by the natives.

Vern. *Koparu*, Anona, *miu*, Aiyura.

4. Finschia chloroxantha DIELS, Bot. Jahrb. 54 (1916) 204; WHITE, Pac. Sc. 3 (1949) 190, f. 2 & 3.—*Grevillea densiflora* WHITE, Proc. R. Soc. Queensl. 34 (1922) 25; LANE-POOLE, For. Res. (1925) 85; WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 228; SLEUM. Bot. Jahrb. 70 (1939) 129.—*Grevillea sp.* HEMSL. Bot. Chall. 1³ (1885) 186, t. 65G.—*Grevillea elaeocarpifolia* GUILLAUMIN, J. Arn. Arb. 13 (1932) 87.—*Helicia micronesica* KANEH. Fl. Micron. (1933) 95, *japon.*, f. 23 (fol., fr.); Bot. Mag. Tokyo 47 (1933) 669, *lat.*; En. Micron. Pl. (1935) 311.—*F. waterhousiana* BURTT, Kew Bull. (1936) 465.—*F. micronesica* KANEH. Bot. Mag. Tokyo 52 (1938) 241, f. 72 (fl.).—*Grevillea micronesica* SLEUM. Bot. Jahrb. 70 (1939) 129 (*micronesiaca*).—*F. densiflora* WHITE *ex* F. S. WALKER, For. Br. Solomon Isl. Prot. (1948) 155.

var. **chloroxantha.**

Tree 5–25(–30) m; trunk buttressed, often raised on stilt-roots; bark grey to light-brown, usually marked with pustules in longitudinal lines; branchlets and innovations densely clothed with a tawny or ferrugineous appressed pubescence. *Leaves* mostly narrow-elliptic or -obovate (oblanceolate), or lanceolate, apex acute or blunt, base cuneate, chartaceous to subcoriaceous, somewhat shining or dull above, greenish-olivaceous to brownish when dry, paler beneath, glabrous or practically so, variable in size, 9–40 by 3½–13 cm; midrib stoutish, prominent beneath, nerves *c.* 12–30 pairs rather or not distinct, reticulations mostly rather visible; petiole rather slender, semi-terete, glabrous or slightly appressed-pubescent, 1–2½ cm by *c.* 2 mm. *Racemes* many-flowered, solitary, axillary or ramiflorous, incl. the short peduncle up to 30 cm; rhachis appressed-ferrugineous-pubescent, 1½–3 mm diam. Bracts subulate or linear, 1 mm, very early caducous. Pedicels in twos, free, 3–12 by ½ mm. Torus very oblique, *c.* 2½ mm diam. *Flowers* yellow-green to bright golden yellow when fresh, nigrescent, pedicels and perianth segments ± laxly clothed with brown hairs. *Perianth* segments (4–)6–8(–9) mm. Disk prominent, horseshoe-shaped or nearly annular. Ovary glabrous, *c.* 2–5 mm long stiped. Style

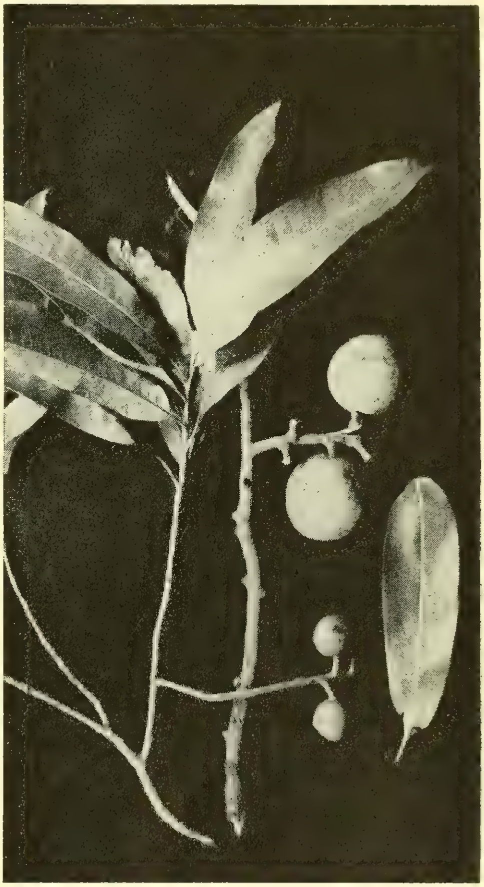

Fig. 10. *Finschia chloroxantha* DIELS *var. macrocarpa* SLEUM., fruiting (as fig. 11, Sept. 1954), × ⅕.

narrowly clavate, minutely greyish-puberulous or papillate or glabrous, up to 1½ cm; stigma terminal, short-conical. *Fruit* green-yellow when quite ripe, compressed, oblique, 2½–3 cm diam., 2–2½ cm thick, on a stout 2–3(–5) by 2½ mm stipe; pedicel 8–10 by 2–3 mm; exocarp rather thin, dissolved in later stages; endocarp bony, rough, 4–5 mm across.

Distr. Micronesia (Palau Isl.: Babeltaop), Melanesia (New Britain: Heath Isl. near Gazelle Peninsula; New Hebrides: Tanna, Eromanga; Solomon Isl.: Ysabel, S. Christoval, Malaita, Bougainville; New Georgia: Kolumbangara), and *E. Malaysia:* New Guinea and Aru Isl.

Ecol. In primary and secondary rain-forest, also in swamp-forest, but apparently on non-inundated ground, scattered although locally common, from the lowland up to 1800 m. *Fl.* Dec.–March, *fr.* March–Aug.

Uses. Fruit with an edible, pleasantly flavoured kernel. Apparently planted on the New Hebrides as the seed is quite an important food-nut there. The seeds are also eaten in Bougainville. The reddish timber is said to have a nice grain.

Vern. *Sauge*, New Guinea: Menari, *akama*, Malaita, *togtua*, Bougainville, *tarroo*, Rabaul.

var. **macrocarpa** SLEUM. *var. nov.*—**Fig. 9–11.** *Fructibus majoribus diversa.* Fruit globose or only very slightly laterally compressed, 5–5½ by *c.* 5 by *c.* 4½ cm; exocarp 2 mm, endocarp bony 6–10 mm thick. Seeds 2, *c.* 3½ by 3 by 2 cm; testa pale, thin, its inner layer jelly-like, blood-red; cotyledons white.

Distr. *Malaysia:* W. New Guinea (Sorong) and introduced from N. New Guinea into the Botanic Gardens, Bogor (*no* XVI.I.J. 4–4a, *type*).

Uses. Said to be useful against leprosy at Sorong.

Vern. *Mbrein*, Sorong, Biak dial.

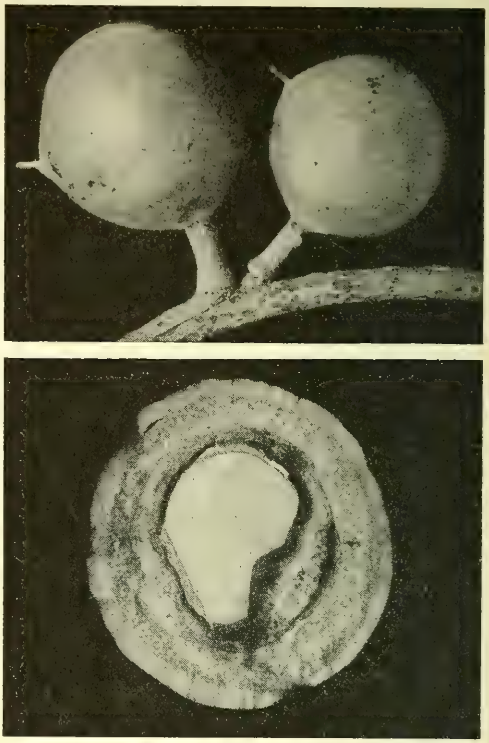

Fig. 11. *Finschia chloroxantha* DIELS *var. macrocarpa* SLEUM. Above 2 young fruits, nat. size, below fruit in section, × 8/11 (Sept. 1954).

4. HELICIA

LOUR. Fl. Cochinch. 1 (1790) 83; SLEUM. Blumea 8 (1955) 7–79.—*Helittophyllum* BL. Bijdr. (1825) 652.—*Castronia* NORONHA, Verh. Bat. Gen. K.W. 5 (1827) 65, *nom. nud.*, *cf.* HASSK. Cat. Hort. Bog. (1844) 317.—*Cyanocarpus* F. M. BAILEY, Rep. Exp. Bell.-Ker (1889) 55.—**Fig. 12–16.**

Trees, rarely shrubs. *Leaves* mostly spiral, rarely subopposite or 3–4-verticillate, simple, entire or dentate (serrate), sessile or petiolate. *Racemes* simple, many-flowered, axillary or ramiflorous, very rarely subterminal. Flowers bisexual. Bracts small, ovate-acuminate to subulate, in Mal. *spp.* subpersistent or caducous. Bracteoles minute. Pedicels mostly in twos, or solitary, free or connate in their lower part, rarely entirely connate. *Perianth*-tube (in Mal. *spp.*) straight, slender, with a clavate to subglobose limb, somewhat swollen at the base, limb straight, segments 4, becoming free and revolute in anthesis. *Stamens* 4, nearly sessile, inserted at the inner base of the limb; anthers oblong, connective apiculate; exine smooth. *Ovary* ovoid or globose, sessile; ovules 2, anatropous, ascendent, inserted at the base of the ovary or laterally attached to the wall on the ventral suture. Style slender, clavate towards the apex; stigma punctiform. Disk glands free (spaced or approximate) or ± connate into a cup. *Fruit* nut- or drupe-like; pericarp mostly thick-coriaceous and rather hard when dry, when fresh apparently its outer part sometimes somewhat fleshy, the inner part drier and hard, rarely with a clear differentiation in endocarp and exocarp, mostly indehiscent, sometimes very tardily splitting irregularly along the ventral (raised or sulcate) suture when dry. *Seeds* 1–2, subglobose respectively hemispheric. Testa thin. Cotyledons fleshy, rugulose in the upper part.

Distr. About 87 *spp.* in S. India (Southwestern Ghats), and Ceylon through SE. Asia to SE. China, Hainan, S. Japan, Formosa, throughout *Malaysia*, extending to Melanesia (New Ireland & New Britain), and NE. Australia. Fig. 12–13.

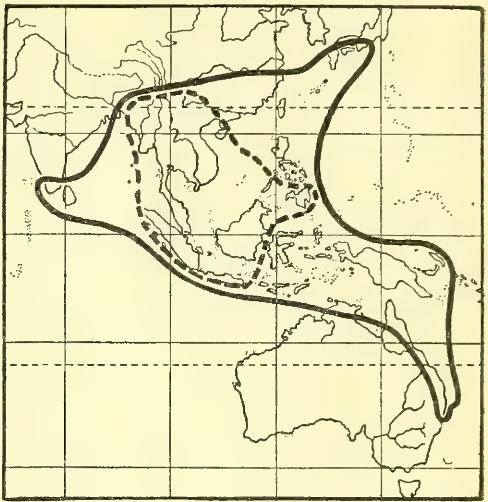

Fig. 12. Distributional area of the genera *Helicia* LOUR. (———) and *Heliciopsis* SLEUM. (– – – –).

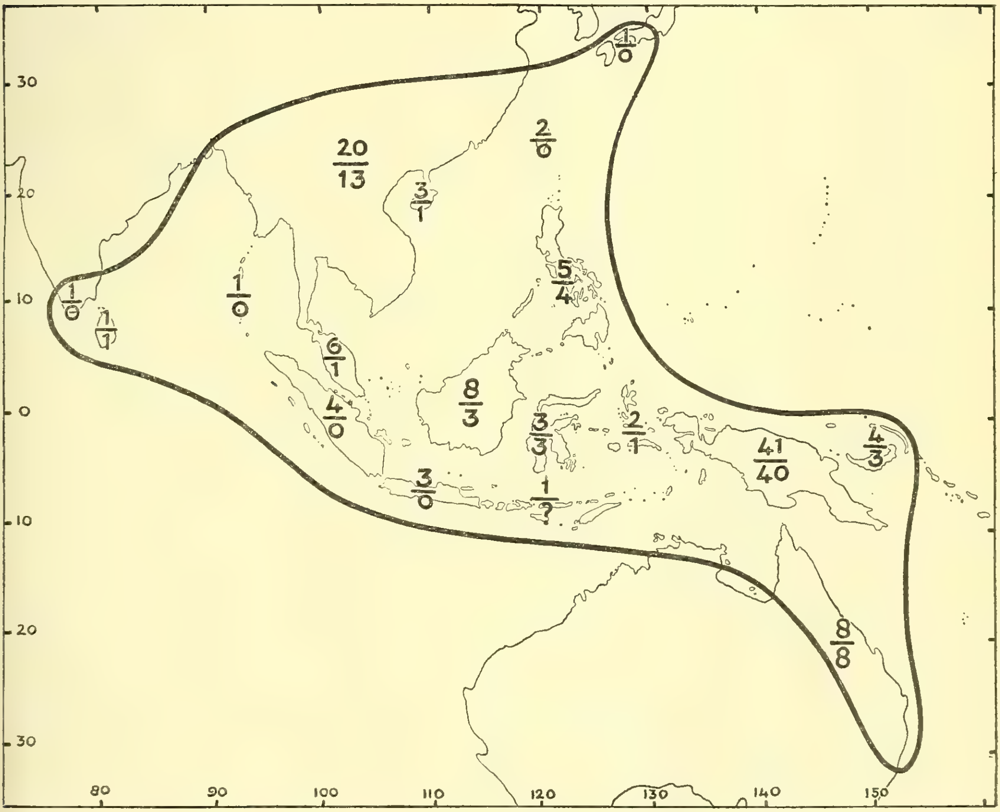

Fig. 13. Distribution of the genus *Helicia* in which are indicated for each subarea the *total number* of species (above the line) and the *number of endemic* species (below the line). The genus comprises 87 species in all.

Ecol. Most species are confined to the substage of the non-seasonal rain-forest, though some are apparently adapted to a more or less seasonal climate. None is known to occur gregariously. Though most species occur in the montane zone between 500 and 2400 m, the total range is from sea-level to *c.* 3350 m on Mt Kinabalu, 2600 m in Central Celebes, and 2650 m in Java.

Uses. Timber is mostly of small size and specimens occur scattered so that the commercial value of this genus is of minor importance.

Notes. I have subdivided the genus into 3 sections.

Sect. Macadamiopsis SLEUM. is characterized from the other sections by perulate inflorescences. It contains only *H. youngiana* MOORE & F.v.M. from Queensland & New South Wales.

Sect. Cyanocarpus (BAILEY) SLEUM. is characterized by drupes (a distinct hard endocarp); it comprises 7 *spp.* in E. Australia and *H. uganensis* DIELS in Melanesia. Possibly *H. acutifolia* SLEUM. from Port Moresby belongs also to this section.

Sect. Helicia with undifferentiated pericarp comprises the bulk of the species. I have not been able to subdivide it further. It is a solid mass of rather closely, often reticulately allied species.

Specific distinction in *Helicia* has been based mainly on the sizes of petioles, pedicels, and perianths, on various types of indument, on nervation, and similar minor vegetative characters. All sizes have been measured in dry material, and the key is, therefore, not fit for identification of living material.

Specific distinction has proved difficult; this is partly caused by the inadequate materials at hand; hardly any specimens have both flowers and ripe fruits. Besides, there are many (31!) specimens which, though singles, have here been accepted as representing distinct species, as intermediates with allied species are absent. Much more material would be needed to establish the range of variability in many species and to go beyond the present tentative revision, in which 27 species have been reduced and 16 have been recognized as new.

KEY TO THE SPECIES

1. Ovary laxly or densely hairy.
2. Leaves entire or nearly so.
3. Perianth 5 (rarely up to 6) mm. Flowers nearly sessile . . . . **1. H. sellae-montis**
3. Perianth 7 mm or more in length. Flowers mostly manifestly pedicelled.
4. Perianth (7–)8–12 mm.
5. Nerves 14–17 pairs.
6. Leaves very broadly attenuate towards the base, the very base obtuse or mostly ± rounded. Perianth 9 mm . . . . **2. H. amplifolia**
6. Leaves cuneate towards the base, the very base ± acute. Perianth 11(–12) mm. **3. H. platyphylla**
5. Nerves up to 12 pairs.
7. Reticulations dense and very prominent on both faces of the leaves.
8. Branchlets of the past year very early glabrescent, the flower-bearing ones glabrous or nearly so. The entire-leaved form of . . . . **23. H. excelsa**
8. Branchlets of the past year (mostly bearing the inflorescences) persistently tomentose or very tardily glabrescent.
9. Perianth 7–8(–9) mm. Fruit *c.* 1–1$^1/_2$(–1$^4/_5$) by ($^3/_5$–)$^4/_5$–1$^1/_2$ cm, pericarp ± $^3/_5$ mm thick.
10. Leaves ± obovate or oblong-obovate, rarely oblong, broadly attenuate towards the obtuse or rounded apex, distinctly petioled; blade *c.* 2 times as long as broad. **4. H. loranthoides**
10. Leaves oblong-lanceolate, gradually and ± long acuminate towards the subacute apex, subsessile; blade *c.* 3–4 times as long as broad . . . . **5. H. celebica**
9. Perianth (10–)11–12 mm. Fruit (1$^4/_5$–)2–3 by *c.* 2 cm, pericarp *c.* 2 mm thick.
11. Pedicels 1–2 (the lowest ones rarely up to 3) mm. Fruit ovoid-ellipsoid, ± persistently rufous-tomentose, 2$^1/_2$–3 by 2 cm . . . . **6. H. fuscotomentosa**
11. Pedicels 3–5 mm. Fruit subglobose, glabrous, *c.* 2 cm across . . . **7. H. rigidiflora**
7. Reticulations ± lax and little or not prominent on both faces of the leaves.
12. Undersurface of the leaves initially ± densely covered with ± crisp hairs, tardily glabrescent.
13. Leaves subsessile . . . . **8. H. uganensis**
13. Petiole (1–)1$^1/_2$–3(–5) cm . . . . **9. H. rufescens**
12. Undersurface of the leaves initially ± laxly covered by ± appressed hairs, soon glabrescent, or glabrous from the beginning.
14. Racemes 17–27 cm, incl. the peduncle 4–5 cm . . . . **10. H. longespicata**
14. Racemes 5–15 cm, incl. the peduncle 1–1$^1/_2$ cm.
15. Ovary obovoid-globose, laxly hairy. Fruit up to 1$^1/_2$ by 1–1$^1/_2$ cm . **11. H. kjellbergii**
15. Ovary oblong-ovoid, densely hairy. Fruit (2$^1/_2$–)3–4(–5) by 1$^1/_2$–2(–2$^1/_2$) cm. The entire-leaved form of . . . . **24. H. serrata**
4. Perianth exceeding 13 mm in length.
16. Perianth limb gradually clavate, 5–6 mm long . . . . **12. H. carrii**
16. Perianth limb rather abruptly ellipsoid, 2–3 mm long.
17. Pedicel 5–8 mm . . . . **13. H. purpurascens**
17. Pedicel 1–2(–3) mm.

18. Leaves ± chartaceous, 2–3$^1/_2$(rarely up to 4) cm wide; nerves not impressed in dry specimens.
19. Perianth 13–15 mm . . . . **14. H. torricellensis**
19. Perianth *c.* 25 mm . . . . **15. H. schlechteri**
18. Leaves subcoriaceous or coriaceous, wider than 4 cm; nerves mostly manifestly impressed in dry specimens.
20. Petiole 4–6 by 2$^1/_2$–4 mm. Inflorescence very lax . . . . **16. H. lauterbachiana**
20. Petiole 15–25 by 1$^1/_2$–2 mm. Inflorescence rather dense . . . . **17. H. oreadum**
2. Leaves manifestly dentate or serrate at least in their upper half.
21. Nerves very markedly impressed above in dry specimens . . . . **18. H. stelechantha**
21. Nerves slightly or not impressed above in dry specimens.
22. Leaves up to 2$^1/_2$ cm wide . . . . **19. H. microneura**
22. Leaves (3–)3$^1/_2$–6$^1/_2$(–12) cm wide.
23. Rhachis very slender in anthesis, *c.* $^1/_2$–$^3/_5$ mm across.
24. Leaves shortly obtusely attenuate at the apex . . . . **20. H. dentellata**
24. Leaves rather abruptly subcaudate-acuminate, not rarely subfalcate, subacute.
25. Leaves rather light greenish-olivaceous when dry, with a few ± irregular teeth, densely reticulate above. Petiole 1–2 cm . . . . **21. H. ledermannii**
25. Leaves ± blackish-brown when dry, ± regularly serrate, rather laxly reticulate above. Petiole *c.* 5 mm . . . . **22. H. arguta**
23. Rhachis stoutish in anthesis, *c.* 1–1$^1/_2$ mm across.
26. Leaves mostly yellowish-greenish and shining when dry; reticulations dense and manifestly raised on both faces. Ovary rusty-villous. Fruit 1–1$^1/_5$(–1$^1/_2$) by $^4/_5$–1$^1/_5$ cm . **23. H. excelsa**
26. Leaves olivaceous to brownish when dry, somewhat shining above, ± dull beneath; reticulations less dense and less or obscurely raised on both faces. Ovary ± densely rufous-sericeous. Fruit (2$^1/_2$–)3–4(–5) by 1$^1/_2$–2(–2$^1/_2$) cm . . . . **24. H. serrata**
1. Ovary entirely glabrous.
27. Leaves peltate . . . . **25. H. peltata**
27. Leaves not peltate.
28. Leaves up to 3 by 1$^3/_5$ cm.
29. Disk glands distinctly rather long-ciliate. Perianth ferrugineous-tomentose. **26. H. microphylla**
29. Disk glands glabrous. Perianth glabrous or nearly so . . . . **27. H. cameronii**
28. Leaves larger.
30. Pedicels with mostly two distinct membranous wings when dry . . . . **28. H. pterygota**
30. Pedicels not winged.
31. Perianth densely ferrugineous-tomentose, hairs ± distinctly spreading . **29. H. microcarpa**
31. Perianth laxly to rather densely hairy by ± appressed hairs or perianth glabrous.
32. Leaves sessile or subsessile, or at least distinctly decurrent to or nearly to the base of the petiole.
33. Perianth 5–12(rarely up to 13) mm.
34. Nerves (at least the upper ones) distinctly straight and ± parallel to each other in their lower $^2/_3$, then curved upwards to the edge.
35. Leaves thick-coriaceous, very stiff, rounded to cordate at the base. **30. H. maxwelliana**
35. Leaves chartaceous to firmly subcoriaceous, cuneate-attenuate or rarely subrotundate at the base.
36. Perianth 5(–6) mm. Nerves 8–10(–12) pairs . . . . **31. H. olivacea**
36. Perianth 9–12 (rarely up to 13) mm.
37. Nerves 16–20 pairs . . . . **32. H. commutata**
37. Nerves up to 12 pairs.
38. Leaves averagely larger, (8–)10–15(–19) by (3$^1/_2$–)4–7(–10) cm.
39. Pedicels 3–4 mm. *Cf.* . . . . **36. H. saruwagedica**
39. Pedicels (6–)7 mm. *Cf.* . . . . **40. H. peekelii**
38. Leaves averagely smaller, 4–8 by 2–3$^1/_2$ cm.
40. Rhachis terete. Limb of the perianth abruptly ellipsoid, 2 mm in length. **33. H. odorata**
40. Rhachis distinctly angular. Limb of the perianth gradually clavate, 3 mm in length. **34. H. teysmanniana**
34. Nerves all curved-ascending over their entire length.
41. Pedicels 2–3(–4) mm.
42. Leaves lanceolate or oblong-lanceolate, up to 2$^4/_5$ cm wide . . . **35. H. acutifolia**
42. Leaves various in shape, 3$^1/_2$–11 cm wide.
43. Perianth 10–12(–13) mm. Fruit obliquely narrow ellipsoid, markedly beaked. **36. H. saruwagedica**
43. Perianth 7–8(–9) mm. Fruit (as far as known) ovoid to ellipsoid.
44. Leaves distinctly appressed rufous-pilose underneath. Nerves 18–20 pairs. **37. H. saurauioides**
44. Leaves glabrous. Nerves 6–10(–12) pairs.

45. Fruit 1½ by 1–1⅕ cm when ripe . . . . **11a. H. kjellbergii var. calva**
45. Fruit 2½–3(–5) by 1½–2½ cm when ripe.
  46. Leaves 5–8 by 4–6 cm (coriaceous, elliptic or ovate-elliptic), rather inconspicuously reticulated. The glabrescent form of . . . . **24a. H. serrata var. oreophila**
  46. Leaves (9–)12–23 by 5–8(–11) cm, finely reticulated on both faces.
    47. Leaves broadly elliptic-oblong, coriaceous, always entire. Nerves 6–7 pairs. (Fruit 3–4 by *c.* 2½ cm . . . . **38. H. latifolia**
    47. Leaves oblong or elliptic-oblong, sometimes lanceolate-oblong, rarely obovate, subcoriaceous, entire to serrate. Nerves 8–10(–12) pairs . . **39. H. moluccana**
41. Pedicels 6–7 mm.
  48. Nerves 6–7 pairs . . . . **40. H. peekelii**
  48. Nerves *c.* 14 pairs . . . . **41. H. neglecta**
33. Perianth exceeding 13 mm in length.
  49. Nerves (certainly the upper ones manifestly) straight in their lower ⅔ and ± parallel to each other, curved upwards towards the edge.
    50. Reticulations deeply impressed above . . . . **42. H. retevenia**
    50. Reticulations not or very slightly impressed above.
      51. Nerves *c.* 7 pairs, steeply ascending from the midrib . . . . **43. H. macrostachya**
      51. Nerves in (9–)10–11 pairs, coming from the midrib at a ± right angle.
        52. Leaves obovate, entire . . . . **44. H. obtusata**
        52. Leaves elliptic or oblong-elliptic, denticulate . . . . **45. H. archboldiana**
  49. Nerves all curved-ascending over their entire length.
    53. Main nerves markedly impressed above in dry specimens . . . . **46. H. wollastonii**
    53. Main nerves flat or mostly somewhat raised above in dry specimens.
      54. Perianth 14–15 mm . . . . **47. H. affinis**
      54. Perianth exceeding 16 mm in length.
        55. Limb of the perianth gradually clavate, 6–7 mm long.
          56. Leaves obovate, distinctly obtuse or truncate at the base, *c.* 1½–2 times as long as broad. **48. H. clemensiae**
          56. Leaves obovate-oblong, subacute at the base, *c.* 3 times as long als broad. **49. H. forbesiana**
        55. Limb of the perianth ± abruptly ellipsoid to subglobose, ± 3 mm long.
          57. Perianth 16–17 mm . . . . **50. H. finis-terrae**
          57. Perianth (20–)25–28 mm.
            58. Fruit subglobose, slightly or not apiculate. Leaves first laxly covered beneath with minute rufescent appressed hairs, glabrescent with age . . . . **51. H. robusta**
            58. Fruit attenuate at apex and base or at least distinctly apiculate. Leaves glabrous from the beginning.
              59. Leaves firmly chartaceous to subcoriaceous, greenish or yellowish or dilutely brownish when dry. Perianth slender. Fruit with 6 ± distinct longitudinal ribs. **52. H. attenuata**
              59. Leaves rigidly subcoriaceous to coriaceous, dark brown to blackish-brown when dry. Perianth stoutish. Fruit not ribbed . . . . . **57a. H. petiolaris var. kingiana**
32. Leaves distinctly petioled, not decurrent or only slightly so in the upper part of the petiole only.
  60. Nerves all or at least the upper 3–4 pairs straight and ± parallel to each other in their lower ⅔, then curved upwards to the margin.
    61. Veins and veinlets distinctly impressed above in dry specimens.
      62. Perianth *c.* 16 mm . . . . **53. H. bullata**
      62. Perianth *c.* 30 mm . . . . **54. H. insculpta**
    61. Veins not or very slightly, veinlets not impressed above in dry specimens, mostly prominent.
      63. Perianth ± densely covered by appressed, rufescent or ferrugineous hairs.
        64. Leaves green-olivaceous or yellowish in dry specimens. Perianth 17–18(–20) mm. **55. H. hypoglauca**
        64. Leaves dark brown in dry specimens. Perianth 25 mm . . . . . . **56. H. albiflora**
      63. Perianth very sparsely hairy or glabrous.
        65. Rhachis stout, *c.* 2½–3 mm diam. Leaves slightly or not reticulated above. **57. H. petiolaris**
        65. Rhachis slender, 1–1½ mm diam. Leaves distinctly densely and prominently reticulated above.
          66. Leaves dark to blackish-brown when dry. Nerves 4–5 pairs. . . . **58. H. paucinervia**
          66. Leaves dilutely greenish-olivaceous when dry. Nerves 7–8 pairs . **59. H. pallescens**
  60. Nerves all curved-ascending over their whole length.
    67. Inflorescence very slender and lax. Rhachis ½–0.7 mm diam. Perianth slender, tube ⅖ mm diam. . . . . **60. H. graciliflora**
    67. Inflorescence stoutish, rather dense. Rhachis 1½–2½ mm diam. Perianth thicker, tube ⅘–1 mm diam.
      68. Petiole ½–1 cm. Leaves elliptic-oblong or elliptic . . . . **61. H. biformis**
      68. Petiole 1½–2½(–3) cm. Leaves oblong or lanceolate-oblong . . . **55. H. hypoglauca**

1. Helicia sellae-montis SLEUM. Bot. Jahrb. 70 (1939) 142; Blumea 8 (1955) 21.

Small tree; branchlets terete, fulvous-tomentose at the tips, glabrous and greyish elsewhere. *Leaves* ± narrow-oblong, gradually acuminate and subacute at the apex, cuneate towards the base into a rather thick *c.* 3 mm long, tomentose petiole, subcoreaceous, mostly nigrescent above when dry, paler beneath, glabrous and shining above, rufous-tomentose beneath specially on midrib and nerves, somewhat glabrescent on the intervenium with age, entire, (11–)$12^{1}/_{2}$–15 by $4^{1}/_{2}$–6 cm; midrib prominent specially beneath, nerves 9–10 pairs, subarcuate and obscurely joined along the edge, flat and ± pale above, a little raised beneath, reticulations rather obscure. *Racemes* ramiflorous, in flower 9–11, in fruit up to 18 cm, rufous-tomentose all over; rhachis slender. *Flowers* sessile or nearly so. Bracts lanceolate, minute. *Perianth* 5 (rarely up to 6) mm, yellowish or white, limb 1 mm diam. Anthers *c.* $1^{1}/_{2}$ mm. Disk glands minute, connate up to their middle. *Ovary* rufous-pilose; style slender, glabrous. *Fruit* ellipsoid, dilutely brownish-velutinous, $5^{1}/_{2}$ by $2^{1}/_{2}$–3 cm, pericarp somewhat crustaceous *c.* 2 mm; pedicel rather stout, 1–$1^{1}/_{2}$ mm.

Distr. *Malaysia:* NE. New Guinea (Morobe Distr.: Sattelberg region and Cromwell Range).

Ecol. In open forest on hilly ground, 900–1500 m. *Fl. fr.* Jan.–Apr.

2. Helicia amplifolia SLEUM. Bot. Jahrb. 70 (1939) 143; Blumea 8 (1955) 21.

Tree; trunk 15–20 cm diam.; branchlets stout, subterete, rufous-tomentose at the tips, glabrescent elsewhere. *Leaves* broadly oblong to elliptic, gradually broadly acuminate and ± obtuse at the apex, very broadly attenuate or ± rounded at the base, stiffly chartaceous, initially laxly covered with ferrugineous hairs specially on the midrib, but soon glabrescent and of a dark brownish-olivaceous colour above, ± dark rufous-velutinous or rufous-pilose underneath, entire, (20–)23–40 by (10–)14–19 cm; midrib somewhat prominent above, strongly so beneath, nerves 14–15 pairs, curved upwards and ending very near to the margin, markedly prominent beneath only, reticulations lax, slightly raised beneath only; petiole rufous-tomentose, 7–9 by 3–4 mm. *Racemes* ramiflorous, dense-flowered, rufous-tomentose all over, 7–8 cm; rhachis nearly villous, *c.* 2 mm across. Bracts subulate, 1 mm. Pedicels free, *c.* 1 mm. *Perianth* pale yellow, 9 mm, limb $1^{1}/_{2}$ mm diam. Anthers *c.* 2 mm. Disk glands free, broadly oblong. *Ovary* rufous-hirsute; style filiform, glabrous. *Fruit* ellipsoid, $4^{1}/_{2}$ by *c.* 3 cm, pericarp crustaceous 4 mm.

Distr. *Malaysia:* NE. New Guinea (Morobe Distr.: Sattelberg region).

Ecol. In hill forest, 900–1050 m. *Fl. fr.* Jan.–Febr.

3. Helicia platyphylla SLEUM. Bot. Jahrb. 70 (1939) 144; Blumea 8 (1955) 22.

Small tree; branchlets rufous-tomentose at the tips, glabrous elsewhere. *Leaves* few at the ends of the branchlets, broad-oblong, gradually or ± abruptly acuminate and subacute at the apex, cuneate into the petiole, ± acute at the very base, rigidly chartaceous to subcoriaceous, dark red-brown when dry, glabrous and shining above, rufous-tomentose on the whole undersurface specially on the midrib and the nerves, entire, (30–) 40–45 by (13–)16–20 cm; midrib prominent above, more strongly so beneath, nerves 15–17 pairs, curved towards and along the edge, flat or somewhat impressed above, prominent beneath, reticulations lax, slightly raised beneath; petiole rufous-tomentose, *c.* 1 cm by 3–4 mm. *Racemes* ramiflorous, rufous-tomentose, dense-flowered, 8–11 cm; rhachis 2 mm diam. Bracts minute. Pedicels mostly in twos, 1–2 mm, stoutish, connate up to the middle. *Perianth* pale pink, 11(–12) mm, limb *c.* $1^{1}/_{2}$ mm across. Anthers *c.* 3 mm. Disk glands ± quadrangular, free. *Ovary* rufous-hirsute; style slender, glabrous. Fruit not known.

Distr. *Malaysia:* SE. New Guinea (Lower Fly River), once found.

Ecol. Rain-forest on ridges at low elevation, said to be common in underbrush. *Fl.* Oct.

4. Helicia loranthoides PRESL, Epim. (1851) 247; MEISN. Prod. 14 (1856) 438; MIQ. Fl. Ind. Bat. 1, 1 (1858) 984; F.-VILL. Nov. App. (1880) 182; VIDAL, Phan. Cuming. (1885) 140; Rev. Pl. Vasc. Filip. (1886) 229; MERR. En. Philip. 2 (1923) 99 *pr. p.;* SLEUM. Blumea 8 (1955) 22.

Slender tree, 3–10 m by 10–25 cm; tips of the branchlets deep ferrugineous-tomentose, glabrescent. *Leaves* obovate or oblong-obovate, rarely oblong, mostly broadly obtusely attenuate to rounded at the apex, cuneate into the petiole and ± decurrent at the base, coriaceous, yellowish-green and shining, greyish- or brownish-dull beneath when dry, initially both faces with a dense ferrugineous ± appressed tomentum, but soon glabrescent above, less quickly so beneath, at last glabrous, entire, rarely subdentate, (5–)6–8(–10, rarely up to 14) by ($2^{1}/_{2}$–)$2^{4}/_{5}$–4(–$5^{1}/_{2}$) cm; midrib ± flat above, prominent beneath, nerves 5–7 pairs, straight in their lower half, curved upwards in the upper part and ± joined along the margin, slightly prominent on both faces, reticulations rather dense, raised on both faces; petiole ± flattened, initially tomentose, glabrescent, $^{4}/_{5}$–$1^{1}/_{2}$(–2) cm. *Racemes* solitary or rarely in twos in the uppermost axils, densely brown tomentose, finally somewhat glabrescent at the flower-tips, dense-flowered nearly to the base, 8–17 cm, mostly exceeding the leaves; rhachis stoutish, $1^{1}/_{2}$–2 mm diam. Bracts narrow-ovate, ± acute, 1–2 mm. Pedicels mostly in twos, ± stoutish, free or connate up to the middle, *c.* 2–3 mm in anthesis, somewhat accrescent in fruit. *Perianth* (7–)8–9 mm, white or yellowish, tube $^{3}/_{5}$–1 (rarely up to $1^{1}/_{2}$) mm diam., limb *c.* $1^{1}/_{2}$ mm diam. Anthers $1^{3}/_{5}$ mm. Disk glands small, free, approximate. *Ovary* ferrugineous-villous; style slender, glabrous. *Fruit* ovoid-ellipsoid, blackish when dry, glabrous, minutely verruculose, *c.* 1(rarely up to $1^{1}/_{2}$) by ($^{3}/_{5}$–)$^{4}/_{5}$–1 cm, pericarp *c.* $^{3}/_{5}$ mm.

Distr. *Malaysia:* Philippines (Luzon, Catanduanes, Leyte, Mindanao, Palawan).

Ecol. In mountain- or moss-forest, 1150–1850 m. *Fl.* May, *fr.* July–Sept.

Uses. Wood heavy, sappy, white, close-grained.

Vern. *Anaping-labláb,* Buk., *tarangísi,* Bag.

5. Helicia celebica Sleum. Blumea 8 (1955) 23.—*H. excelsa* (Roxb.) Bl. *var.* Koord. Minah. (1899) 576.—*H. excelsa* (Roxb.) Bl. *var. celebica* Koord. in Koord.-Schum. Syst. Verz. 3. Abt. (1914) 38, *nom. nud.*—*Finschia excelsa* (Roxb.) Bl. *ex* Boerl. Handl. 3, 1 (1900) 151 *var.* (Celebes), *err. pro H. excelsa;* de Clercq, Nieuw Plantk. Woordenb. (1909) 242.

Tree up to 24 m by *c.* 30 cm; branchlets ferrugineous-tomentose at the tips, tardily glabrescent. *Leaves* oblong-lanceolate, gradually acuminate and subacute at the apex, cuneate towards the base and ± distinctly decurrent along the petiole, subsessile, the very young ones ferrugineous-tomentose on both faces, quickly glabrescent, mature ones subcoriaceous and glabrous, midrib and petiole excepted, yellowish-green and shining above when dry, dull beneath, entire, 8–15 by $2^1/_2$–4 cm; midrib distinctly raised beneath, nerves 6–8 pairs curved-ascending, ± manifestly inarched along the edge, pale and nearly flat above, prominent beneath, reticulations rather dense and raised on both faces; petiole stout, averagely 2–3 mm, in less decurrent leaves slightly longer. *Racemes* in the uppermost axils, solitary, or rarely in twos, rather dense-flowered, rufous-ferrugineous-tomentose, 8–15 cm; rhachis $1^1/_2$–2 mm diam. Bracts ovate-acuminate, *c.* $1^1/_5$ mm, subpersistent as are the bracteoles. Pedicels mostly in twos, free or connate up to the middle, rather thick, 3–4 mm in anthesis, somewhat accrescent in fruit. *Perianth* dilutely green, *c.* 8 mm, swollen both at the apex and the base, tube 1 mm diam. in the middle. Anthers *c.* $1^1/_2$ mm. Disk glands very short, truncate, free. *Ovary* rufous-villous; style slender, glabrous. *Fruit* ± oblique, ovoid-ellipsoid, very shortly contracted at the base, dirty green, finally blackish when fresh, black when dry, minutely verruculose, glabrous, $1^1/_2$–$1^4/_5$ by $1^1/_5$–$1^1/_2$ cm, pericarp ± $^3/_5$ mm.

Distr. *Malaysia:* NE. Celebes (Manado).

Ecol. In rain-forest on sandy soil, 450–1600 m. *Fl. fr.* Apr.

Vern. *Mowésem,* Tt.

Note. Closely related to the previous species.

6. Helicia fuscotomentosa Suesseng. Mitt. Bot. Staatssamml. Münch. 2 (1950) 61; in Fedde, Rep. 54 (1951) 225; Sleum. Blumea 8 (1955) 24.

Tree 10–15 m; branchlets rather stout, densely and ± persistently dark rufous-tomentose at the tips, more greyish- to yellowish-tomentose below in the older parts, finally glabrescent. *Leaves* elliptic to oblong-elliptic, gradually or rather abruptly acuminate and subacute at the apex, cuneate into the petiole, the very young ones rufous-tomentose on both faces, soon glabrescent, mostly entirely glabrous at flowering time midrib and petiole excepted, subcoriaceous, yellowish-green to yellowish-olivaceous when dry, entire, (5–)8–12(–18, in suckers or seedlings up to 26) cm by ($3^1/_2$–)4–6 (–8–11) cm; midrib slightly raised above, very distinctly so beneath, nerves (5–)6–8(–9) pairs, curved-ascending, rather obscurely inarching along the edge, prominent on both faces, reticulations rather dense and raised on both faces; petiole 1–2 cm by $1^1/_2$–2(–$2^1/_2$) mm. *Racemes* axillary, solitary, rather dense-flowered, 6–8 cm, rufous- nearly villous-tomentose; rhachis $1^1/_2$–2 mm across. Bracts ovate-acuminate, 1–$1^1/_2$ mm. Pedicels stoutish, 1–2 (the lowest ones rarely up to 3) mm in flower, mostly in twos and ± connate. *Perianth* 11–12 mm, tube $1^1/_2$ mm, limb clavate 2–$2^1/_2$ mm diam. Anthers *c.* 2 mm. Disk glands broadly triangular, obtuse, free, spaced. *Ovary* globose, rufous-villous; style slender, glabrous. Nearly ripe *fruit* oblique, elongate-ellipsoid to ovoid, apiculate, shortly attenuate at the base, rufous-tomentose, $2^1/_2$–3 by *c.* 2 cm, pericarp 2 mm; pedicel 2–3 mm.

Distr. *Malaysia:* Borneo.

Ecol. Mountain-forest, 350–1500 m, apparently scattered and rare on stony ridges. *Fl.* March–May, *fr.* Apr.

7. Helicia rigidiflora Sleum. Blumea 8 (1955) 24.—*H. loranthoides* (*non* Presl) Merr. En. Philip. 2 (1923) 99, *pro parte.*

Tree; branchlets rather stout, the younger parts rufous- or greyish-tomentose, glabrescent. *Leaves* obovate to oblong-obovate, shortly acuminate and subacute at the apex, cuneate at the base, and somewhat decurrent in the upper part of the petiole, firmly subcoriaceous, brownish- or greenish-yellowish when dry, very shining above, pallid and ± dull beneath, rufous-tomentose initially both at the midrib and petiole, glabrous elsewhere, entire, (5–)6–10(–12) by 3–5(–$6^1/_2$) cm; midrib slightly prominent above, conspicuously raised beneath, nerves 6–8 pairs moderately curved-ascending, obscurely anastomosing near the edge, prominent on both faces, reticulations dense and distinctly elevated on both faces; petiole 1–$1^1/_2$ (–$2^1/_2$) cm. *Racemes* axillary from rufous-tomentose branchlets of the past year, ± laxly set with flowers to nearly their base, 8–10 cm, rufous-tomentose; rhachis stout, *c.* 2 mm diam. Bracts ovate, nearly 2 mm, ± concealed in the crisped tomentum. Pedicels stoutish, mostly in twos and connate up to their middle, 3–5 mm. *Perianth* rather thick, rigid, 10–11 mm, tube $1^1/_2$ mm across, limb shortly clavate, 2 mm diam. Anthers *c.* $1^1/_2$ mm. Disk glands oblong-ovate, free, spaced. *Ovary* globose, rufous-villous; style slender, glabrous. *Fruit* subovoid-globose, blackish when dry, glabrous, densely minutely verruculose, $1^4/_5$–2 cm diam., pericarp coriaceous *c.* 2 mm.

Distr. *Malaysia:* Philippines (Mindanao: Bukidnon, Misamis; Mindoro).

Ecol. Forests, probably in the higher regions. *Fl.* May–July, *fr.* April.

8. Helicia uganensis Diels *ex* Sleum. Bot. Jahrb. 70 (1939) 145; Sleum. Blumea 8 (1955) 18.

Tree 5–8 m; branchlets rufous-tomentose at the tips, glabrous elsewhere, older parts thick with greyish bark. *Leaves* narrow-oblong to lanceolate, gradually acuminate and subacute at the apex, long-cuneate at the base and somewhat decurrent, subsessile, rigidly chartaceous to subcoriaceous, entire, dark glaucous-greenish or brownish and a little shining above when dry, dilutely brownish and dull beneath, glabrous above except midrib and nerves, laxly ferrugineous-pilose beneath, more densely so on midrib and nerves, (13–)16–24 by (4–)5–7 cm; midrib slightly elevated above, markedly so beneath, nerves 10(–12) pairs, arcuate, distinctly raised beneath only, reticulations lax, slightly prominent beneath; petiole tomentose, 3–6 by 2–3 mm. *Racemes* ramiflorous, dense-flowered nearly to their base, slender, 11–14 cm, densely ferrugineous-tomentose on the rhachis and pedicels, less so on the perianth; rhachis 1–1$^1/_2$ mm diam. Bracts ovate-lanceolate, 1–2 mm. Pedicels stoutish, mostly in twos and connate up to their middle, 1–1$^1/_2$ mm. *Perianth* yellowish-brown, *c.* 7 mm, tube $^1/_2$ mm diam., limb 1 mm diam. Anthers 1 mm. Disk glands broadly oblong, free. *Ovary* rufous-villous; style slender, filiform. *Fruit* drupaceous, ellipsoid, 5–7 by 3$^1/_2$ cm, blackish when ripe; pericarp 4–5 mm, outer layer first succulent, subsequently spongious-corky, soon ± dissolute and showing a rather dense net of thicker and thinner anastomosing fibres, inner layer rather hard, lignescent, 1–1$^1/_2$ mm. *Seed* 1, rugulose in the upper half.

Distr. *Melanesia* (New Ireland, New Britain).

Ecol. In secondary rain-forest close to the seashore. *Fl.* Aug., *fr.* Oct.

Vern. *Lai-lai*, New Britain, Cape Hoskins.

Note. The special structure of the pericarp with its spongious or nearly corky outer and rather hard inner part, makes us suspect, that the fruit may be capable to drift, specially as the tree is reported to occur near the sea-shore. This is up till now the only species of *sect. Cyanocarpus* represented in Malaysia.

9. Helicia rufescens Prain, Kew Bull. (1912) 342; Gamble, J. As. Soc. Beng. 75, ii (1914) 435; Ridl. Fl. Mal. Pen. 3 (1924) 142; Burk. Dict. (1935) 1134; Sleum. Blumea 8 (1955) 25.

Tree 10–24 m by 60 cm; branchlets stout, dark rufous-tomentose, tardily glabrescent. *Leaves* obovate or obovate-oblong, rarely broadly oblanceolate, apex shortly attenuate, subacute to nearly rounded-obtuse, base ± long-cuneate and ± decurrent in the upper part of the petiole, subcoriaceous, dull olive-green to blackish-brown above when dry, dark rufous-tomentose on both faces when very young, gradually glabrescent, usually tomentose or hairy for a long time on the midrib above and at least on the nervation beneath, entire (serrate only in very young specimens or suckers), 15–30 by (5–)6–11 cm, upper ones smaller (those of suckers up to 40 by 13 cm); midrib elevated on both faces, nerves (8–)12 pairs, lowest ones close, straight and parallel, upper ones spaced, curved and ± distinctly anastomosing, all slightly prominent beneath only, reticulations subinconspicuous; petiole rufous-tomentose, 3–4(–5) by $^1/_5$–$^1/_3$ cm, more slender and shorter in the upper leaves or in mountain forms. *Racemes* axillary or ramiflorous, solitary or in twos, (10–)15–20 cm, dense-flowered, dark rufous-tomentose; rhachis 1$^1/_2$–2 mm diam. Bracts ovate, minute. Pedicels rather robust, mostly in twos and connate up to their middle, 1–2(–3) mm. *Perianth* 12 mm, tube $^4/_5$ mm diam., limb clavate 1$^1/_2$ mm diam. Anthers *c.* 2 mm. Disk glands obtuse, free. *Ovary* rufous-villous; style slender, glabrous. *Fruit* subglobose, flattened laterally, broadly attenuate at both ends, or contracted at the base into a short stipe, yellowish-brown, dark brown when dry, rufous-tomentose when young, ± glabrescent at full maturity, 2$^1/_2$–3 by 2–2$^1/_2$ cm, 1$^1/_2$–1$^4/_5$ cm thick; pericarp coriaceous, 1 mm; pedicel 6–7 by 2 mm.

Distr. *Malaysia:* Malay Peninsula (Perak, Kedah, Pahang, Johore), apparently also in Sumatra (East Coast, sterile material).

Ecol. In open forest on hills, 150–450 m and 1200 and 1500 m (Cameron Highlands). *Fl.* Apr., *fr.* March, April, Oct.

Uses. Wood is reported to be very hard.

Vern. *Sida barak*, M.

Note. The mountain specimens have smaller leaves but are doubtless conspecific.

10. Helicia longespicata Sleum. Bot. Jahrb. 70 (1939) 143; Blumea 8 (1955) 26.

Tree 8 m; branchlets rufous-tomentose when very young, glabrescent. *Leaves* oblong, rounded or very broadly obtusely acuminate at the apex, attenuate at the base, inequilateral, thinly subcoriaceous, or chartaceous, brown when dry, glabrous above except the midrib, which is rufous-tomentose but glabrescent, initially rufous-tomentellous beneath, glabrescent on the intervenium, entire, (8–)21–26(–33) by (6$^1/_2$–)9–12(–13) cm; midrib prominent on both faces, nerves *c.* 10 pairs, curved, more distinctly prominent beneath only, reticulations rather dense, slightly prominent on both faces; petiole rufous-tomentose, 1$^1/_5$–1$^4/_5$ cm by 2$^1/_2$ mm. *Racemes* ramiflorous, (17–)22–27 cm incl. the peduncle 4–5 cm, rufous-tomentose; rhachis slender, 1 mm diam. Bracts minute. Pedicels in twos and ± connate, 1–1$^1/_2$ mm. *Perianth* pale green, 8 mm, limb 1 mm diam. in nearly full-developed state. Anthers *c.* 1$^1/_2$ mm. Disk glands connate at the base. *Ovary* densely ferrugineous-pilose; style glabrous, very slender. Fruit not known.

Distr. *Malaysia:* SE. New Guinea (Port Moresby), once found.

Ecol. In forests at *c.* 1500 m. *Fl.* Febr.

11. Helicia kjellbergii Sleum. Blumea 8 (1955) 26. *var.* **kjellbergii.**

Tree 4–8(–20) m; branchlets glabrous. *Leaves* oblong, shortly obtusely acuminate at the apex, cuneate and decurrent at the base into a ± winged petiole, hence subsessile, subcoriaceous, glabrous, dark greenish-brownish and very shining above, (9–)10–18 by 4½–6½ cm; midrib slightly prominent above, more distinctly so beneath, nerves 8–10(–12) pairs curved-ascending, obscurely inarching remote from the edge, slightly raised on both faces, reticulations obscure; petiole 2–3 mm. *Racemes* from the upper axils, solitary, rarely in twos, ± ascending, rather densely set with flowers nearly to the base, 7–10 cm, elongating to 13 cm in fruit; rhachis 1–1½ mm diam., ± densely ferrugineous-tomentose as are the bracts and pedicels. Bracts subovate-lanceolate, 1½ mm. Pedicels mostly in twos, connate up to the middle, glabrescent in the upper third, 2–3 mm. *Perianth* whitish, 7–8 mm, laxly to subdensely covered with ± appressed, ferrugineous hairs, tube ½ mm diam., limb clavate 1 mm diam. Anthers 1½ mm. Disk glands broadly ovate, rather thick, truncate, free, close. *Ovary* globose to ± obovoid, laxly covered by longish ± crisped dilutely ferrugineous hairs, ± glabrescent; style slender, glabrous. *Fruit* (probably immature) ellipsoid, glabrous, blackish, very minutely verruculose, 9–11 by 7–9 mm, pericarp 0.7 mm.

Distr. *Malaysia:* SE. Celebes (Kendari), once found. Similar (sterile) material seen from Lesser Sunda Islands (Flores).

Ecol. In secondary thicket, 100 m. *Fl. fr.* March.

var. **calva** SLEUM. Blumea 8 (1955) 27.

Leaves lanceolate-oblong, 3½–4½ cm wide. Inflorescence less densely ferrugineous-pilose than in the type. *Ovary* glabrous. Mature *fruit* ellipsoid, very shortly contracted at the base, 1½ by 1–1⅕ cm, pericarp 1 mm.

Distr. *Malaysia:* Central Celebes (Masamba).

Ecol. Rare in primary forest, 200 m.

Vern. *Rotoh*, Toradja.

12. Helicia carrii SLEUM. Bot. Jahrb. 70 (1939) 145; Blumea 8 (1955) 27.—*H. brassii* SLEUM. *l.c.* 146.—*H. divaricata* SLEUM. *l.c.* 146.

Tree 5–10 m; branchlets terete, young parts rufous-ferrugineous-tomentose, glabrescent. *Leaves* oblong, lanceolate-oblong, obovate-oblong or subelliptic-oblong, gradually rather shortly acuminate at the apex, obtuse or subacute, attenuate into the petiole at the base, ± firmly chartaceous, yellowish-green or pallid olivaceous when dry, entire or remotely subdenticulate towards the apex, glabrous, shining above, midrib tomentellous, dull beneath and densely rufous-ferrugineous-pilose on the midrib and nerves, less so on the intervenium, finally ± glabrescent, 5–14 by (1⅘–)2½–5½ cm; midrib slightly elevated above, more distinctly so beneath, nerves (6–)7–8 (–10) pairs, curved and anastomosing near the edge, somewhat raised beneath only, reticulations rather dense, distinctly raised beneath only; petiole stoutish, tomentose (⅔–)1–1½ cm. *Racemes* ramiflorous or axillary, dense, rusty-tomentose, 8–11 cm; rhachis 1½–2 mm diam. Bracts ovate-subacuminate, 1–1½ mm. Pedicels rather thick, 3–5 mm, ± connate up to the middle when set in twos. *Perianth* brownish outside, cream or creamy-yellow inside, (16–)17–20 mm, tube 1⅕–1½ mm, limb gradually clavate, ± 2½ mm diam. Anthers *c.* 3 mm. Disk glands subquadrangular, ± connate in a ring. *Ovary* densely fulvous-ferrugineous-pilose; style slender, glabrous. Immature *fruit* subglobose, laxly rufous-pilose.

Distr. *Malaysia:* SE. New Guinea.

Ecol. In forests, 1500–2400 m. *Fl.* Nov.–Jan.

13. Helicia purpurascens SLEUM. Blumea 8 (1955) 27.

Tree up to 12 m; tips of the branchlets rusty-tomentose, glabrescent. *Leaves* oblong or lanceolate-oblong, shortly abruptly acuminate and subacute at the apex, attenuate and distinctly decurrent at the base, dilutely yellowish green and shining above, brownish-olivaceous and dull beneath when dry, firmly subcoriaceous, glabrous, entire, (9–)10–15 by 4–5 cm; midrib slightly prominent above, strongly so beneath, nerves 10–11 (–12) pairs coming from the midrib at *c.* 70–80°, rather straight in the lower part, curved towards the margin and distinctly anastomosing, slightly prominent above, more distinctly so beneath, reticulations irregular and dense, raised on both faces; petiole stout, ½–1(–1⅓) cm. *Racemes* ramiflorous, *c.* 30 cm incl. the peduncle *c.* 10 cm, dense-flowered, rather densely covered with longish, appressed, ferrugineous hairs; rhachis 2–2½ mm across. Bracts ovate-lanceolate, acute, sometimes soon glabrescent, 2–3 mm, mostly early caducous. Pedicels rather slender, mostly in twos, free or connate up to the middle. *Perianth* deep plum-red, 20–23 mm, tube ⅔ mm diam., limb ellipsoid 2–2½ mm diam. Anthers 2½ mm. Disk glands thick, connate in the lower half, minutely punctate. *Ovary* densely rufous-pilose; style slender, glabrous. Fruit not known.

Distr. *Malaysia:* Central E. New Guinea (Western & Central Highlands), *c.* 2350 m.

14. Helicia torricellensis LAUT. in K. SCH. & LAUT. Nachtr. (1905) 257; Bot. Jahrb. 50 (1913) 331; SLEUM. Blumea 8 (1955) 28.

Small tree; tips of the branchlets fuscous-tomentose, early glabrescent. *Leaves* lanceolate, long and gradually acuminate towards the apex, rather obtuse, cuneate towards the base and rather distinctly decurrent, thinly subcoriaceous, olivaceous-greenish when dry, shining and, the midrib excepted, glabrous above; very young ones sparsely set with subferrugineous, appressed hairs beneath, but glabrescent, finally glabrous, entire, 7–14 by 2–3½ cm; midrib slightly raised above, distinctly so beneath, nerves *c.* 10 pairs, rather straight and parallel, curved and joined together near the margin, distinctly prominent beneath only, reticulations very dense and rather prominent on both faces; petiole somewhat flattened, ± winged, glabrous, 2–10 mm. *Racemes* ramiflorous, dense, 12–14 cm, rather densely rufous-ferrugineous hairy in all parts; rhachis 1–1½ mm across. Bracts ovate-lanceolate, subglabrous, *c.* 2 mm. Pedicels *c.* 2 mm, mostly in twos and connate halfway. *Perianth* white, slender, (13–)14–15 mm, tube $^1/_2$ mm diam., limb ellipsoid $1^1/_2$ mm diam. Anthers *c.* 2 mm. Disk glands thick, subquadrangular, free, close, forming a ring. *Ovary* rufous-tomentose; style slender, glabrous. Fruit not known.

Distr. *Malaysia:* NE. New Guinea (Torricelli Mts), once found, 1000 m. *Fl.* April.

15. Helicia schlechteri LAUT. in K. SCH. & LAUT. Nachtr. (1905) 256; Bot. Jahrb. 50 (1913) 333, f. 2; SLEUM. Blumea 8 (1955) 28.

Treelet; branchlets slender, very young parts appressed rufous-ferrugineous-tomentose, glabrescent. *Leaves* lanceolate, gradually long acuminate towards the apex, subacute, attenuate at the base and ± decurrent, thinly subcoriaceous or chartaceous, glabrous, a little shining above, dull beneath, dilutely olivaceous-greenish when dry, entire, 10–18 by 2–$3^1/_2$(–4) cm; midrib prominent on both faces, nerves 8–10 ± curved and ± distinctly anastomosing near the margin, slightly raised on both faces or impressed above, reticulations very dense, minutely prominent on both faces; petiole robust, flattened, 2–8 mm. *Racemes* axillary, lax, slender, 13–30 cm, rather densely set with very fine, appressed, rufous hairs; rhachis 1 mm diam. Bracts ovate-lanceolate, acute, 1–$1^1/_2$ mm, early caducous. Pedicels 2 mm, mostly in twos, free to entirely connate. *Perianth* white, slender, *c.* 25 mm, tube $^3/_5$ mm diam., limb $1^1/_2$ mm diam. Anthers $1^4/_5$ mm. Disk glands free, minute, truncate. *Ovary* densely appressed rufous-pilose; style very slender, glabrous. Fruit not known.

Distr. *Malaysia:* NE. New Guinea (Torricelli Mts), once found, 600 m.

16. Helicia lauterbachiana SLEUM. Bot. Jahrb. 70 (1939) 147; Blumea 8 (1955) 29.—*H. grandifolia* LAUT. Nova Guinea 8 (Sept. 1910) 285; Bot. Jahrb. 50 (1913) 332, *non* LECOMTE (May 1910).

Treelet 3–4 m. Branchlets glabrous, the tips not seen. *Leaves* broadly lanceolate or subovate-lanceolate, gradually acuminate and obtuse at the apex, cuneate at the base and decurrent along a very short petiole, coriaceous, dilutely brown and somewhat shining when dry, glabrous, entire, slightly revolute at the margin, 20–32 by 7–11 cm; midrib thick, prominent on both faces, nerves 9–10(–11) pairs, curved-ascending, joined near the edge, mostly distinctly impressed above in dry specimens, prominent beneath, reticulations very dense, minutely raised on both faces; petiole rugose, 4–6 by $2^1/_2$–4 mm. *Racemes* apparently ramiflorous, slender, 25–43 cm, very laxly set with flowers, rather densely covered with long, ferrugineous, appressed hairs; rhachis *c.* 1 mm diam. Bracts minute, lanceolate, *c.* 1 mm, mostly early caducous. Pedicels 2–3 mm, solitary or in twos, free or connate at the very base. *Perianth* white, 22–25 mm, tube $^1/_2$ mm diam., limb ellipsoid, $1^1/_2$–2 mm diam. Anthers $1^1/_2$ mm. Disk glands broadly ovate, free. *Ovary* subglobose, rufous-pilose. Style very slender, glabrous. Fruit not known.

Distr. *Malaysia:* S. New Guinea (Noord = Lorentz River), once found, low alt. *Fl.* July.

17. Helicia oreadum DIELS, Bot. Jahrb. 54 (1916) 203; SLEUM. Blumea 8 (1955) 29.—*H. phaeotricha* DIELS, *l.c.* 203.—*H. validinervis* WHITE, Proc. R. Soc. Queensl. 34 (1922) 26; SLEUM. Bot. Jahrb. 70 (1939) 147.

Small tree 3–6 m; tips of the branchlets fuscous-pilose, early glabrescent. *Leaves* lanceolate or narrow obovate-oblong, rather shortly and gradually acuminate at the apex, subacute, ± broadly attenuate into the petiole, somewhat inequilateral, subcoriaceous, pale green when dry, shining on both faces, glabrous above, initially laxly, appressedly, ferrugineous-pilose on the intervenium beneath, more densely so on the midrib, nerves and petiole, finally nearly completely glabrous, entire, (10–)12–22(–29) by 4–7(–9) cm; midrib robust, prominent on both faces; nerves 9–11 pairs, moderately curved and ± parallel, arching in a mostly very distinct intramarginal vein, ± distinctly impressed above when dry, prominent beneath, reticulations dense and conspicuously raised on both faces; petiole $1^1/_2$–2(–$2^1/_2$) cm, at the base $1^1/_2$–2 mm thick. *Racemes* axillary or ramiflorous, 18–28 cm, incl. the short peduncle, rather dense-flowered, fuscous-tomentose; rhachis *c.* $1^1/_2$ mm diam. Bracts ovate-lanceolate, subpersistent, mostly equalling the pedicels. Pedicels $1^1/_2$–2 mm, mostly in twos, free or connate halfway up. *Perianth* rose-red or purplish, slender, *c.* 18 mm, tube $^3/_5$ mm diam., limb ellipsoid, $1^1/_2$ mm diam. Disk glands fleshy, free, divergent. *Ovary* rufous-tomentose; style slender, glabrous. Fruit not seen.

Distr. *Malaysia:* East New Guinea (Sepik region; Central Distr.).

Ecol. In rain-forest, up to 1500 m. *Fl.* Apr.–May, Aug.–Sept.

18. Helicia stelechantha DIELS, Bot. Jahrb. 54 (1916) 202; SLEUM. *ibid.* 70 (1939) 135, *in clav.*; Blumea 8 (1955) 30.

Treelet 4–5 m; tips of the branchlets densely appressed rusty-pilose, glabrescent. *Leaves* elliptic or subovate-elliptic, shortly acuminate and subacute at the apex, cuneate into the petiole, slightly inequilateral, dilutely olivaceous above when dry, rather livid beneath, glabrous, remotely and rather coarsely serrate, slightly revolute at the margin, 10–24 by 5–10 cm; midrib prominent, specially beneath, nerves 8–10 pairs rather straight in the lower, curved in the upper part, ± parallel, anastomosing, manifestly impressed above in dry specimens, strongly prominent beneath, reticulations dense and slightly raised on both faces; petiole ($1^1/_2$–)2–3 cm. *Racemes* slender, cauliflorous, up to 25 cm, subdensely appressedly rufous-ferrugineous hairy. Bracts linear, 2–$2^1/_2$ mm. Pedicels mostly in twos, connate at the base, rather slender, 3–$4^1/_2$ mm. *Perianth* pale rose, 14–15 mm, tube $^1/_2$ mm diam., limb $1^1/_2$ mm. Anthers $1^1/_2$ mm. Disk glands thick, broadly obovate, free. *Ovary* rufous-tomentose; style slender, glabrous. Fruit not known.

Distr. *Malaysia:* NE. New Guinea (Sepik River region: 'Schraderberg'), once found in mossy forest, 2070 m. *Fl.* June.

19. Helicia microneura WHITE, J. Arn. Arb. 10 (1929) 209; SLEUM. Bot. Jahrb. 70 (1939) 135, *in clav.*; Blumea 8 (1955) 32.

Small, slender, virgate tree; tip of the branchlets appressedly rusty-tomentose, glabrescent. *Leaves* lanceolate or oblong-lanceolate, subacutely acuminate at the apex, cuneate at the base and decurrent on the petiole, firmly subcoriaceous, olivaceous to dark brown, glabrous and somewhat shining above when dry, more dilutely so and rather dull beneath, initially sparsely pilose with appressed hairs on intervenium and midrib, early glabrescent, with 2–4 teeth in the upper part on each side, (4–)5–7 by 2–2¹/₂ cm; midrib nearly flat above, prominent beneath, nerves *c.* 8 pairs, distinctly curved-anastomosing, slightly prominent on each face, reticulations very dense, minutely raised on both faces; petiole 2–3 mm. *Racemes* axillary or ramiflorous, very slender, densely appressedly rufous-pilose, 3–4¹/₂ cm, rather laxly set with flowers nearly to the base; rhachis ¹/₂ mm diam. Bracts not seen. Pedicels mostly in twos and nearly connate up to the apex. *Perianth* white, rather densely appressed-pilose in bud, glabrescent during anthesis, *c.* 6 mm, tube ¹/₂ mm, limb ⁴/₅ mm diam. Anthers ³/₄ mm. Disk glands rather thick, broadly ovate, truncate, free, close. *Ovary* rufous-tomentose; style slender, glabrous. Fruit unknown.

Distr. *Malaysia:* SE. New Guinea (Owen Stanley Range: between Mts Brown and Clarence), once found, 900–1200 m. *Fl.* May.

20. Helicia dentellata SLEUM. Bot. Jahrb. 70 (1939) 147; Blumea 8 (1955) 32.

Treelet 3–4 m; tips of branchlets laxly to subdensely clothed with appressed, rufous hairs, glabrous and brownish later. *Leaves* oblong or elliptic-oblong, gradually attenuate towards the top, obtuse, broadly attenuate at the base and ± decurrent along the petiole, olivaceous-brown when dry, rather shining on both faces, stiffly chartaceous, midrib very laxly rusty-hairy on both faces, later glabrous, mostly manifestly subserrate-dentate, or sometimes with a few teeth in the upper part only, very rarely nearly entire, 7–14(–16) by 3¹/₂–5¹/₂(–6¹/₂) cm; midrib slightly elevated above, conspicuously so beneath, nerves 6–7 pairs distinctly curved-anastomosing, slightly raised beneath, reticulations rather dense and slightly raised on both faces; petiole glabrescent, 3–6(–9) mm. *Racemes* axillary, dense-flowered, 7–10 cm, slender, rather densely rufous-pilose on rhachis and pedicels; rhachis *c.* ³/₅ mm diam. Bracts ovate-acute, 1 mm. Pedicels mostly in twos, slender, 1¹/₂–2 mm. *Perianth* yellow or greenish, laxly rufous-pilose, 7–8 mm. Anthers 1¹/₅ mm. Disk glands subquadrangular, free, close. *Ovary* rufous-tomentose; style slender, glabrous. Immature *fruit* ellipsoid, apiculate, verruculose, laxly rufous-pilose, 8 by 6 mm.

Distr. *Malaysia:* S. and SE. New Guinea.

Ecol. Lowland rain-forest undergrowth. *Fl.* Aug.–Sept., *fr.* Dec.

21. Helicia ledermannii DIELS, Bot. Jahrb. 54 (1916) 204; SLEUM. Blumea 8 (1955) 33.

Shrub 1–1¹/₂ m; branchlets slender, ± densely rusty-sericeous at the innovations. *Leaves* lanceolate-ovate or oblong-ovate, 2–3 cm subcaudate-acuminate, subacute and ± falcate at the apex, attenuate into the petiole, slightly decurrent, firmly chartaceous, very young ones covered with golden silky hairs on both faces, mature ones olivaceous-greenish when dry, glabrous and almost shining above, subpersistently ± densely covered with longish, appressed, rusty hairs all over the undersurface specially on the midrib, finally glabrescent, remotely and ± irregularly serrate in the upper half by a few rather sharp teeth, 8–13 by 3¹/₂–5 cm; midrib somewhat prominent above, more distinctly so beneath, nerves 6–8 pairs, curving upwards, obscurely anastomosing near the edge, slightly prominent on both faces, reticulations dense and raised on both faces; petiole rather slender, 1–2 cm, glabrescent. *Racemes* ramiflorous, dense-flowered nearly to the base, densely appressed-rusty tomentose; rhachis ¹/₂ mm diam. Bracts narrow-lanceolate, 1–1¹/₂ mm. Pedicels 1¹/₂ mm, mostly in twos, nearly connate to the top. *Perianth* lilac-red, *c.* 6 mm, tube ¹/₂ mm diam., limb 1 mm diam. Anthers 1¹/₂ mm. Disk glands thick, minute, cushion-shaped, free, close. *Ovary* densely rufous-pilose; style slender, glabrous. Fruit not yet known.

Distr. *Malaysia:* N. New Guinea (Sepik River region: 'Etappenberg'), once found.

Ecol. In dense rain-forest with *Pandanus*, *Agathis* and *Freycinetia*, 850 m. *Fl.* Oct.

22. Helicia arguta SLEUM. Bot. Jahrb. 70 (1939) 147; Blumea 8 (1955) 33.

Shrub, *c.* 3¹/₂ m; tips of the branchlets rather densely appressed-rufous-tomentose, glabrescent. *Leaves* elliptic-oblong, acutely rather shortly and abruptly acuminate at the apex, narrowed into the petiole, subcoriaceous, dark green to blackish-brown and shining above when dry, rusty-hairy on the midrib, finally glabrescent, rather sharply and regularly serrate, 7–9 by 3¹/₂–4 cm; midrib more distinctly elevated beneath only, nerves 6–7 pairs curved-ascending, obscurely anastomosing, slightly prominent on both sides, reticulations ± lax above, rather dense, and finely raised beneath; petiole *c.* 5 mm. *Racemes* ramiflorous, very slender, rather densely fuscous-pilose, 7–8¹/₂ cm; rhachis ³/₅ mm diam. Bracts ovate-acuminate, *c.* 1 mm. Pedicels mostly in twos and connate up to the middle, slender, fuscous-pilose, 2 mm. *Perianth* yellowish with salmon centre, *c.* 6 mm, laxly fuscous-pilose, or glabrescent from the top. Anthers 1¹/₅ mm. Disk glands subovate-oblong, connate at the base. *Ovary* rusty-hirsute; style glabrous. Fruit not known.

Distr. *Malaysia:* E. New Guinea (Central Distr.: Boridi), once found.

Ecol. In secondary forest, 1200 m. *Fl.* Nov.

23. Helicia excelsa (ROXB.) BL. Ann. Sc. Nat. II, 1 (1834) 219; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 84 *incl. var.* α & β; MEISN. in DC. Prod. 14 (1856) 441 *incl. var. edentata* MEISN.; MIQ. Fl. Ind.

Bat. 1, 1 (1858) 987; Hook. *f.* Fl. Br. Ind. 5 (1886) 191; Lecomte, Not. Syst. 1 (1909) 191; Fl. Gén. I.-C. 5 (1914) 162, f. 14(5); Gamble, J. As. Soc. Beng. 75, ii (1914) 346 *incl. var. salicifolia* (Pr.) Gamble, *var. forbesii* Gamble p. 347; Merr. J. Str. Br. R. As. Soc. *no* 85 (1922) 168; Parkinson, For. Fl. Andam. Isl. (1923) 228; Ridl. Fl. Mal. Pen. 3 (1924) 143 *incl. var.*; Bak. *f.* J. Bot. 63 (1925) Suppl. 89; Burk. Dict. (1935) 1133; Kanjilal & Das, Fl. Assam 4 (1940) 107; Suesseng. in Fedde, Rep. 54 (1951) 226 *p.p.*; Sleum. Blumea 8 (1955) 36.—*Roupala excelsa* Roxb. (Hort. Beng. 1814, 83, *nomen*) Fl. Ind. 1 (1820) 363 (*Rhopala*); ed. Carey 1 (1832) 365 (Wall. Cat. 1038); Wight, Ic. (1839) t. 190.—*H. salicifolia* Presl, Epim. (1851) 247; Meisn. in DC. Prod. 14 (1856) 439; Miq. Fl. Ind. Bat. 1, 1 (1858) 985; Kurz, For. Fl. Br. Burma 2 (1877) 312.—*Alseodaphne crassipes* Hook. *f.* Fl. Br. Ind. 5 (1886) 146; Ridl. Fl. Mal. Pen. 3 (1924) 100, *cf.* Symington, Kew Bull. (1937) 319.—*H. oblanceolata* Merr. Pap. Mich. Ac. Sc. 24 (1939) 67.

Tree 15–28 m by 30–50 cm; tips of the slender branchlets rusty-tomentose, very soon glabrescent, finally glabrous. *Leaves* ± narrow-oblong or oblanceolate or obovate-oblong, ± abruptly acuminate at the apex, subacute or obtuse, cuneate into the petiole and somewhat decurrent, chartaceous to subcoriaceous, rarely coriaceous, yellow-greenish when dry, rusty-tomentose on both faces and on the petiole when very young, but soon glabrescent, entirely glabrous at maturity and mostly shining above, less so beneath, entire or mostly with some ± coarse ± obtuse teeth on both sides in the upper part, (8–)10–15(–24) by (3–)$3^{1}/_{2}$–5(–8) cm; midrib slightly raised above, distinctly so beneath, nerves (6–)7–8(–10) pairs, rather straight in their lower part, curved upwards, ± joined along the edge, somewhat prominent on both faces, reticulations dense, slightly but well visibly raised on both faces; petiole $^{3}/_{5}$–1(–$1^{1}/_{2}$) cm. *Racemes* from the upper axils, sometimes subterminal, solitary or 2–3 together, rather slender, dense-flowered nearly to their base, mostly ± densely rusty-tomentose all over, rarely ± glabrescent, never entirely glabrous, (5–)7–12(–15) cm; rhachis 1–$1^{1}/_{2}$ mm diam. Bracts ovate-lanceolate, rather thin, 2–3 mm, often equalling the pedicels. Bracteoles minute, usually rather long persistent as are the bracts. Pedicels rather slender, 2–3(–4) mm in anthesis, mostly in twos, free or halfway connate. *Perianth* yellowish-green, fragrant, slender, rusty-tomentose or at least ± densely pilose, rarely with only some scattered rufescent hairs, (6–)7–8 mm, tube $^{1}/_{2}$ mm diam., limb 1 mm diam. Anthers *c.* $1^{1}/_{2}$ mm. Disk glands free, nearly rounded. *Ovary* ferrugineous-villous; style slender, glabrous. *Fruit* ellipsoid or obliquely ovoid, obtuse, smooth, glabrous, bluish-nigrescent, 1–$1^{1}/_{5}$ (–$1^{1}/_{2}$) by $^{4}/_{5}$–$1^{1}/_{5}$ cm; pericarp $^{4}/_{5}$–1 mm; pedicel 7–8 mm.

Distr. E. Bengal, Lower Burma, Indo-China, Siam; in *Malaysia:* Sumatra (also Simalur Isl.), Malay Peninsula, Riouw, Banka, Borneo.

Ecol. In rain-forest, on tops of low hills, jungle ridges, often along streams, scattered, from low altitudes up to 1000 m, rarely up to 1500 m. *Fl.* Jan.–May, *fr.* Apr.–June.

Use. Wood said to be hard with a light brown colour and remarkably broad rays, which are connected by close transverse bars; useful for house-construction and mines.

Vern. *Krindjing daun*, *pangkat*, *rantu*, Palemb., *kusi*, Sum. W. Coast, *tutun lasurimanu ètem*, *tutunbajut ètĕm*, *bofo ètĕm*, *tuaro batu*, *bahèneng pajo*, Simalur, *mĕmbatu laiang*, *mata kaok*, *mĕdang obu*, Mal. Pen.; Borneo: *hati buntal*, *marabomban*, Kutei, *rambai*, Sungei, *pasir-pasir*, Sandakan.

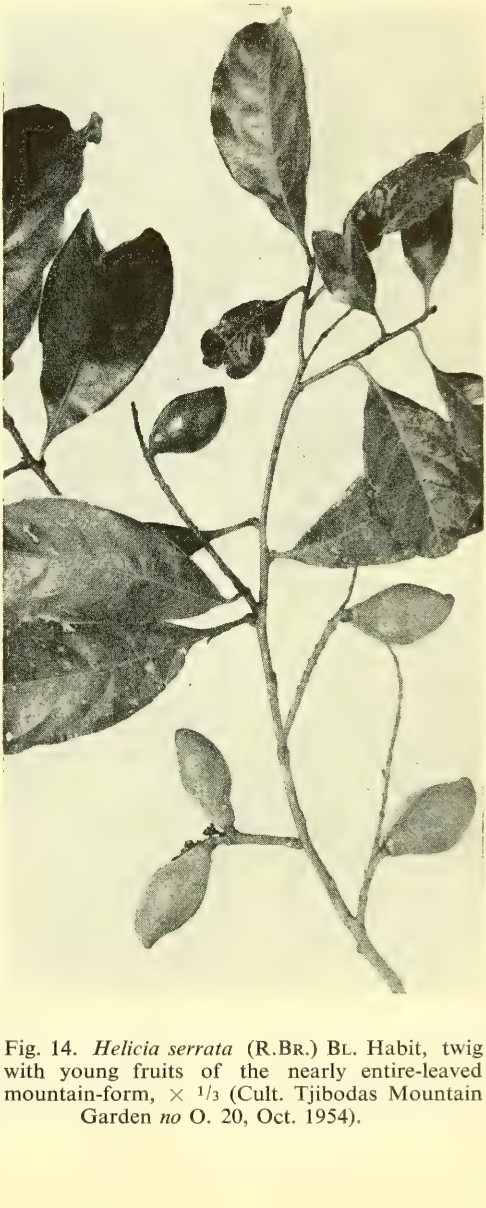

Fig. 14. *Helicia serrata* (R.Br.) Bl. Habit, twig with young fruits of the nearly entire-leaved mountain-form, × $^{1}/_{3}$ (Cult. Tjibodas Mountain Garden *no* O. 20, Oct. 1954).

24. Helicia serrata (R.BR.) BLUME, Ann. Sc. Nat. II, 1 (1834) 215; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 84; MEISN. in DC. Prod. 14 (1856) 441; MIQ. Fl. Ind. Bat. 1, 1 (1858) 987; K. & V. Bull. Inst. Bot. Btzg *no* 2 (1899) 10, *incl. var. petiolata* K.&V.; Bijdr. 5 (1900) 314 *incl. var. subintegra* K.&V. *l.c.* 315, 317; KOORD. Exk. Fl. Java 2 (1912) 154; KOORD.-SCHUM. Syst. Verz. (1913) fam. 66, p. 3; MERR. Int. Rumph. (1917) 205; KOORD. Fl. Tjib. (1923) 47; BAK. *f.* J. Bot. 63 (1925) Suppl. 89; HEYNE, Nutt. Pl. (1927) 588; OCHSE & BAKH. Groent. (1931) 621, f. 380; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 79, p. 4; SLEUM. Blumea 8 (1955) 34.—*Arbor vespertilionum* RUMPH. Herb. Amb. 7 (1755) 17, *excl.* t. 10.—*Roupala serrata* R.BR. Trans. Linn. Soc. 10 (1810) 192 (*Rhopala*); R.BR. Prod. Fl. Nov. Holl. Suppl. (1830) 32; ROXB. Fl. Ind. ed. CAREY (1832) 365.—*H. curtisii* GAMBLE, Kew Bull. (1913) 116; J. As. Soc. Beng. 75, ii (1914) 348; RIDL. Fl. Mal. Pen. 3 (1924) 142.—*H. scortechinii* GAMBLE, Kew Bull. (1913) 117; J. As. Soc. Beng. 75, ii (1914) 348; RIDL. Fl. Mal. Pen. 3 (1924) 143.—*H. brachyantha* MERR. Pap. Mich. Ac. Sc. 24 (1936) 66.—**Fig. 14–15.**

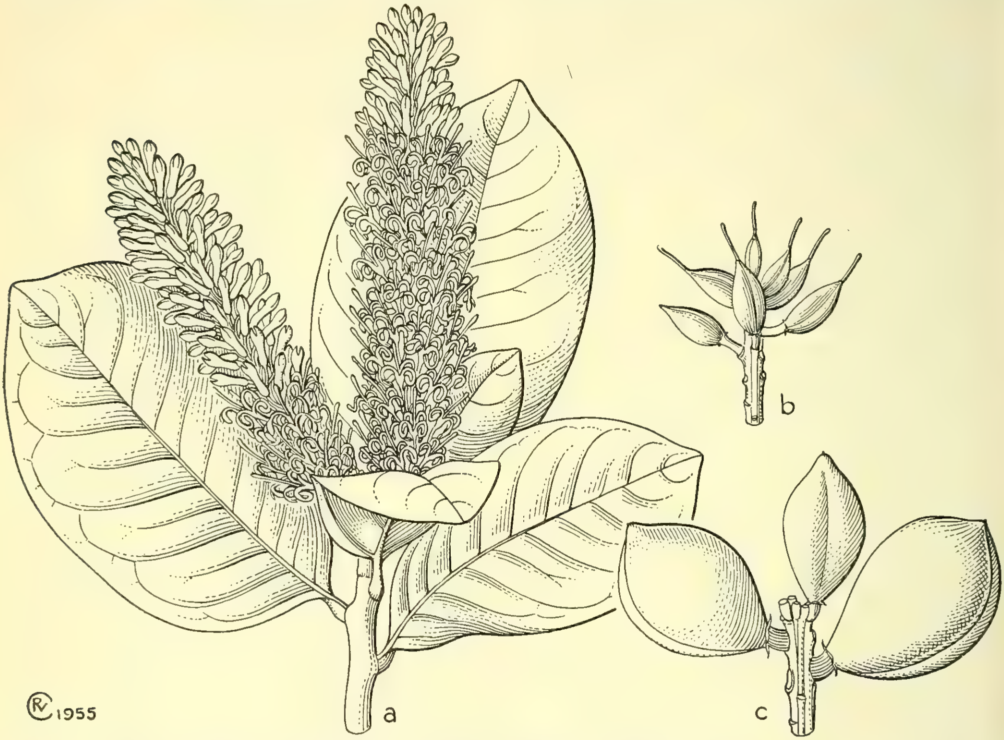

Fig. 15. *Helicia serrata* (R.BR.) BL. *var. oreophila* SLEUM. *a.* Habit, × $^{2}/_{3}$, *b.* developing fruits, × $^{2}/_{3}$, *c.* mature fruit, × $^{2}/_{3}$ (after VAN STEENIS 11668 from Mt Papandajan, 2650 m alt.).

KEY TO THE VARIETIES

Leaves subcoriaceous, oblong or elliptic-oblong, rarely lanceolate-oblong, mostly manifestly serrate, rarely subentire . . . . . . *var.* **serrata**

Leaves coriaceous, ovate-elliptic to elliptic, mostly inconspicuously serrate, or entire . *var.* **oreophila**

var. **serrata.—Fig. 14.**

Tree 10–30 m by $^{1}/_{3}$–1 m; tips of branchlets rather densely ferrugineous-sericeous, soon glabrescent. *Leaves* elliptic or elliptic-oblong, rarely lanceolate-oblong, shortly acuminate, subacute or obtuse at the apex, attenuate into a nearly winged petiole, subcoriaceous, glabrous, ± shining, yellowish or brownish-olivaceous above when dry, mostly dull brownish beneath when dry, initially with fine, rufescent, appressed hairs rather densely spread all over the under-surface, tardily glabrescent, mostly ± regularly sharply or obtusely serrate along the whole margin, rarely subserrate or entire (serrate and nearly entire leaves sometimes occurring on the same tree), (10–)12–20(–22) by (4–)5–8$^{1}/_{2}$(–12) cm; midrib not or slightly prominent above, distinctly so beneath, nerves 8–10 pairs, curved, ± obsoletely joined near the margin, nearly flat above, prominent beneath, reticulations lax, somewhat raised mostly beneath only; petiole (1–)1$^{1}/_{2}$–2 cm, glabrescent. *Racemes* axillary or ramiflorous, rather slender, dense, 9–15 cm, rather densely rufous-tomentellous, ± glabrescent with age, rarely nearly glabrous, specially when attacked by galls; rhachis *c.* 1 mm diam. Bracts minute, ovate-acuminate. Pedicels rather slender, mostly in twos and connate halfway, 2–3(–4) mm. *Perianth* white, changing to cream or light brown during anthesis, with an unpleasant, nauseating odour, 7–8(–10) mm, tube *c.* 1 mm diam., limb 1½ mm diam. Anthers 1½–2 mm. Disk glands oblong or ovate-oblong, truncate, rather thick, free and ± spaced. *Ovary* mostly densely, rarely laxly rufous-sericeous. Style slender, glabrous. *Fruit* (in Jav. specim.) ± broadly ellipsoid, somewhat oblique, shortly attenuate at the apex and base, not rarely distinctly contracted at the base, apex apiculate or obtuse, sordid-green, brown when dry, smooth, with a mostly distinctly prominent rib, (2½–)3–4(–5) by 1½–2(–2½) cm, pericarp 1–2 mm, pedicel 4–6 by 2 mm.

Distr. *Malaysia:* Sumatra, Malay Peninsula (Penang), Java, Borneo (also Karimata Isl.), Moluccas (Ambon: Nusa Laut).

Ecol. In rain-forest, in hilly country or on ridges, apparently rare in the lowland, more frequent between 1000–1600 m.

Uses. Wood honey-coloured, prettily marked by the broad yellowish medullary rays. The young shoots are eaten in Java.

Vern. *Kaju sippur*, *k.s. gading*, *k.s. tombak*, *k. si hondung*, *k. si djogar*, M (Asahan), *bareubeuj*, *kĕndung*, J, S, *kaju morsego* (after RUMPHIUS), *lepu punchu*, Borneo (Dusun Tambun).

Notes. The species has not been recollected in Nusa Laut and no fruits from Ambon have been accessible to me. The description above is of fruits from Java; those from Bornean and Karimata specimens differ markedly, being depressed-ovoid, smaller (2½ by 3 cm), and blue-black, with apparently thinner pericarp. It is possible that they agree with those of the Ambon tree, in which case *H. serrata* in its proper sense would occur in Borneo and Ambon. The Sumatra, Malay Peninsula, and Java specimens, although not discernible in leaf- and flower-characters, should then be regarded as a separate species and should be named *H. curtisii* GAMBLE.

var. **oreophila** SLEUM. Blumea 8 (1955) 35.— **Fig. 15.**

Small tree, 3–8 m, with dense crown. *Leaves* coriaceous, elliptic or ovate-elliptic, entire or nearly so. *Inflorescences* not rarely glabrescent. Perianth ± 10 mm, often glabrescent. *Ovary* laxly pilose, very rarely glabrous.

Distr. *Malaysia:* Sumatra (NW. slope of Mt Talamau), Java.

Ecol. Edge of rain-forest or subalpine brushwood, also among alang-alang in scrubs, 2000–*c.* 2650 m.

25. Helicia peltata WHITE, J. Arn. Arb. 10 (1929) 210; SLEUM. Blumea 8 (1955) 38.

Tree 18–24 m; branchlets dark rufous-tomentose. *Leaves* ovate to elliptic-ovate or elliptic, peltate almost 1 cm beyond the rounded base, ± coriaceous, apex broadly obtusely acuminate, dark olivaceous to blackish-brown when dry, rufous-pilose or tomentose on both faces when very young, glabrous and shining above at maturity except the midrib and nerves which remain pubescent for a long time, dark rufous-pilose to -velutinous all over the undersurface, entire or undulate, (10–)12–24(–34) by 6–12(–17) cm; midrib prominent on both faces, nerves 12–18 pairs, rather straight and parallel, curved near the edge and inconspicuously anastomosing, nearly flat above, prominent beneath, reticulations lax, raised beneath only; petiole rufous-tomentose, 3–4 cm by 3 mm. *Racemes* ramiflorous, dense, 12–22 cm, rufous-tomentose on rhachis and pedicels; rhachis 2 mm diam. Bracts minute, ovate-acute. Pedicels rather robust, in twos, free or connate halfway, 3–5 mm. *Perianth* cream, 25 mm, subdensely rufous-pilose, inflated at the base (2½ mm), tube 1 mm diam., limb 2½ mm diam. Anthers 3 mm. Disk glands thick, truncate, free, close, imitating a cup. *Ovary* ovoid, glabrous; style slender. Fruit unknown.

Distr. *Malaysia:* New Guinea (Central Distr.: Bisiatabu), once found, 450 m.

Uses. Sapwood pale, heart-wood light brown.

Vern. *Oraluma.*

26. Helicia microphylla DIELS, Bot. Jahrb. 54 (1916) 201; SLEUM. Blumea 8 (1955) 39.

Tree or treelet, densely branched; tips of the branchlets ferrugineous-tomentose, glabrescent. *Leaves* ovate to oblong-ovate, shortly obtusely acuminate at the apex, attenuate at the base, coriaceous, very young ones rusty-tomentose on both faces, early glabrescent above, clothed with crisp rusty hairs beneath, finally entirely glabrous, dilutely brownish when dry, shining above, dull beneath, entire, 1½–3 by 1–1⅗ cm; midrib impressed above, prominent beneath, nerves 4–5(–6) pairs, coming from the midrib at nearly right angles, straight in the lower part, curved distally, as the densely reticulated veins slightly impressed above, obscurely raised beneath; petiole slender, finally glabrescent, 3–5(–7) mm. *Racemes* axillary, solitary, strict, rather slender and dense-flowered, 4–7 cm, rusty-tomentose; rhachis 1 mm. Bracts ovate-acuminate, *c.* 1 mm. Pedicels slender, mostly in twos, connate at the base, 4–5 mm. *Perianth* yellow, 14–17 mm, tube 1 mm, limb clavate 1½ mm diam. Anthers 2½ mm. Disk glands ovate, thin, rufous-pilose or -ciliate at the upper margin, close, slightly imbricate. *Ovary* glabrous. Fruit not known.

Distr. *Malaysia:* NE. New Guinea (Madang Distr.: Bismarck Mts), once found in rain-forest, 2400 m.

27. Helicia cameronii F.v.M. Trans. R. Soc. Vict. n.s. 1^2 (1889) 7; LAUT. Bot. Jahrb. 50 (1913) 330, f. 1; SLEUM. Blumea 8 (1955) 38.

Treelet or shrub; tips of the branchlets tomentose by crisped ferrugineous or later greyish hairs, glabrescent. *Leaves* elliptic or oblong-elliptic, shortly obtusely acuminate at the apex, cuneate at the base, very young ones ± appressed-rufescent hairy specially on the midrib beneath, soon entirely glabrous, subcoriaceous, olivaceous-yellowish and dull when dry, entire or with 1–2 teeth on each side, somewhat recurved at the margin, $1^{4}/_{5}$–$2^{2}/_{5}$ by $^{4}/_{5}$–$1^{1}/_{5}$ cm; midrib slightly impressed above, prominent beneath, nerves *c.* 5 pairs rather straight below, curved upwards to the edge, very slightly impressed above, raised beneath, reticulations rather obscure; petiole 0–2 mm. *Racemes* solitary, ramiflorous, 5–$6^{1}/_{2}$ cm, dense; rhachis stoutish, $1^{1}/_{2}$ diam., laxly rufescent-pilose as are the pedicels. Bracts minute, lanceolate, caducous. Pedicels mostly in twos, connate at the base, 4–6 mm. *Perianth* 30 mm, with some rufous hairs at the base, glabrous elsewhere, tube $^{3}/_{4}$ mm across, limb gradually clavate, 4 mm by $1^{4}/_{5}$ mm. Anthers *c.* 4 mm. Disk glands ovate, close, connate at the base only. *Ovary* glabrous; style slender. Fruit unknown.

Distr. *Malaysia:* SE. New Guinea (Central Distr.: Mt Knutsford), once found.

28. Helicia pterygota SLEUM. Blumea 8 (1955) 40. —*H. erratica* (*non* HOOK. *f.*) STAPF, Trans. Linn. Soc. Bot. 4 (1894) 220; MERR. En. Born. (1921) 235.

Shrub or small tree $1^{1}/_{2}$–7 m, glabrous in all its parts. *Leaves* lanceolate or oblong-lanceolate, acute-acuminate at the apex, ± long cuneate at the base, slightly decurrent, chartaceous to subcoriaceous, olivaceous-greenish or light yellowish-green when dry, ± shining, mostly with a few remote teeth in the upper part or entire, (7–)8–11 (–14–17) by 2–$3^{1}/_{2}$(–5) cm; midrib slightly prominent above, strongly so beneath, nerves 8–9 pairs, mostly rather straight in the lower part, curved upwards and ± distinctly anastomosing, somewhat raised on both faces, reticulations rather dense and minutely prominent on both faces; petiole slender, 1–$1^{1}/_{2}$ cm. *Racemes* axillary or subterminal, laxly set with flowers nearly to the base; rhachis angular, $^{1}/_{2}$–1 mm diam. Bracts ovate-acuminate, membranous, *c.* 1 mm. Pedicels rather slender, provided with mostly one very distinct membranous wing on both sides, mostly in twos and connate for $^{1}/_{3}$–$^{1}/_{2}$, 4–5(–6) mm. *Perianth* cream-whitish or light yellowish-greenish, sometimes lavender-tinged or lemon, very slender, 11–12 mm, tube $^{2}/_{5}$–$^{1}/_{2}$ mm diam., limb elongate-ellipsoid, subacute, 1 mm diam. Anthers $1^{3}/_{5}$ mm. Disk glands ovate-oblong, truncate, ± retuse, free, close. *Ovary* glabrous; style filiform. Fruit not yet known.

Distr. *Malaysia:* Br. N. Borneo (Mt Kinabalu).

Ecol. Rain-forest ridge, 900–1500 m. *Fl.* Dec.–June.

29. Helicia microcarpa SLEUM. Blumea 8 (1955) 41.

Small tree; tips of the branchlets deep rufous-tomentose, glabrescent. *Leaves* elliptic, broadly shortly subabruptly acuminate at the apex, subacute to obtuse, broadly attenuate to nearly rounded at the base, somewhat inequilateral, subcoriaceous or stiff-chartaceous, pale yellowish-greenish when dry, rather dull on both faces, mature ones glabrous above, laxly ± crisped rufous hairy beneath specially on the midrib and nerves, entire, 4–$6^{1}/_{2}$ by 2–3 cm; midrib nearly flat above, prominent beneath, nerves *c.* 6 pairs, ± curved upwards and inarching before the edge, nearly inconspicuous above, slightly raised beneath, reticulations dense, obsolete or very slightly impressed above, visibly raised beneath; petiole rather slender, rather long, remaining tomentose, 7–10 mm. *Racemes* axillary, solitary, rather stiff and suberect, 7–11 cm incl. the peduncle 1–2 cm, densely dark rusty tomentose all over; rhachis 1–$1^{1}/_{2}$ mm diam. Bracts lanceolate, $1^{1}/_{2}$ mm. Pedicels rather robust, mostly in twos, connate at the base or halfway up, 3 mm. *Perianth* brownish, seen only in rather developed buds, probably *c.* 18 mm in anthesis, tube $^{4}/_{5}$ mm diam., limb clavate, $1^{1}/_{2}$ mm diam. in bud. Anthers *c.* $1^{3}/_{4}$ mm. Disk glands ovate-oblong, free, somewhat spaced. *Ovary* glabrous. Immature *fruit* subglobose-ellipsoid, crowned by a very slender style 18–19 mm.

Distr. *Malaysia:* E. New Guinea (Western & Central Highlands), *c.* 2350 m. *Fl.* Sept. and Nov.

30. Helicia maxwelliana GIBBS, J. Linn. Soc. Bot. 42 (1914) 131; MERR. En. Born. (1921) 235; SLEUM. Blumea 8 (1955) 42.

Small fastigiate tree, 3 m; branchlets robust, the youngest parts subangular and laxly covered by very short, appressed, rufescent hairs, older ones terete, glabrous, all dark brown. *Leaves* broadly elliptic- to obovate-oblong, broadly attenuate to rounded at the apex, with a terminal blackish gland, mostly cordate or rounded at the base or nearly auriculate, subsessile, thick-coriaceous, olivaceous-yellowish to dark brown when dry, ± shining above, dull beneath, entire or occasionally with 1–3 minute glandular teeth on both sides, glabrous, slightly revolute at the margin, 15–23 by (7–)8–11 cm; midrib slightly prominent above, very stout and prominent beneath, nerves (8–)9–10 pairs, straight in their lower part, divided or dissolute into veins before reaching the edge, ± distinctly anastomosing, prominent on both sides, reticulations rather dense and conspicuous on both faces; petiole 3–5 by 4 mm, rugulose. *Racemes* axillary, ramiflorous or cauline, solitary, 10–14 cm, dense-flowered, rather densely appressedly rufous-pilose on rhachis and pedicels, less so on the perianth; rhachis robust, *c.* 2 mm diam., terete. Bracts ovate-acuminate, 1–$1^{1}/_{2}$ mm, hairy. Pedicels stoutish, 3–4(–5) mm, mostly in twos or fours, free or connate at the base. *Perianth* white, sweet-scented, 12–13(–14) mm, tube $^{1}/_{2}$–$^{3}/_{5}$ mm, limb clavate, $1^{1}/_{2}$ mm diam. Anthers 2 mm. Disk glands ovate, connate at the base. *Ovary* glabrous. Immature *fruit* obliquely subglobose, apiculate, slightly contracted at the base.

Distr. *Malaysia:* Br. N. Borneo (Mt Kinabalu: Marai Parai). A very similar sterile specimen seen from the Malay Peninsula (Trengganu: G. Padang), *c.* 1220 m.

Ecol. In dense forest scrub or low open jungle, on edge of mossy forest, 1500–1800 m. *Fl.* Dec.–Febr., *fr.* March.

31. Helicia olivacea SLEUM. Bot. Jahrb. 70 (1939) 136; Blumea 8 (1955) 43.

Slender tree, *c.* 16 m; tips of the branchlets red-brown when dry, glabrous. *Leaves* oblong, shortly obtusely acuminate at the apex, attenuate into the petiole and ± decurrent, slightly inequilateral, chartaceous to subcoriaceous, olivaceous above, brownish beneath when dry, dull, glabrous, entire or rarely remotely subdenticulate or undulate, 11–14 by 4–5$^{1}/_{2}$ cm; midrib rather strongly raised on both faces, nerves 8–10(–12) pairs, straight and ± parallel in their lower $^{2}/_{3}$, curved upwards and anastomosing, finely raised on both faces, reticulations rather dense, minutely elevated on both faces; petiole 3–5 mm, very thickened and rugose at the base. *Racemes* ramiflorous, dense-flowered, *c.* 11 cm, laxly, appressed-rufescent hairy on rhachis and pedicels, very laxly so on the perianth; rhachis 1 mm diam. Bracts ovate-acute, minute. Pedicels 1$^{1}/_{2}$–2 mm, mostly in twos and connate at the base. *Perianth* cream 5(–6) mm, tube $^{2}/_{5}$ mm diam., limb broadly ellipsoid, 1 mm diam. Anthers 1$^{1}/_{2}$ mm. Disk glands broadly oblong, retuse, free or connate at the base only. *Ovary* glabrous. *Fruit* ellipsoid or subglobose, *c.* 3$^{1}/_{2}$ cm long, smooth, brown when dry, with small pale dots; pericarp rather hard, *c.* 4 mm.

Distr. *Malaysia:* NE. New Guinea (Morobe Distr.: Sattelberg), once found.

Ecol. In forest, 600 m. *Fl. fr.* March.

32. Helicia commutata SLEUM. Bot. Jahrb. 70 (1939) 137; Blumea 8 (1955) 43.

Branchlets practically glabrous, brown or reddish-brown. *Leaves* lanceolate-oblong, gradually attenuate towards the apex, ± acute, shortly cuneate and decurrent on the petiole, chartaceous, brownish and shining on both faces when dry, entire or obscurely and remotely glandular-denticulate, glabrous, 15–22 by 4–6 cm; midrib prominent on both faces, nerves 16–20 pairs, straight and ± parallel in their lower part, curved upwards and rather distinctly anastomosing before the edge, slightly prominent on both faces, reticulations very fine and dense, well visible on both faces; petiole *c.* 1 cm, not winged in the lowest 3–5 mm, thickened. *Racemes* axillary, slender, rather dense-flowered, 9–15 cm; rhachis subterete, 1 mm diam., glabrous as are the pedicels, or with some scattered appressed very short hairs. Bracts minute, early caducous. Pedicels slender, in twos, connate at the base, 2(–3) mm. *Perianth* slender, *c.* 9 mm, glabrous, tube $^{1}/_{2}$ mm diam., limb elongate-ellipsoid *c.* 1 mm diam. Anthers 1$^{1}/_{2}$ mm. Disk glands nearly quadrangular, free or coherent at the base. *Ovary* glabrous; style slender. Fruit unknown.

Distr. *Malaysia:* NE. New Guinea (Madang Distr.: Bismarck Mts), in forest at 1100 m, once found. *Fl.* Oct.

33. Helicia odorata DIELS, Bot. Jahrb. 54 (1916) 201; SLEUM. Blumea 8 (1955) 44.

Tree, 5–15(–20) m; tips of the branchlets brownish and glabrous. *Leaves* obovate-elliptic or more rarely obovate, shortly ± abruptly obtusely acuminate at the apex, attenuate and ± decurrent into the petiole, subcoriaceous, greyish-brownish and somewhat shining above when dry, brownish and rather dull beneath, very young ones laxly appressed-pilose, glabrescent, mature ones glabrous, entire, (4–)5–8 by (2–)2$^{1}/_{2}$–3$^{1}/_{2}$ cm; midrib prominent on both faces, nerves 4–5(–6) pairs, rather straight in their lower part, curved upwards and rather strongly anastomosing, slightly or not raised above, more distinctly so beneath, reticulations dense, finely prominent on both faces; petiole $^{1}/_{2}$–1(–1$^{1}/_{2}$) cm, at least partly winged by the decurrent blade. *Racemes* axillary, ± dense-flowered, slender, 6–10 cm; rhachis terete, dark brown when dry, 1–1$^{1}/_{5}$ mm diam., very laxly appressed rusty-pilose or glabrous. Bracts ovate-lanceolate, nearly subulate, *c.* $^{1}/_{2}$ mm, subpersistent. Pedicels slender, mostly in twos, connate at the base, glabrous, 4–5 mm. *Perianth* white, fragrant, *c.* 12 mm, glabrous, tube $^{1}/_{2}$ mm diam., limb ellipsoid, 2 by 1$^{1}/_{2}$ mm. Anthers *c.* 2 mm. Disk glands ovate, free, ± close. *Ovary* glabrous. *Fruit* obovoid, slightly attenuate at the very base, *c.* 5 by 4–4$^{1}/_{2}$ cm, pericarp coriaceous, 4 mm; pedicel 1 by 0.3–$^{2}/_{5}$ cm.

Distr. *Malaysia:* N. New Guinea (Sepik: Hunsteinspitze; Habbema Lake; Wissel Lakes).

Ecol. In old or secondary moss-forest, 1300–2800 m. *Fl.* Febr., March, July; *fr.* Oct.

Vern. *Ijonneh*, Enarotali, Kapauku language.

34. Helicia teysmanniana SLEUM. Blumea 8 (1955) 44.

Small tree; branchlets glabrous, brownish when dry. *Leaves* obovate or mostly oblong-obovate, gradually attenuate towards the obtuse apex, with a rather thick, terminal gland underneath, cuneate and decurrent towards the base of the petiole, subcoriaceous, mostly brownish-yellowish when dry, rarely darker brown, somewhat shining on both faces, glabrous, entire, 4–7 by (2–)2$^{1}/_{2}$–3$^{1}/_{2}$ cm; midrib slightly prominent above, more distinctly so beneath, often somewhat reddish in dry specimens, nerves 4–5 pairs, straight in their lower half, curved upwards near the edge and ± distinctly anastomosing, slightly raised above, more so beneath, reticulations dense, prominent beneath, slightly or not so above; petiole $^{1}/_{2}$–1 cm, much thickened and soon corky at the base. *Racemes* axillary, rather dense, 6–14 cm; rhachis angular, dilutely brown when dry, appressedly rufescent-pilose in the lower part, glabrescent towards the top, 1$^{1}/_{2}$–2 mm diam. Bracts narrow-ovate or lanceolate, acute, 2 mm, subpersistent. Pedicels thickened towards the apex, mostly in twos, shortly connate at the base, hairy below, glabrous above, 5–6 mm. *Perianth* yellowish, not rarely red or violet-tinged specially at the top and/or the base, 12–13 mm, tube $^{1}/_{2}$ mm diam., limb gradually clavate, 3 by 1$^{1}/_{5}$–1$^{1}/_{2}$ mm. Anthers 2$^{1}/_{2}$ mm. Disk glands oblong, free, spaced. Ovary glabrous. Fruit not known.

Distr. *Malaysia:* SE. Celebes (Bonthain Peak).

Ecol. In rain-forest 1700–2600 m. *Fl.* June.

Vern. *Katji-katji*, *ani-anisi*, Bonthain.

35. Helicia acutifolia Sleum. Bot. Jahrb. 70 (1939) 140; Blumea 8 (1955) 45.

Small tree *c.* 6 m; tips of the branchlets appressedly rufous-pilose, glabrescent. *Leaves* oblong or oblong-lanceolate, gradually subcaudate-acuminate at the apex, acute, attenuate and ± decurrent into the petiole, sometimes to near its base, brown and ± dull when dry, chartaceous, entire, rarely with a few minute teeth in the upper half on each side, 5–10 by 2–3 cm; midrib slightly prominent above, rather strongly so beneath, nerves *c.* 8 pairs, straight below, curved upwards, obscurely inarching, slightly raised on both faces, reticulations dense, minutely prominent on both faces; petiole slender, 4–5 mm. *Racemes* from the upper axils, slender, 7–12 cm, rather dense-flowered, sparsely appressedly rufous hairy all over; rhachis ½–⅘ mm diam. Bracts minute, early caducous. Pedicels often in twos, free or connate at the base, 2–3 mm. *Perianth* yellowish-whitish, 9 mm in mature buds, tube ½ mm diam., limb subacute, *c.* 1 mm diam. Anthers 1⅕ mm. Disk glands subquadrangular, free except their bases. *Ovary* glabrous; style slender. Fruit unknown.

Distr. *Malaysia:* SE. New Guinea (Central Div.: Mt Victoria), once found.

Ecol. In secondary forest, *c.* 2040 m. *Fl.* Jan.

36. Helicia saruwagedica Sleum. Bot. Jahrb. 70 (1939) 138; Blumea 8 (1955) 45.

Small bushy tree, *c.* 5 m; branchlets glabrous. *Leaves* lanceolate-oblong to broadly oblong, shortly obtusely attenuate at the apex, broadly cuneate to nearly rounded at the base, rather stiffly subcoriaceous, very young ones blackish-brownish-olivaceous above, brownish underneath when dry, moderately glossy on both faces specially above, entire, (8–)10–15(–19) by (3½–)4–6(–8–10) cm; midrib slightly raised above, very prominent beneath, nerves 7–8 pairs, elevated on both faces, upper ones sometimes rather straight, lower ones or all together somewhat curved, a little raised on both faces, reticulations lax, minutely elevated, mostly well visible beneath; petiole 2–7 mm, thickened, rugose. *Racemes* axillary, ± pendulous, rather dense, 8–14(–18) cm, glabrous or nearly so; rhachis almost terete, 1–1½ mm diam. Bracts minute, acute, nearly scariose. Pedicels mostly in twos, connate at the base, 3–4 mm. *Perianth* pale yellow, sometimes yellowish-greenish or reddish, 10–12(–13) mm, tube ⅗ mm diam., limb ellipsoid, 1½ mm diam. Anthers 1½ mm. Disk glands subquadrangular, free, close. *Ovary* glabrous; style strikingly thickened towards the apex. Submature *fruit* obliquely narrow-ellipsoid, subfusiform, acuminate into a marked ± curved beak, almost truncate at the base, smooth, 3–3½ by 1½–1¾ cm, green when fresh, finally nigrescent.

Distr. *Malaysia:* NE. New Guinea (Morobe Distr.: Mt Saruwaged; Western Highlands: Mt Hagen).

Ecol. In mountain bush, 1000–1800 m. *Fl.* Jan.–June.

37. Helicia saurauioides Sleum. Blumea 8 (1955) 46.

Tree? Tips of the branchlets densely, appressedly rufous-pilose, glabrescent. *Leaves* oblong or subobovate-oblong, very shortly obtusely acuminate towards the apex, obtuse or nearly rounded, broadly cuneate into the petiole and somewhat decurrent, subcoriaceous, brown when dry, ± shining above, dull beneath, entire or remotely glandular-denticulate in the upper half, very young ones rather densely, appressedly rufous-pilose on both faces, at maturity entirely glabrous above, ± persistently and rather densely pilose on midrib and nerves, laxly so on the intervenium beneath, (13–)15–26 by (5½–)6½–11 cm; midrib markedly raised on both faces, nerves *c.* 18–20 pairs, slightly curved and ± parallel, excurrent along the edge or obscurely anastomosing, slightly prominent above, distinctly so beneath, reticulations very dense and minutely, but well visibly prominent; petiole ± pubescent, very thickened and rugose in the lower part, ½–1 cm. *Racemes* axillary, rather dense, 10–16 cm, erect, ± densely covered with short, appressed, rufous hairs; rhachis terete, 1½ mm diam. Bracts ovate-lanceolate, 1 mm, ± caducous. Pedicels mostly in twos, connate at the base, 1 mm. *Perianth* seen only in bud, probably 8–9 mm, tube ½ mm diam., limb shortly clavate *c.* 1 mm diam. Anthers 1⅕ mm. Disk glands free, close. *Ovary* glabrous; style after anthesis 8–9 mm. Fruit unknown.

Distr. *Malaysia:* W. New Guinea (Wissel Lakes), once found.

Ecol. In rain-forest. *Fl.* Oct.

38. Helicia latifolia White, Proc. R. Soc. Queensl. 34 (1922) 26; Sleum. Bot. Jahrb. 69 (1938) 132, *in clav.*; Blumea 8 (1955) 46.

Tree 8–24 m, bole up to 10–15 m; branchlets glabrous. *Leaves* broadly elliptic-oblong, very shortly acuminate, apex obtuse, cuneate into a very short petiole, coriaceous, dark olivaceous-brownish when dry, shining on both faces especially above, glabrous, entire, (13–)15–22 by (6½–)7–11 cm; midrib thick, prominent on both faces especially beneath, nerves 6–7 pairs curved-ascending, indistinctly inarched near the edge, ± manifestly prominent above, always distinctly so beneath, reticulations very dense finely raised on both faces, especially beneath; petiole stout, 2–4(–6) by 3–4 mm. *Racemes* probably axillary, rather slender, *c.* 16 cm, laxly set with flowers; rhachis *c.* 1⅓ mm diam., terete, laxly covered with fine, short, appressed, rufescent hairs as are the pedicels, the latter solitary or in pairs, connate at the base, rather slender, 3–4 mm. *Perianth* said to be sparsely hairy and 9 mm long. Disk glands broadly ovate, free, close. *Ovary* glabrous. *Fruit* obliquely obovoid-ellipsoid, not beaked, 3–4 by *c.* 2½ cm.

Distr. Melanesia (New Britain); in *Malaysia:* New Guinea (N. & Central Distr.; Milne Bay).

Ecol. In rain-forest, on coral limestone outcrops (Jacquinot Bay), on deep volcanic soil (Open Bay), or on slopes of an iron stone-gravel capped ridge (Milne Bay), from the lowland up to 500 m. *Fl.* Aug., *fr.* June.

Note. In leaf-characters similar to *H. saruwagedica*, but fruit apparently not beaked.

Uses. Heart-wood brownish.

Vern. *Garramuta*, Waigani, *ohesali*, Upper Waria.

39. Helicia moluccana (R.BR.) BL. Ann. Sc. Nat. II, 1 (1834) 216 *quoad pl. molucc.*; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 83; MEISN. in DC. Prod. 14 (1856) 438; MIQ. Fl. Ind. Bat. 1, 1 (1858) 983; Ann. Mus. Bot. Lugd. Bat. 1 (1864) 204; MERR. Philip. J. Sc. 11 (1916) Bot. 267; SLEUM. Blumea 8 (1955) 47.—*Roupala moluccana* R.BR. Trans. Linn. Soc. 10 (1810) 191 *(Rhopala)*, *nec* JACK (1820) *nec* ROXB. (1820); R. & S. Syst. Veg. 3 (1818) 429; SPRENG. Syst. Veg. 1 (1825) 482.—*H. amboinensis* MIQ. Ann. Mus. Bot. Lugd. Bat. 1 (1864) 204.—*H. obtusidens* MIQ. *l.c.* 204.

Tree (6–)15–25 m, buttressed up to $1^2/_5$ m high when old; tips of the branchlets densely covered with short, distinctly appressed, rufescent hairs, glabrescent. *Leaves* oblong or elliptic-oblong or obovate-oblong, sometimes lanceolate-oblong, rarely obovate, shortly obtusely acuminate at the apex, cuneate and ± decurrent into the petiole, very young ones laxly clothed on both faces with fine, appressed, rufescent hairs, glabrescent except the midrib which is mostly more densely and for a longer time hairy, subcoriaceous to coriaceous, dark olivaceous- or brownish and shining above when dry, ± dark brown and dull beneath, entire or occasionally with few incurved teeth in the upper half, rarely ± deeply uncinate-serrate along the whole margin, (9–)12–23(–27) by (4–)5–8(–11) cm; midrib prominent on both faces specially beneath, nerves 8–10(–12) pairs, curved and ascending along the margin, not or obscurely inarching, slightly prominent on both faces, reticulations very dense, minutely raised on both faces; petiole stoutish, 2–5(–10) mm, ± winged, very thickened and rough at the base, finally glabrescent. *Racemes* mostly solitary, axillary or ramiflorous, rather slender, dense, 7–15 cm, laxly to subdensely appressedly rufous-hairy; rhachis 1–$1^1/_2$ mm. Bracts ovate-acuminate, acute, 1 mm, ± caducous. Pedicels 2–4(rarely up to 5) mm, mostly in twos, connate at the base, rather slender. *Perianth* whitish or greenish or yellowish, fragrant, slender, 7–8(–9) mm, mostly sparsely, appressedly rufous-pilose, tube $^1/_2$ mm diam., limb ellipsoid, $1^1/_2$ mm diam. Anthers $1^4/_5$–$2^1/_2$ mm. Disk glands orange-red when fresh, broadly ovate to suborbicular, truncate and ± minutely crenulate or retuse, free, very close, seemingly connate. *Ovary* glabrous; style slender. *Fruit* obliquely ellipsoid or ovoid, sometimes somewhat compressed laterally, ± apiculate, attenuate to nearly rounded at the base, $2^1/_2$–3 (–$3^1/_2$) by 2–$2^1/_2$(–3) cm, pericarp leathery, ± hard, 2–3 mm, lateral ridge manifest; pedicel 5–6 mm.

Distr. *Malaysia:* Moluccas (Talaud, Halmaheira, Ternate, Tidore, Buru, Ambon) and possibly W. and N. New Guinea (Wissel Lake region; Rouffaer River; Idenburg River).

Ecol. In primary rain-forest, rare and scattered, but occasionally common, from 150–800 m in the Moluccas, in New Guinea from 300–1750 m. *Fl.* Jan.–Dec., *fr.* March.

Vern. *Dito ro*, Halmaheira (Wajoli), *suling*, Ternate, *kapangat*, Buru, *ay lomamar dawon ketjil*, *a.l. daun besar*, *parudang*, *turut nama*, Ambon.

Note. The poor New Guinea material known up till now is similar in flowers but somewhat different in nervation; fruits are unknown.

40. Helicia peekelii LAUT. Bot. Jahrb. 45 (1911) 359; *l.c.* 50 (1913) 331; SLEUM. *ibid.* 69 (1938) 131, *in clav.*; Blumea 8 (1955) 48.

Treelet; tips of the branchlets rufous-pilose, glabrescent. *Leaves* broadly oblong, apex shortly rather abruptly acuminate, obtuse, cuneate and decurrent into the petiole, subsessile, chartaceous to subcoriaceous, olivaceous and ± shining above when dry, paler and ± dull beneath, glabrous, entire, 16–19 by *c.* 7 cm; midrib prominent on both faces, nerves 6–7 pairs, curved upwards, rather spaced, ± distinctly inarching before the edge, slightly prominent above, more conspicuously so beneath, reticulations dense and slightly raised on both faces; petiole thick, rugose, 2–3 mm. *Racemes* apparently ramiflorous, dense, 12–16 cm, rather laxly clothed with appressed, rufous hairs on rhachis and pedicels, very laxly so on the perianth; rhachis $1^1/_2$ mm diam. Bracts ovate-acuminate, acute, *c.* 1 mm. Pedicels slender, mostly in twos, free or connate at the very base, 6–7 mm in anthesis. *Perianth* 11 mm, tube $^3/_5$ mm diam., glabrous or subglabrous, limb clavate $1^1/_2$ mm diam. Anthers 2 mm. Disk glands subquadrangular, connate into a crenate cup. *Ovary* glabrous; style slender. Fruit unknown.

Distr. *Melanesia:* New Ireland (Namatanai), once found.

Note. Rather close to *H. moluccana* in habit, but different, besides by the characters given in the key, by other minor features: thinner leaves, more spaced and more distinctly inarched nerves, disk glands more connate.

41. Helicia neglecta DIELS *ex* SLEUM. Bot. Jahrb. 70 (1939) 135; Blumea 8 (1955) 49.

Tree? Branchlets glabrous. *Leaves* oblong, gradually obtusely acuminate at the apex, cuneate and somewhat decurrent into the petiole, subsessile, olivaceous-green and rather shining above when dry, brownish and ± dull beneath, glabrous, rather coarsely subsinuate-serrate, 18–25 by 8–$9^1/_2$ cm; midrib slightly prominent above, conspicuously so beneath, nerves *c.* 14 pairs slightly curved and ascending, ± parallel, somewhat impressed above when dry, sharply prominent beneath, reticulations lax, nearly obscure above, minutely raised beneath; petiole 4–5 by 2–3 mm, thickened and rugose at the base. *Racemes* axillary, solitary, dense, *c.* $11^1/_2$ cm incl. the peduncle 2 cm, laxly clothed with fine, appressed, rufous hairs all over; rhachis angular, $1^1/_2$ mm diam. Bracts ovate, minute, very early caducous. Pedicels mostly in twos, connate at the base, rather robust, 6–7 mm, accrescent up to 9 mm. *Perianth* 12 mm, tube $^1/_2$ mm diam., limb ellipsoid, $1^1/_2$ mm diam. Anthers 2 mm. Disk glands connate in a low ring. *Ovary* glabrous; style slender. Fruit unknown.

Distr. *Melanesia:* New Ireland (Ugana), once found.

Ecol. In secondary forest, 100 m. *Fl.* July.

42. Helicia retevenia SLEUM. Bot. Jahrb. 70 (1939) 141; Blumea 8 (1955) 50.

Treelet; tips of the branchlets angular, minutely appressed pilose, glabrescent. *Leaves* obovate-oblong, ± rounded at the apex, attenuate and somewhat decurrent into the petiole, subcoriaceous, rather rigid, glabrous except the midrib in not yet fully developed leaves, olivaceous-brownish when dry, shining above, dull beneath, entire, slightly revolute at the margin, 6–8 by $2^1/_4$–$2^1/_2$ (–$3^1/_2$) cm; midrib prominent on both faces, nerves 8–9 pairs, straight in their lower part, curved upwards and anastomosing near the edge, markedly impressed above, slightly raised beneath, veins and veinlets rather densely reticulated and impressed above, nearly obscure beneath; petiole slender, *c.* 1 cm. *Racemes* axillary, rather dense, glabrous, *c.* 8 cm; rhachis slender, angular, 1 mm diam. Bracts lanceolate, acute, nearly 1 mm. Pedicels rather slender, mostly in twos and connate up to $^1/_3$, 4–5 mm. *Perianth* slender, 15–16 mm, $^1/_2$ mm diam., limb $1^1/_5$ mm diam. Anthers *c.* $2^1/_2$ mm. Disk glands oblong-ovate, halfway connate, forming a crenate cup. *Ovary* glabrous. Fruit not known.

Distr. *Malaysia:* SE. New Guinea (Central Distr.: Mt Victoria, below the 'Gap'), once found, *c.* 1980 m. *Fl.* Dec.

43. Helicia macrostachya LAUT. Bot. Jahrb. 50 (1913) 332; SLEUM. Blumea 8 (1955) 49.

Small tree; branchlets glabrous, angular at the tips, later subterete. *Leaves* obovate-oblong or obovate, very broadly attenuate and obtuse to nearly rounded at the apex, cuneate and decurrent into the very short petiole, coriaceous or subcoriaceous, black or blackish-brownish when dry, shining above, not or slightly so beneath, glabrous, entire, 14–17 by 5–6 cm; midrib slightly prominent above, strongly so beneath, nerves *c.* 7 pairs steeply ascending from the midrib, rather straight in their lower part, curved in the upper one and obscurely anastomosing, prominent on both faces, reticulations dense, finely raised on both faces; petiole stout, *c.* 2 mm. *Racemes* ramiflorous, robust, rather laxly flowered, *c.* 42 cm incl. the peduncle 2 cm, laxly appressedly rufous-pilose on rhachis and pedicels; rhachis subterete, *c.* $2^1/_2$ mm diam. Bracts ovate-acuminate, minute. Pedicels mostly in twos, connate up to $^1/_3$ their length, rather slender, 4–5 mm. *Perianth* *c.* 20 mm, glabrous, tube *c.* $^4/_5$ mm, limb elongate-ellipsoid, $1^1/_2$–2 mm diam. Anthers $3^1/_2$ mm. Disk glands ovate, free, close. *Ovary* glabrous. Fruit unknown.

Distr. *Malaysia:* NE. New Guinea (Morobe Distr., Waria River region: Pema), once found.

Ecol. Mountain-forest, *c.* 400 m. *Fl.* May.

44. Helicia obtusata SLEUM. Bot. Jahrb. 70 (1939) 139; Blumea 8 (1955) 51.

Tall tree, 20–60 cm diam.; branchlets red-brown, glabrous. *Leaves* obovate, very broadly attenuate and obtuse or mostly rounded at the apex, sometimes slightly emarginate, cuneate and decurrent nearly to the base of the petiole, coriaceous, glabrous, yellowish-olivaceous or brownish and somewhat shining above when dry, dull brown beneath, entire, 11–14(–18) by $5^1/_2$–7(–$9^1/_2$) cm; midrib prominent on both faces, robust beneath; nerves (9–)10–11 pairs, coming from the midrib at ± right angles, rather straight in the lower $^2/_3$, bifid and ± distinctly curved-anastomosing, slightly prominent above, more distinctly so beneath, reticulations rather dense, minutely but well visibly raised on both faces; petiole $^1/_2$–1(–$1^1/_2$) cm, ± distinctly winged, robust, thickened and rugose at the base. *Racemes* axillary, stout, dense, practically glabrous, 10–14 cm, nigrescent; rhachis angled, *c.* $2^1/_2$ mm diam. Bracts ovate-acute, 1 mm, subpersistent. Pedicels in twos, rather robust, connate at the base, 5–7 mm. *Perianth* white, cream or yellowish-green, *c.* 20 mm, tube $^4/_5$–1 mm diam., limb clavate, subacute, *c.* $2^1/_5$ mm diam. Anthers *c.* 4 mm. Disk glands broadly ovate, nearly quadrangular, free, close. *Ovary* glabrous. Fruit not known.

Distr. *Malaysia:* NE. New Guinea (Morobe Distr.: Sattelberg-Mt Saruwaged region).

Ecol. In hill forest, 1200–1800 m. *Fl.* Febr.–June.

45. Helicia archboldiana SLEUM. Blumea 8 (1955) 51.

Small tree, 3 m; branchlets subterete, glabrous. *Leaves* elliptic or oblong-elliptic, shortly rather abruptly acuminate at the apex, subacute or obtuse, broadly cuneate and decurrent into the petiole, thinly coriaceous, somewhat shining and dark red-brown on both faces when dry, glabrous, rather regularly subserrate-denticulate, 8–12 by 4–6 cm; midrib prominent on both faces, nerves *c.* 10 pairs, coming from the midrib at ± right angles, straight below, curved upwards and anastomosing before the edge, slightly prominent on both faces, reticulations very dense, finely but well visibly raised on both faces; petiole $^1/_2$–1 cm, winged nearly to the rugose and thickened base. *Racemes* (one seen) ramiflorous, *c.* 15 cm, ± densely covered with appressed, rufous, very short subsetose hairs on rhachis and pedicels, laxly so on the perianth; rhachis terete, rather slender, 1–$1^1/_3$ mm diam. Bracts ovate-acuminate, minute, hairy. Pedicels solitary or in twos, connate at the very base, rather slender, 3 mm. *Perianth* green, changing to violet at the base, 22–23 mm, tube $^1/_2$ mm diam., limb elongate-ellipsoid, subacute, $1^1/_2$ mm diam. Anthers *c.* 2 mm. Disk glands subquadrangular or obovate-truncate, free, close, upper margin minutely denticulate or crenulate. *Ovary* glabrous; style slender, elongate-clavate towards the apex. Fruit unknown.

Distr. *Malaysia:* N. New Guinea (Idenburg River), once found.

Ecol. In mossy forest-undergrowth, 1600 m. *Fl.* Febr.

46. Helicia wollastonii RIDL. Trans. Linn. Soc. Bot. 9 (1916) 145; SLEUM. Bot. Jahrb. 69 (1938) 132; Blumea 8 (1955) 52.

Tree or treelet? Branchlets terete, glabrous, shining. *Leaves* obovate-oblong or obovate, shortly subcuspidate-acuminate, acute or obtuse at the apex, cuneate and ± decurrent into the petiole, subcoriaceous or firmly chartaceous, glabrous, shining and brown or sordid-olivaceous above, rather dull and brown beneath when dry, entire, 12–17 by 5–7 cm; midrib distinctly raised on both faces, nerves 7–8 pairs curved upwards and manifestly joined together, deeply impressed above when dry, sharply prominent beneath, reticulations dense and finely prominent on both faces; petiole rather robust, 1–1$^1/_2$ cm, narrow-winged nearly to the base, thickened and transversely rugose at the base. *Racemes* axillary, slender, laxly flowered nearly to the base, 10–15 cm, glabrous in all parts; rhachis striate, subterete, *c.* 1$^1/_5$ mm diam. Bracts subulate, very minute. Pedicels slender, mostly in twos, connate at the base, 5–6 mm. Perianth light yellow, nigrescent when dry, 15–16 mm, tube $^2/_5$–$^1/_2$ mm diam., limb ellipsoid 1$^1/_2$ mm diam. Anthers *c.* 2 mm. Disk glands ovate to nearly rounded, rather fleshy, free, close. *Ovary* glabrous. *Fruit* ellipsoid, slightly wider below the middle, apiculate, ± attenuate at the base, 2$^1/_2$ by 1$^4/_5$ cm, pericarp 2 mm.

Distr. *Malaysia:* S. New Guinea (Utakwa River region), once found.

Ecol. Lowland rain-forest, 45 m. *Fl.* Oct.–Nov.

47. Helicia affinis SLEUM. Bot. Jahrb. 70 (1939) 137; Blumea 8 (1955) 53.—*H. moluccana* (*non* (R.BR.) BL.) LAUT. *l.c.* 50 (1913) 331.

Small tree; branchlets terete, red-brown. *Leaves* oblong or obovate-oblong, broadly and obtusely acuminate at the apex, cuneate and decurrent into the petiole, firmly chartaceous, glabrous, brown when dry, slightly paler beneath, somewhat shining on both faces, entire, (16–)21–30 by (6$^1/_2$–)7$^1/_2$–10 (–13) cm; midrib prominent specially beneath, nerves 8–9 pairs, curved-ascending and excurrent along the margin, not anastomosing, slightly raised above, sharply so beneath, reticulations dense, minutely elevated on both faces; petiole 4–5 by 3–4 mm, rugose. *Racemes* from the upper axils, densely flowered nearly to the base, 14–22 cm, rather densely short-appressedly rufescent hairy on the rhachis, laxly or very laxly so on pedicels and perianths; rhachis terete, 1$^1/_2$ mm diam. Bracts ovate, very acute, minute. Pedicels mostly in twos and connate at the base, 2–3 mm. *Perianth* 14–15 mm, tube $^1/_2$ mm diam., limb ellipsoid 1$^1/_3$ mm diam. Anthers 2 mm. Disk glands broadly oblong or subquadrangular, free or coherent at the base. *Ovary* glabrous; style slender. Fruit not known.

Distr. *Malaysia:* NE. New Guinea (Madang Distr.: Kani Mts).

Ecol. Rain-forest, 600–1100 m. *Fl.* Jan., May.

48. Helicia clemensiae SLEUM. Bot. Jahrb. 70 (1939) 139; Blumea 8 (1955) 54.

Small tree; tips of the branchlets somewhat compressed, appressedly rufous-pilose, glabrescent. *Leaves* obovate, ± rounded at the apex, cuneate towards the obtuse or truncate base, olivaceous above when dry, darker beneath, or mostly becoming dark brownish or nearly blackish, somewhat shining on both faces, glabrous, entire (14–)19–26 by (8–)9–14 cm; midrib prominent especially beneath, nerves *c.* 10 pairs arcuate-ascending, not or only the uppermost ones obscurely inarching near the edge, slightly raised above, sharply prominent beneath, reticulations lax, raised specially beneath; petiole 3–4 by 2–3 mm, rugose with age. *Racemes* axillary or ramiflorous, dense, 16–19 cm, rather densely to laxly fine appressedly rufescent-hairy on the rhachis and pedicels, very laxly so on the perianth; rhachis 1$^1/_2$–2 mm. Bracts ovate-lanceolate, acute, 1 mm. Pedicels rather robust, solitary or in pairs and connate at the very base, 5–6(–7) mm. *Perianth* white, 28–30 mm, tube $^3/_5$–$^4/_5$ mm diam., limb elongate-clavate, 6–7 by 2 mm. Anthers 5–6 mm. Disk glands connate into a flat, minutely erose or denticulate cup. *Ovary* glabrous; style stoutish, elongate-fusiform at the top.

Distr. *Malaysia:* NE. New Guinea (Morobe Distr.: Sattelberg region).

Ecol. In hill-forest, 600 m. *Fl.* Jan.

49. Helicia forbesiana F.v.M. Vict. Nat. 3 (1886) 63; Bot. Centralbl. 29 (1887) 84; Descr. Not. 9 (1890) 61; BAIL. Queensl. Agr. J. 24 (1910) 22; LAUT. Bot. Jahrb. 50 (1913) 331; SP. MOORE, J. Bot. 61 (1923) Suppl. 43; SLEUM. Bot. Jahrb. 70 (1939) 139; Blumea 8 (1955) 54.

Tree *c.* 15 m; tips of the branchlets rather densely, appressedly rufous-pilose. *Leaves* lanceolate or oblong-lanceolate, not rarely oblanceolate or obovate-oblong, rather abruptly acuminate at the apex, subacute or blunt, gradually cuneate towards the subacute base and ± distinctly decurrent, subcoriaceous, yellowish-olivaceous or brownish and ± shining above, mostly dull brown beneath when dry, glabrous, entire, rarely remotely denticulate, 15–25(–30) by 5–8(–11) cm; midrib robust and prominent on both faces, nerves 9–10 pairs, curved-ascending and ± distinctly inarching, mostly slightly impressed above in dry specimens, prominent beneath, reticulations rather dense and conspicuous at least underneath, veinlets faint; petiole 3–8 by 2–4 mm, glabrous, rugose at the very thickened base. *Racemes* ramiflorous, dense, 10–15 cm incl. the peduncle 2 cm, rather densely appressedly rufous hairy on rhachis and pedicels, very laxly so on the perianth; rhachis rigid, 2–3 mm diam. near the base. Bracts elongate-ovate, subacute, 1–1$^1/_2$ mm. Pedicels rather robust, 6–9 mm, mostly in twos and connate at the very base. *Perianth* white, rather stiff, 25–28 mm, tube $^3/_5$–1 mm diam., limb gradually clavate 5–6 by 2–2$^1/_2$ mm. Anthers *c.* 4 mm. Disk glands connate into a flat crenulate or obscurely 4-dentate cup. *Ovary* glabrous; style rather robust, glabrous. Immature *fruit* obliquely ovoid.

Distr. *Malaysia:* SE. New Guinea (Central and North. Distr.).

Ecol. In forest, generally at 600–1500 m, once found in tall regrowth forest (with bigger leaves) at 25 m. *Fl.* Aug.–Nov.

50. Helicia finis-terrae LAUT. Bot. Jahrb. 50 (1913) 332; SLEUM. Blumea 8 (1955) 60.

Small tree; branchlets terete, glabrous. *Leaves* obovate or broadly obovate-oblong, broadly attenuate and obtuse at the apex, shortly cuneate and manifestly decurrent into the petiole, ± coriaceous, brown when dry, somewhat shining above, dull beneath, glabrous, entire, slightly revolute at the margin, 30–36 by (12–)13–16 cm; midrib strongly prominent on both faces, nerves 9–10 pairs curved-ascending, ± excurrent near the edge, obscurely inarched, slightly prominent above, more so and distinct beneath, reticulations dense, slightly raised on both faces; petiole 5–7 mm, very thick and rugose. *Racemes* ramiflorous, *c.* 22 cm, rather dense, glabrous except some appressed, very short, rufescent hairs on rhachis and pedicels; rhachis stout, terete, with numerous minute tubercles, *c.* 2¹/₂ mm diam. Bracts minute. Pedicels in twos, connate at the base, 3 mm. *Perianth* (15–)16–17 mm, tube *c.* ³/₅ mm diam., limb ellipsoid rounded-obtuse at the top, 1¹/₂–1⁴/₅ mm diam. Anthers *c.* 3 mm. Disk glands nearly rounded, truncate, free, close. *Ovary* glabrous. Fruit unknown.

Distr. *Malaysia:* N. New Guinea (Finisterre Mts), once found.

Ecol. In rain-forest, 1200 m. *Fl.* Nov.

Uses. Heart-wood brown, rays very distinct.

Vern. *Kisi kisi*, Orokaiva dial. (Mumuni), *togona*, Boku.

51. Helicia robusta (ROXB.) R.BR. *ex* WALL. Cat. (1831) *sub no* 2702; BL. Ann. Sc. Nat. II, 1 (1834) 220; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 83; HASSK. Cat. Hort. Bog. (1844) 94; MEISN. in DC. Prod. 14 (1856) 440; MIQ. Fl. Ind. Bat. 1, 1 (1858) 986; BEDD. Man. (1872) 173; Fl. Sylv. (1873) t. 301; KURZ, Fl. Burm. 2 (1877) 311; F.-VILL. Nov. App. (1880) 182; HOOK. *f.* Fl. Br. Ind. 5 (1886) 191; BOERL. Handl. 3, 1 (1900) 151; GAMBLE, J. As. Soc. Beng. 75, ii (1914) 344; RIDL. Fl. Mal. Pen. 3 (1924) 142; GAMBLE, Fl. Madras 2 (1925) 1243; BAK. *f.* J. Bot. 63 (1925) Suppl. 89; KANJILAL & DAS, Fl. Assam 4 (1940) 106; SUESSENG. in Fedde, Rep. 54 (1951) 225; SLEUM. Blumea 8 (1955) 55.—*Roupala robusta* ROXB. Fl. Ind. ed. CAREY & WALL. 1 (1820) 366 (*Rhopala*); SPRENG. Syst. Veg. 1 (1825) 482 (*pro parte, parte alt. = H. cochinchinensis);* R. & S. Mant. 3 (1827) 285; ROXB. Fl. Ind. ed. CAREY (1832) 363; WIGHT, Ic. Pl. Ind. Or. (1839) t. 191.—*Rupala serrata* REINW. *ex* BL. Cat. (1823) 42, *nom. nud.*—*Helittophyllum javanicum* BL. Bijdr. (1826) 652.—*Roupala glabrata* WALL. Cat. (1831) *no* 3661, *nom. nud. (Rhopala).*—*H. javanica* BL. Ann. Sc. Nat. II, 1 (1834) 217; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 81, 83, t. 18; MEISN. in DC. Prod. 14 (1856) 440; MIQ. Fl. Ind. Bat. 1, 1 (1858) 986; KURZ, Nat. Tijd. N. I. 27 (1864) 172; K. & V. Bijdr. 5 (1900) 306; KOORD. Exk. Fl. Java 2 (1912) 155, f. 33; Atlas (1915) t. 597; RIDL. J. Fed. Mal. St. Mus. 8 (1917) 81; KOORD. Fl. Tjib. (1923) 47; HEYNE, Nutt. Pl. (1927) 588; OCHSE & BAKH. Ind. Groent. (1931) 620, f. 379; BURK. Dict. (1935) 1133; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 79, p. 5.—*H. cumingiana* PRESL, Epim. (1851) 246; MEISN. in DC. Prod. 14 (1856) 440; MIQ. Fl. Ind. Bat. 1, 1 (1858) 986; F.-VILL. Nov. App. (1880) 182; VIDAL, Phan. Cuming. (1885) 139; Rev. Pl. Vasc. Filip. (1886) 229; MERR. Philip. J. Sc. 1 (1906) Suppl. 49; En. Philip. 2 (1923) 99, incl. *var. parvifolia* MERR. *l.c.* 99.—*H. philippinensis* MEISN. in DC. Prod. 14 (1856) 441; MIQ. Fl. Ind. Bat. 1, 1 (1858) 987; F.-VILL. Nov. App. (1880) 182; VIDAL, Phan. Cuming. (1885) 140; Rev. Pl. Vasc. Filip. (1886) 229; Sinopsis Atl. (1883) 37, t. 79; MERR. Philip. J. Sc. 1 (1906) Suppl. 49.—*H. glabrata* MEISN. in DC. Prod. 14 (1856) 442, *nom. nud.*—*H. castaneaefolia* MEISN. *l.c.* 441; MIQ. Fl. Ind. Bat. 1, 1 (1858) 986; F.-VILL. Nov. App. (1880) 182; MERR. En. Philip. 2 (1923) 100.—*H. attenuata* [*non* (JACK) BL.] KURZ, Nat. Tijd. N. I. 27 (1864) 172.—*H. obovata* (*non* BENN.) KURZ, *l.c.*—*H. travancorica* BEDD. *ex* HOOK. *f.* Fl. Br. Ind. 5 (1886) 191.—*H. oligophlebia* MERR. Philip. J. Sc. 11 (1916) Bot. 6; En. Philip. 2 (1923) 100.—*H. obovata* (*non* BENN.) RIDL. J. Mal. Br. R. As. Soc. 1 (1923) 90.—**Fig. 16.**

var. **robusta.**

Shrub or mostly small tree, (2–)5–8(–18) m, starting flowering and fruiting already when a shrub. Tips of the branchlets appressedly rufescent-pilose, glabrescent. Flush bluish- or blackish-green above, azure beneath when fresh, of suckers bright purple. *Leaves* sparse, mostly obliquely subopposite, sometimes 3–4-subverticillate, obovate-oblong or obovate, shortly rather abruptly acuminate, subacute or obtuse, attenuate, ± decurrent along the short thick petiole, the base itself mostly ± abruptly obtuse or truncate or subcordate, sometimes subacute, firmly subcoriaceous, dilutely to dark or sometimes blackish olivaceous or yellowish-green above when dry, mostly brownish and dull beneath, glabrous and ± shining above, initially clothed with numerous, fine, appressed hairs all over the undersurface, glabrescent and finally entirely glabrous, mostly rather regularly and coarsely serrate (teeth not rarely sharp in young specimens), sometimes less distinctly serrate to subentire, with some ± obtuse teeth on each side in the upper part of the blade, (7–)8–25(–40) by (4–)5–10(–15) cm, and in suckers still larger; midrib prominent on both faces specially beneath, nerves (7–)10–12(–13) pairs, curved-ascending, not or inconspicuously inarching along the edge, prominent above, very distinctly so beneath, reticulations fine, rather lax, slightly but well visibly raised on both faces; petiole 1–6(–8–10) by 2–4 mm, rugose, purplish when fresh. *Racemes* axillary and/or ramiflorous, solitary or rarely in twos, dense, 12–25(–30) cm, rather densely appressed-rufous hairy in all parts in bud, finally very laxly hairy, never entirely glabrous; rhachis subangular, $1^1/_2$–2 mm diam. Bracts ovate, acute, 1–$1^1/_2$ mm. Pedicels rather robust, mostly in pairs, connate at the base, (3–)4–7(–9) mm. *Perianth* white or greenish-white, sometimes cream, rather slender, (18–)20–22(–25) mm, tube $^3/_5$–1 mm diam., limb ellipsoid, $1^1/_2$–2(–$2^1/_2$) mm diam. Anthers ± 2 mm. Disk glands broadly elliptic or ovate-elliptic, ± truncate or rarely bidentate, free and close or slightly connate at the base, seemingly forming a cup in anthesis but divergent afterwards. *Ovary* glabrous; style slender, red when fresh. *Fruit* broadly obliquely ellipsoid or subglobose, mostly

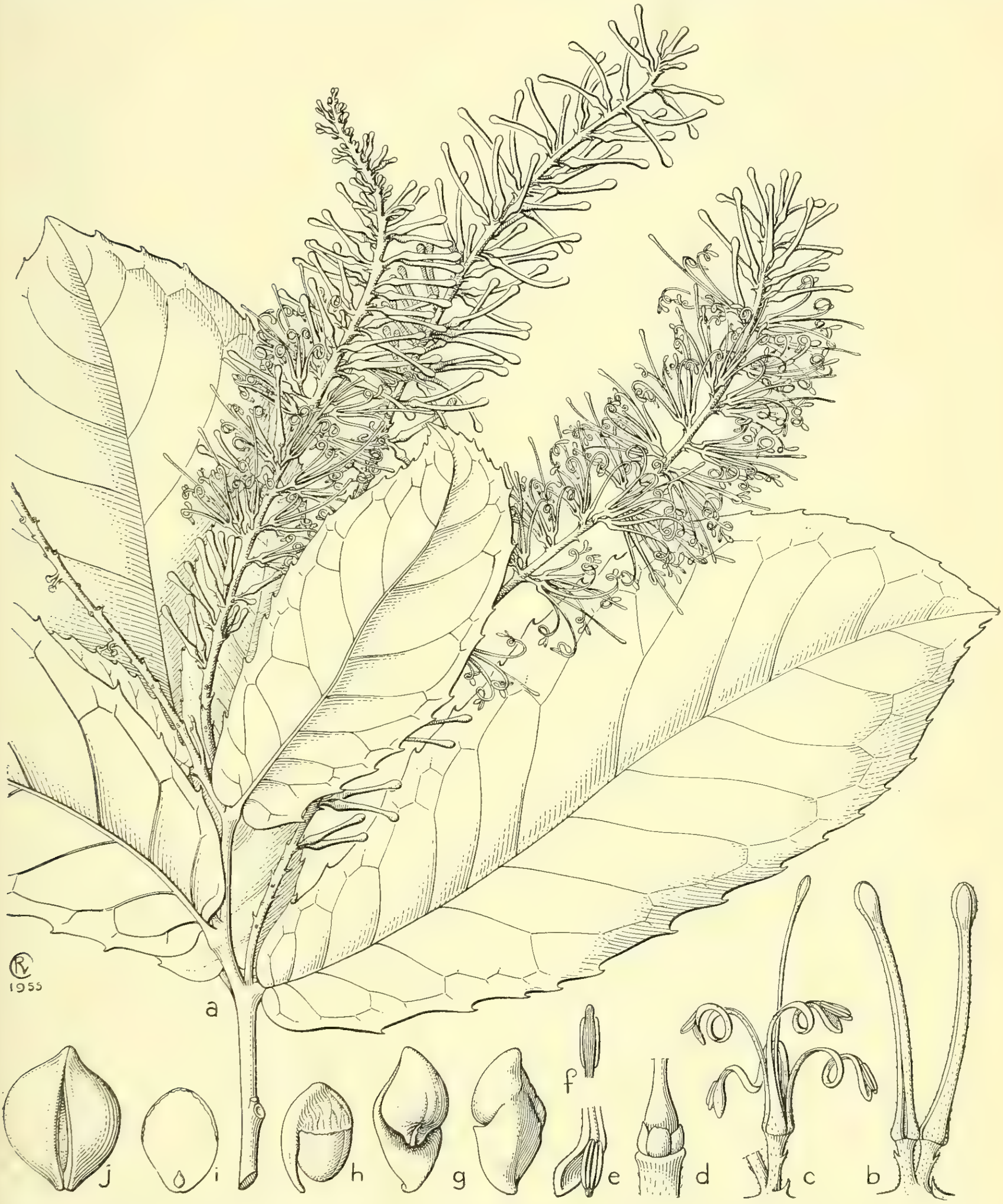

Fig. 16. *Helicia robusta* (ROXB.) R.BR. *var. robusta*. *a*. Habit, × $^1/_2$, *b*. pair of buds, × $1^1/_2$, *c*. open flower, × $1^1/_2$, *d*. base of ovary with disk glands, × $2^1/_2$, *e*. limb with anther, × $2^1/_2$, *f*. back of anther, × $2^1/_2$, *g*. developed embryo, × *c*. $2^1/_2$, *h*. seed with funicle, × $^1/_2$, *i*. seed halved, cotyledon with plumule, × $^1/_2$, *j*. fruit split along ridge, × $^1/_2$ (after LAM 2271).

shortly apiculate and somewhat contracted at the base, rarely rounded at both ends, (2–)$2^{1}/_{2}$–3(–4) by 2–3 cm, initially deep green or yellowish with purplish tinge, later dark purple or blackish; pericarp hard, leathery, 2–3 mm. *Seeds* 1(–2), reticulate-rugose in the upper half; pedicel 6–10 by 2–3 mm.

Distr. S. India (S. Deccan: Travancore), E. Bengal, Assam, Indo-China; in *Malaysia:* Sumatra, Malay Peninsula, Banka, Billiton, Java (rather common in W. Java, rare in Central Java, absent in E. Java), Borneo, Philippines.

Ecol. Both in primary and secondary rainforest, on steep slopes and hills, not rarely on clayey ground, also on volcanic sands, along creeks or near swamps, from the lowlands up to 1600(–1900) m, scattered but occasionally common. *Fl.* throughout the year, mainly May–Aug., *fr.* mainly July–Sept.(–Nov.).

Vern. Sumatra: *langkaput*, Rawas, *lada*, Karo Highlands, *kaju hakondung*, Asahan, *kaju maributan*, Palembang, *kaju kaributan*, Lamp. Banka: *kĕrating, kaju mĕkralong, kratong*. Malay Penins.: *mĕdang kĕladi, m. laiang, m. gatal, m. hakat, putat paya*; *jĕring tupai*, Trengg., *sĕrantan tua*, Pahang, *putat ulu*, Johore. Java: *kĕndung, kamdung gĕdé*, S, *kĕndung*, *kadjeng kĕndung*, *kandung*, J. Borneo: *buntal*, SE. Born., *watutu*, W. Kutei (Dyak), *buak buak*, *jaring jaringan jawa*, Sandakan, *ponsch*, Kwijau, *korodo*, Kinabat., *bronsop*, Orang Sg. Philippines: *apápid*, Klg., *biskóng, chamosíl, olét, olítan, uátan, uláten, uáten*, Ig., *lákot, manlúab, putólan*, Tag., *lóban*, Bon., *malaantígau*, S.L.Bis., *tarangisia*, Bag.

Uses. The wood is occasionally used for shafts of axes and sometimes for house-building; it is not a first-class timber. Young shoots are eaten in Java as a vegetable. The fruit is reported to be poisonous.

Notes. In the SE. Asiatic and W. Malaysian specimens the leaf-base is mostly constantly obtuse or rounded though occasionally acute, in Borneo the acute leaf-base occurs more frequently, and in the Philippines it is mostly acute. In absence of other differential characters I cannot keep the Philippine specimens specifically apart.

In the Philippine mountains a local form occurs with small, not rarely nearly entire leaves not deserving an infraspecific epithet.

Another completely entire-leaved form is distinguished here as a variety.

var. **integrifolia** (ELM.) SLEUM. Blumea 8 (1955) 57. —*H. integrifolia* ELM. Leafl. Philip. Bot. 8 (March 1915) 2798; MERR. En. Philip. 2 (1923) 99.—*H. longiflora* MERR. Philip. J. Sc. 10 (Sept. 1915) Bot. 300.—*H. integra* MERR. Philip. J. Sc. 10 (Sept. 1915) Bot. 301; En. Philip. 2 (1923) 99.

Differs from the type by the entire, not rarely somewhat smaller leaves.

Distr. *Malaysia:* Philippines (Luzon, Mindanao).

Note. A specimen which comes near this variety but differing in somewhat thicker leaves and other minor characters has been collected by CLEMENS (55095) on Mt Kinabalu in Br. N. Borneo in an open place at the base of the great wall, at 3350 m, the highest altitudinal record of the genus. This number has been referred to *H. erratica* HOOK. *f.* by SUESSENGUTH (in Fedde, Rep. 54, 1951, 226). This is, however, a continental Asiatic species with distinctly petioled leaves distributed from S. India and the E. Himalaya through Assam, Upper Burma, Indo-China and Siam to Tenasserim, and a synonym of *H. nilagirica* BEDD.

52. Helicia attenuata (JACK) BL. Ann. Sc. Nat. II, 1 (1834) 216; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 83; MEISN. in DC. Prod. 14 (1856) 439; MIQ. Fl. Ind. Bat. 1, 1 (1858) 985; HOOK. *f.* Fl. Br. Ind. 5 (1886) 190; BOERL. Handl. 3, 1 (1900) 151; K. & V. Bijdr. 5 (1900) 313; HALL. *f.* Med. Rijksherb. 12 (1912) 23; KOORD. Exk. Fl. Java 2 (1912) 154; GAMBLE, J. As. Soc. Beng. 75, ii (1914) 341; RIDL. Fl. Mal. Pen. 3 (1924) 141; BURK. & HENDERS. Gard. Bull. S. S. 3 (1925) 417; HENDERS. Gard. Bull. S. S. 4 (1928) 314; MERR. J. Arn. Arb. 33 (1952) 243; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 79, p. 6; SLEUM. Blumea 8 (1955) 61.—*Roupala attenuata* JACK, Mal. Misc. 1 (1820) 10 *(Rhopala)*; in Hook. Bot. Misc. 2 (1830) 65.—*Roupala moluccana* (*non* R.BR., *nec* JACK) ROXB. (Hort. Beng. 1814, 83, *nom. nud.*) Fl. Ind. ed. CAREY & WALL. 1 (1820) 364, descr.; R. & S. Mant. 3 (1827) 284; ROXB. Fl. Ind. ed. CAREY (1832) 361.—*H. obovata* BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 83; MEISN. in DC. Prod. 14 (1856) 440 *incl. var. minor* MEISN. *l.c.*; MIQ. Fl. Ind. Bat. 1, 1 (1858) 985; K. & V. Bijdr. 5 (1900) 311; KOORD. Nat. Tijd. N.I. 62 (1902) 226 *incl. var. connata* K. & V.; *l.c.* 63 (1904) 39.—*H. oblongifolia* BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 83; MEISN. in DC. Prod. 14 (1856) 438; MIQ. Fl. Ind. Bat. 1, 1 (1858) 983 *incl. var. subpetiolata* MIQ. *l.c.* 984; Sum. 1 (1860) 148; K. & V. Bijdr. 5 (1900) 310.—*H. bennettiana* MIQ. Fl. Ind. Bat. 1, 1 (1858) 984; K. & V. Bijdr. 5 (1900) 309; KOORD. Exk. Fl. Java 2 (1912) 155; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 79, p. 7.—*H. sumatrana* MIQ. Sum. 1 (1860) 148, 364.—*Finschia sumatrana* MIQ. *ex* BOERL. Handl. 3, 1 (1900) 151 (*sphalm. err. pro H. sumatrana*).—*H. suffruticosa* RIDL. J. Fed. Mal. Stat. Mus. 6 (1915) 171; Fl. Mal. Pen. 3 (1924) 141.—*H. lanceolata* (*non* K. & V.) BAK. *f.* J. Bot. 63 (1925) Suppl. 89.—*H. kingiana* (*non* PRAIN) MERR. Pap. Mich. Ac. Sc. 24 (1939) 67.

Shrub (1–)3–5 m, or small tree, rarely up to 20 m; branchlets light brown, glabrous. *Leaves* oblong or elliptic-oblong, rarely oblanceolate or obovate, gradually narrowed towards the apex, mostly subacute, attenuate and decurrent into the petiole, subacute or obtuse at the very base, rarely subcordate, firmly chartaceous to subcoriaceous, greenish- or yellowish-brownish when dry, entire or remotely denticulate, or repand-serrate in the upper half, 9–25(–30) by 3–8(–11–17) cm; midrib prominent on both faces, nerves 7–9(–10) pairs curved-ascending, distinctly anastomosing before the margin, slightly raised or sometimes somewhat impressed above, prominent beneath, reticulations rather dense, slightly raised on both faces; petiole 2–8(–10) mm, thickened and rugose at the base. *Racemes* solitary, axillary or ramiflorous, dense-flowered nearly to the base, 12–25(–30) cm; rhachis glabrous or nearly so, terete, (1$^1/_2$–)2–3 mm diam. (blue when fresh as are the pedicels), often greenish when dry. Bracts subulate, minute, up to 1 mm. Pedicels mostly in pairs, connate up to $^1/_3$, rather robust, glabrous or nearly so, 4–5(–6) mm. *Perianth* whitish or cream or greenish, sometimes rose-tinged, with a rather unpleasant, sweet smell, (18–)22–25(–28) mm, glabrous, tube $^1/_2$–$^3/_5$ mm diam., limb ellipsoid *c.* 1$^1/_2$ mm diam. Anthers *c.* 2$^1/_2$ mm. Disk glands subtruncate, nearly entirely connate in a crenulate ring. *Ovary* narrow-ovoid, glabrous; style filiform. *Fruit* broadly ellipsoid or ovoid, ± oblique, shortly apiculate, ± manifestly attenuate at the base or contracted into a short stipe, mostly with 6 ± distinct, obtuse vertical ribs, first bluish-green, finally purplish-black, 3–4(–5) by (2–)2$^1/_2$–3 cm, pericarp leathery, *c.* 2 mm; pedicel 4–5 by 2$^1/_2$ mm.

Distr. Siam; in *Malaysia:* Sumatra, Malay Peninsula, Borneo, Java, and Bali.

Ecol. In primary and secondary rain-forest, mainly in the montane zone 650–1700 m, but descending to the lowland and ascending up to 2650 m; by streams, on hill slopes or mountain ridges, on various soils, rather common. *Fl. fr.* Jan.–Dec.

Uses. Wood whitish to light brown, locally used in house-building, but not very durable if exposed to all sorts of weathers.

Vern. Sumatra: *Kaja pinang*, Karo Batak, *sĕrantie*, Palemb., *kaju si holip*, *k. sulim*, Tapan., *k. darudung*, *k. si hondum*, *k. hahondung*, Asahan. Malay Peninsula: *putat talang*, Selang., *kani batu puteh buaya*, Malacca, *rambai hutan*, Pahang, *dada kura*, Perak, *golang paya*, *gurang bukit*. Java: *kĕndung*, *k. batu*, *pasang tjĕbon*; *ki geuntul*, Bantam. Borneo: *katjang*, Dyak, Murung, *ringin*, Sarawak.

Note. The species is rather variable in leaf-characters. Specimens with a rather thin texture and an acute leaf-base, as in the type-specimen, are found in Siam, the Malay Peninsula, Sumatra, and rather rarely so in Java and Borneo. Another form with thicker texture and a rounded-obtuse or sometimes subcordate leaf-base is frequent in Java and Borneo, exclusively so in Bali and once found in Sumatra.

The first form is mostly found at lower altitude, the second in the higher localities. The high percentage of intergrades does not permit to distinguish them as distinct species or even as varieties, specially so as no additional characters run parallel with the differences in the leaf-texture and shape.

53. Helicia bullata SLEUM. Blumea 8 (1955) 63.

Small tree, *c.* 8 m; tips of the branchlets dark ferrugineous-tomentose, older part less densely pilose, brownish, finally glabrescent. *Leaves* elliptic or obovate-elliptic, broadly attenuate, subacuminate or obtuse, or rounded at the apex, cuneate but not decurrent on the petiole, sometimes slightly inequilateral, subcoriaceous, greenish-yellow when dry, younger ones covered with a rather crisp rusty tomentum on the midrib above and on the whole surface underneath, specially on the midrib and the nerves, mature ones glabrous and shining above, rusty-hairy beneath on midrib and nerves, glabrescent on the intervenium, entire, (9–)14–20 by (5–)7–11 cm; midrib prominent above, strongly so beneath, nerves 8–12 pairs, lower ones ± straight, upper ones ± curved and rather distinctly anastomosing before the edge, deeply impressed above in the mature leaves as are the laxly areolate veins, distinctly raised beneath; petiole stout, ± persistently tomentose, finally glabrescent and rugose, 1$^1/_5$–1$^4/_5$ by 2$^1/_2$ mm, base very thick. *Racemes* ramiflorous, solitary or in pairs, firm, very dense-flowered nearly to the base, rusty ± appressed-tomentose; rhachis 3 mm diam. at the base. Bracts ovate-acuminate, 1 mm. Pedicels rather robust, mostly in twos, connate in the lower third, 4–5 mm. *Perianth* white, *c.* 16 mm, dilated at the base, tube 1 mm across, limb clavate, subacute, 1$^4/_5$ mm diam. Anthers 3$^1/_2$ mm. Disk glands ovate-oblong, retuse, free, close. *Ovary* glabrous; style slender. Fruit not known.

Distr. *Malaysia:* Central New Guinea (Western Highlands: Nondugl), once found. *Fl.* April.

54. Helicia insculpta SLEUM. Bot. Jahrb. 70 (1939) 141; Blumea 8 (1955) 64.

Shrub or treelet 2–6 m; branchlets robust, tips densely ferrugineous-crisped hairy, glabrescent. *Leaves* crowded near the top of the branchlets, broadly oblong or elliptic, rarely oblong, broadly acuminate and obtuse, sometimes nearly rounded at the apex, broadly cuneate to nearly rounded at the base, subcoriaceous, very young ones fairly densely clothed with subappressed, dilutely ferrugineous, ± crisp, detersile hairs, glabrescent except the midrib, regularly glandular- rather obtusely dentate, 6$^1/_2$–8(–10) by 3$^1/_2$–4$^1/_2$(–5) cm; midrib slightly prominent or impressed above, strongly raised beneath, nerves *c.* 7 pairs, curved-ascending and inarched, distinctly impressed above, rather sharply prominent beneath, reticulations lax, slightly impressed above, ± raised beneath; petiole rather robust, ± ferrugineous-pubescent, 5–6 mm. *Racemes* ramiflorous, dense, stout, 6–8 cm; rhachis 2$^1/_2$ mm diam., densely rufous-ferrugineously pilose. Bracts ovate-acuminate, glabrescent, 2–2$^1/_2$ mm. Pedicels mostly in twos, connate at the base, 2$^1/_2$–3 mm, laxly rufous-pilose. *Perianth* rose-red, in bud rather densely, in anthesis laxly or very laxly appressed-rufescent hairy, *c.* 30 mm, tube 0.7 mm diam., limb clavate 2$^1/_2$ mm diam. Anthers 2$^1/_2$–3 mm. Disk glands connate into a low, annular cup. *Ovary* glabrous; style stoutish, fusiform at the top. Fruit not known.

Distr. *Malaysia:* SE. New Guinea (Owen Stanley Range; Mt Victoria), 2400–2800 m. *Fl.* Dec.–Jan.

55. Helicia hypoglauca DIELS, Bot. Jahrb. 54 (1916) 202; SLEUM. *l.c.* 70 (1939) 142; Blumea 8 (1955) 66.

Slender tree 20–25 m; tips of the branchlets rufous-tomentose, glabrescent. *Leaves* lanceolate-oblong or oblong, shortly acuminate and subacute at the apex, attenuate at the base, somewhat decurrent in the upper third of the petiole, subcoriaceous, pale olivaceous-green to yellowish and shining above when dry, paler and ± dull beneath, very young ones rufescent-appressedly pilose or -sericeous on the under-surface, glabrescent, finally glabrous, entire or occasionally with a solitary, minute tooth on each side, (6–)7–12(–15) by (2½–)3½–5½ cm; midrib slightly prominent above, distinctly so beneath, nerves 6–7(–8) pairs, rather straight in their lower part, curved upwards and inarching towards the edge, all somewhat raised above, a little more so beneath, reticulations fairly dense and slightly, but well visibly elevated on both faces; petiole rather slender, tardily glabrescent, 1½–2½(–3) cm. *Racemes* axillary and ramiflorous, solitary, sometimes in all the upper leafless axils together forming a terminal panicle, dense, 7–13(–15) cm, rather densely rusty-appressedly hairy all over; rhachis 1½–2 mm diam. Bracts ovate-lanceolate, subacute, *c.* 1½ mm, mostly early caducous. Pedicels mostly in pairs, connate at the base, rarely halfway, rather slender, 3–5 mm. *Perianth* whitish or cream, sometimes yellow, 17–18(–20) mm, tube $\frac{4}{5}$ mm across, limb ellipsoid, 2 mm diam. Anthers 2 mm. Disk glands broadly obovate, truncate, ± manifestly connate into an undulate cup. *Ovary* glabrous; style slender. Fruit not known.

Distr. *Malaysia:* NE. New Guinea (Sepik region; Mt Saruwaged-Sattelberg vicinity).

Ecol. In mountain-forest, 400–1800 m, occasionally common. *Fl.* June–Dec.

56. Helicia albiflora SLEUM. Bot. Jahrb. 70 (1939) 138; Blumea 8 (1955) 67.

Tree *c.* 12 m; young branchlets densely dark rufous-appressed-tomentulose, glabrescent. *Leaves* oblong, broadly obtusely attenuate at the apex, broadly attenuate to nearly rounded at the base, somewhat decurrent in the uppermost part of the petiole, olivaceous-brown or dark-brown when dry, shining above, paler brown and rather dull beneath, very young ones rufous-pubescent underneath, mature ones glabrous or nearly so, entire, (12–)15–17 by 5½–7(–8) cm; midrib slightly prominent above, more distinctly so beneath, nerves 8–9 pairs, somewhat raised above, rather prominent beneath, curved upwards and ± distinctly inarching near the edge, reticulations dense, slightly, but well visibly elevated on both faces; petiole 1½–2 cm, ± densely appressed-pilose, tardily glabrescent. *Racemes* ramiflorous, 10–12 cm, rather densely, shortly, appressed-rufous-pilose on rhachis and pedicels; rhachis 2–2½ mm diam. Bracts lanceolate, acute, 1–1½ mm. Pedicels rather robust, mostly in pairs and connate at the base, *c.* 3 mm. *Perianth* white, laxly, longish, appressed-rufous hairy, 25 mm, tube $\frac{4}{5}$ mm diam., limb 2 mm diam. Anthers 2½ mm. Disk glands subquadrangular, short, connate in a crenulate cup. *Ovary* glabrous; style stoutish. Fruit unknown.

Distr. *Malaysia:* SE. New Guinea (S. ascent of Mt Victoria *pr.* Isuarava).

Ecol. In secondary forest at 1200–1370 m. *Fl.* Febr.

57. Helicia petiolaris BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 84; MEISN. in DC. Prod. 14 (1856) 438; MIQ. Fl. Ind. Bat. 1, 1 (1858) 983; HOOK. *f.* Fl. Br. Ind. 5 (1886) 190; RIDL. J. Str. Br. R. As. Soc. 33 (1900) 132; GAMBLE, J. As. Soc. Beng. 75, ii (1914) 342; MERR. En. Born. (1921) 235; RIDL. Fl. Mal. Pen. 3 (1924) 141; BURK. Dict. (1935) 1134; SLEUM. Blumea 8 (1955) 67.—*Roupala moluccana* (*non* R.BR., *non* ROXB.) JACK, Mal. Misc. 1 (1820) 10 (*Rhopala*), reimpr. Hook. Bot. Misc. 2 (1830) 65; R. & S. Mant. 3 (1827) 284.—*H. attenuata* [*non* (JACK) BL.] RIDL. J. Fed. Mal. Stat. Mus. 7 (1916) 49.—*H. erratica (non* HOOK. *f.)* SUESSENG. in Fedde, Rep. 54 (1951) 226, *pro parte.*

var. **petiolaris.**

Shrub or small tree 4–8–12(–20) m by up to 45 cm; branchlets stout, glabrous. *Leaves* obovate or oblong-obovate, shortly broadly to narrowly acuminate, acute or obtuse at the top, sometimes nearly rounded, cuneate and slightly decurrent at the base, rigid, subcoriaceous to coriaceous, glabrous, olive-green to brownish and shining above when dry, dull and rather dark brown or sometimes blackish beneath, entire, (10–)14–22(–27) by (5–)6–10(–13) cm; midrib slightly raised above, strongly so beneath, nerves 7–8(–10) pairs, curved and ± conspicuously inarching near the margin, minutely impressed or mostly somewhat raised above, always distinctly elevated beneath, reticulations rather dense, minutely, but visibly raised on both faces; petiole robust, (1–)1½–2½(–4) cm. *Racemes* axillary, dense-flowered to the base, 15–25(–30) cm, often blackish in dry specimens; rhachis subangular, purpurascent when fresh, 2–2½(–3) mm diam., mostly very laxly beset with fine, rufescent, appressed hairs as are the pedicels, or glabrous. Bracts narrow ovate-acuminate or subulate, pilose, minute, mostly subpersistent. Pedicels stoutish, nearly always in pairs and connate at or above the base, 5–6(–10) mm. *Perianth* white or greenish-white, glabrous, somewhat stiff, (18–)20–22(–25) mm, tube robust, *c.* 1 mm diam., limb narrow-ellipsoid, 2–2½ mm diam. Anthers *c.* 3 mm. Disk glands obtusely ovate, close and ± connate into a crenate or sometimes very minutely fimbriate cup in anthesis, divergent under the young fruit. *Ovary* glabrous. *Fruit* subglobose to obovoid, dark bluish to purple when fully ripe, (2–)2½–3 by 2½–3 cm, very shortly apiculate or nearly rounded at the top, ± contracted at the base, splitting tardily along the distinct rib; pericarp hard-leathery, 2 mm.

Distr. *Malaysia:* Malay Peninsula (Penang, Kedah, Perak, Kelantan, Selangor, Johore, Singapore), Borneo.

Ecol. In rain-forest, from the lowland up to 2100 m alt.

Uses. The timber is said to be used in housebuilding, but is not of a high class.

Vern. *Gong*, *putat tepi*, M, *kubat*, Selangor; Borneo: *uwat lutu*, Kajan Dyak.

var. **kingiana** (PRAIN) SLEUM. Blumea 8 (1955) 69. —*H. kingiana* PRAIN, Kew Bull. (1912) 342; GAMBLE, J. As. Soc. Beng. 75, ii (1914) 343; RIDL. Fl. Mal. Pen. 3 (1924) 142.—*H. obscurinervis* CHATTERJEE, Kew Bull. (1948) 65.

Differing from the type by the very shortly petioled or subsessile leaves with a distinctly decurrent blade. Fruit subglobose-ellipsoid, manifestly apiculate, distinctly contracted into a stipe.

Distr. Lower Burma (Tavoy), S. Siam (Puket); in *Malaysia:* Malay Peninsula (Penang, Perak, Pahang), Borneo (Sarawak).

Vern. *Sangka tua*, Pahang.

58. Helicia paucinervia MERR. Philip. J. Sc. 17 (1921) 247; En. Philip. 2 (1923) 100; SLEUM. Blumea 8 (1955) 71.

Shrub or small tree, 1–5 m; branchlets terete, smooth, dark red-brown when dry, youngest parts laxly very fine appressed-hairy, glabrescent. *Leaves* oblong-elliptic or subobovate-oblong, broadly attenuate at the apex and blunt, sometimes nearly rounded, cuneate and slightly decurrent into the petiole, firmly subcoriaceous, brown-olivaceous and glossy above when dry, dull and paler brown beneath, entire or distantly and rather coarsely toothed in the upper half, 10–15 by 4–6(–8) cm; midrib prominent on both faces, nerves (4–)5 pairs curved-ascending and ± distinctly anastomosing, elevated both above and beneath, reticulations rather dense, well visibly raised on both faces; petiole 1(–1$^1/_2$) cm. *Racemes* axillary or sometimes ramiflorous, rather dense, 14–20 cm; rhachis subterete, 1$^1/_2$ mm diam., very laxly covered with minute appressed rufescent hairs as are the pedicels. Bracts ovate-acuminate or deltoid, acute, $^1/_2$ mm. Pedicels mostly in pairs, free or connate at the very base, 2–3 mm. *Perianth* white or cream, glabrous, (16–)17–19 mm, tube slender, $^2/_5$–$^1/_2$ mm diam., limb ellipsoid, 1–1$^1/_5$ mm diam. Anthers 1$^1/_2$ mm. Disk glands connate in the lower half, forming a crenate cup. *Ovary* glabrous. *Fruit* subglobose, very shortly apiculate, somewhat contracted at the base, smooth, *c.* 3$^1/_2$ cm diam., pericarp leathery, dry, rather hard, 2–3 mm; pedicel 4 by 3 mm.

Distr. *Malaysia:* Philippines (Mindanao: Surigao; Dinagat Isl.).

Ecol. Along river-banks on iron deposits, 300 m.

59. Helicia pallescens DIELS, Bot. Jahrb. 54 (1916) 200; SLEUM. Blumea 8 (1955) 72.

Treelet; tips of the branchlets subangular, glabrous. *Leaves* oblong-lanceolate or oblong, rarely lanceolate-elliptic, gradually and rather acutely acuminate at the apex, subfalcate, attenuate into the petiole, not decurrent, coriaceous or subcoriaceous, entirely glabrous, pale olivaceous-greenish above when dry, entire, 15–20 by 3$^1/_2$–7 cm; midrib impressed above when dry, strongly raised beneath, nerves 7–8 pairs long curved-ascending and excurrent along the edge, inconspicuously inarching, reticulations dense, very finely but well visibly raised on both faces; petiole stoutish, ± 1 cm. *Racemes* ramiflorous, very slender, 6–8 cm, incl. the peduncle *c.* 1$^1/_2$ cm; rhachis glabrous or with some very small, scattered, appressed hairs, *c.* 1$^1/_2$ mm diam. Bracts not seen, probably early caducous. Pedicels mostly in pairs, 3–4 mm, free or connate halfway. *Perianth* white, sparsely fine appressed-rusty hairy or ± glabrous, 18–20 mm, tube $^3/_5$ mm across, limb elongate-ellipsoid *c.* 2 mm diam. Anthers 2 mm. Disk glands thick, broadly obovate, truncate or slightly emarginate, free, close. *Ovary* glabrous; style slender. Fruit not known.

Distr. *Malaysia:* N. New Guinea (Sepik River region: 'Lordberg'), once found.

Ecol. In moss-forest, 1000 m. *Fl.* Dec.

60. Helicia graciliflora MERR. Philip. J. Sc. 3 (1908) Bot. 132; En. Philip. 2 (1923) 99; SLEUM. Blumea 8 (1955) 72.

Small tree, *c.* 6 m; tips of the branchlets densely, ± appressed-rufous hairy, glabrescent. *Leaves* elliptic-lanceolate, rather shortly acute-acuminate, often ± curved at the apex, attenuate and decurrent into the petiole, somewhat inequilateral, chartaceous to thinly subcoriaceous, entire or with a few distant teeth towards the top, very rarely with one or two large lobes, very young ones appressedly rufous-pilose on both faces, soon glabrescent, mature ones still with some hairs on the midrib beneath, finally glabrous, olivaceous-brownish and somewhat shining above, brownish and dull beneath, (8–)10–14(–20) by 2$^1/_2$–4$^1/_2$(–6) cm; midrib nearly flat above, prominent beneath, nerves *c.* 7 pairs, rather straight in their lower part, curved upwards and inarching towards the edge, slightly prominent above, more distinctly so beneath, reticulations fine and dense on both faces; petiole slender, glabrescent, 1–1$^1/_2$(–2) cm. *Racemes* axillary, solitary, lax, very slender; flowers in pairs, $^1/_2$–1 cm spaced, rather densely appressedly longish-rufous hairy all over; rhachis $^1/_2$ mm diam. Bracts ovate-lanceolate, thin, 1$^1/_2$–2 mm. Pedicels very slender, *c.* 3 mm, connate at the base. *Perianth* very slender, 14–16 mm, finally glabrous except the base and limb, tube $^2/_5$ mm diam., limb ellipsoid, 1 mm diam. Anthers 1$^1/_2$ mm. Disk glands subquadrangular, retuse, free, very close, seemingly forming a cup. *Ovary* glabrous; style very slender. Fruit not known.

Distr. *Malaysia:* Philippines (Mindanao), 700 m.

61. Helicia biformis SLEUM. Bot. Jahrb. 70 (1939) 140; Blumea 8 (1955) 73.

Compact tree, 4–6 m; branchlets subterete, glabrous. *Leaves* elliptic-oblong or elliptic, broadly acuminate at the apex, obtuse, rarely shortly emarginate, broadly attenuate into the petiole, sometimes nearly rounded at the base, very slightly decurrent, coriaceous, yellowish to dark olivaceous above when dry, dull brown beneath, very young ones densely pale stiff-hairy on both faces specially beneath, together with a kind of flaky, peeling scales formed by the epidermis, mature ones glabrous or beneath laxly fine appressed-rufescent caducous-hairy, entire, (4½–)5½–8(–9) by (2½–)3–4½ cm; midrib slightly prominent or somewhat impressed above, very prominent beneath, nerves 6–8 pairs, straight below and ± parallel, curved upwards and ± distinctly joined before the edge, somewhat impressed above, sharply prominent beneath, reticulations obscure above, slightly raised beneath; petiole robust, mostly very shortly appressed-pubescent, ½–1 cm. *Racemes* ramiflorous, dense, 5–9 cm, rather densely rufescent-appressed hairy all over; rhachis 2–2½ mm diam. Bracts ovate-lanceolate, acute, 1½–2 mm, mostly early caducous. Pedicels generally in pairs, free or connate at the base, stoutish, 3–4 mm. *Perianth* showy red, sometimes glabrescent from the apex, 20–23 mm, tube 1 mm diam., limb elongate-ellipsoid, 2–2½ mm diam. Anthers 2 mm. Disk glands connate in a low crenulate cup. *Ovary* glabrous; style rather robust. Fruit not known.

Distr. *Malaysia:* SE. New Guinea (Central Distr.: Wharton Range, *pr.* Murray Pass).

Ecol. In forests or forest borders, 2840 m. *Fl.* July–Aug.

Doubtful or excluded species

Helicia ovata (JACK) BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 84; MEISN. in DC. Prod. 14 (1856) 439; MIQ. Fl. Ind. Bat. 1, 1 (1858) 984.—*Roupala ovata* JACK, Mal. Misc. 2 (1822) 95 *(Rhopala)*, reimpr. Hook. Comp. Bot. Mag. 1 (1836) 259; MERR. J. Arn. Arb. 33 (1952) 243.

'Leaves subsessile, ovate, acute on both ends, glabrous, entire, alternate and opposite, *c.* 25 by 15 cm, margin revolute, veins conspicuous. Racemes axillary, pedicels very short, slightly tomentose as are the perianth and ovary.'—Sumatra: Tapanuli, leg. JACK.

No type-specimen is available. I have seen no material from Sumatra which would coincide with the original description. Possibly the simple-leaved form of a species of *Heliciopsis.*

Helicia serrata R.BR. *ex* F.-VILL. Nov. App. (1880) 182.

'Ex silvis S. Mateo, Luzon.'

No material seen. Certainly not the true *H. serrata* (R.BR.) BL. which does not occur in the Philippines.

5. HELICIOPSIS

SLEUM. Blumea 8 (1955) 79.—**Fig. 12, 17–18.**

Dioecious trees. *Leaves* spiral, simple and entire or lobed, not rarely pinnatisect, sessile or petioled. *Racemes* simple, many-flowered, axillary or ramiflorous. Bracts subulate, small, or linear-elongate, ± persistent or ± caducous. Bracteoles minute, ± caducous. Pedicels mostly in twos, free or connate up to 4/5 their length. *Perianth* straight, tube rather slender, limb clavate or ellipsoid, attenuate towards the base in the ♂ flowers, dilated at the base by the swollen ovary in the ♀ flowers; segments 4, revolute in anthesis. *Stamens* 4, sessile or nearly so, inserted at the base of the limb; anthers oblong, with pollen only in the ♂ flowers, similar in shape but without pollen in the ♀ flowers; connective apiculate; exine reticulate. *Disk* glands 4, free, mostly approximate and seemingly forming a cup. *Ovary* sessile. Style slender, clavate towards the apex, stigma punctiform, terminal. *Ovules* 2, orthotropous, hanging from the top of the cavity, fertile only in the ♀ flowers, reduced in size or absent in the ♂ ones. *Drupe:* exocarp leathery, rather thin, mostly soon dissolved, sometimes ± persistent; mesocarp formed by very numerous radial ± soft fibres, persistent, sometimes early dissolved or nearly absent; endocarp hard, woody at least in the inner part, mostly rather thick, the outer face reticulate-lacunose, the lacunae sometimes perforated. *Seed* 1, nearly globose, or seeds 2, hemispherical, wrinkled in the upper part; testa thin; cotyledons large, fleshy.

Distr. At least 7 *spp.*, 2 in Burma, Indo-China, SE. China, and Siam, 5 in *W. Malaysia:* Sumatra, Malay Peninsula, Java, Borneo, and the Philippines (Palawan, Mindanao). Fig. 12.

Notes. The genus combines certain characters of *Helicia* LOUR. (anthers sessile) with those of *Macadamia* F.v.M. (ovules orthotropous, pendent from the top of the cavity), but is very different from both by the dioecious flowers, the peculiar structure of the pericarp, and the pollen, which has a manifestly reticulate exine. By the latter character specimens with ♂ flowers can easily be recognized.

This is another case of a dioecious genus in the family. Among the unnamed materials there are apparently some two or three additional undescribed species but the specimens are too inadequate for description.

The species are apparently very rare and are hence very insufficiently known. Of the two Javan ones only ♂ flowers have been collected; of *H. rufidula* the flowers are unknown and in other species the fruit is absent. The range of variation of characters is therefore hard to establish.

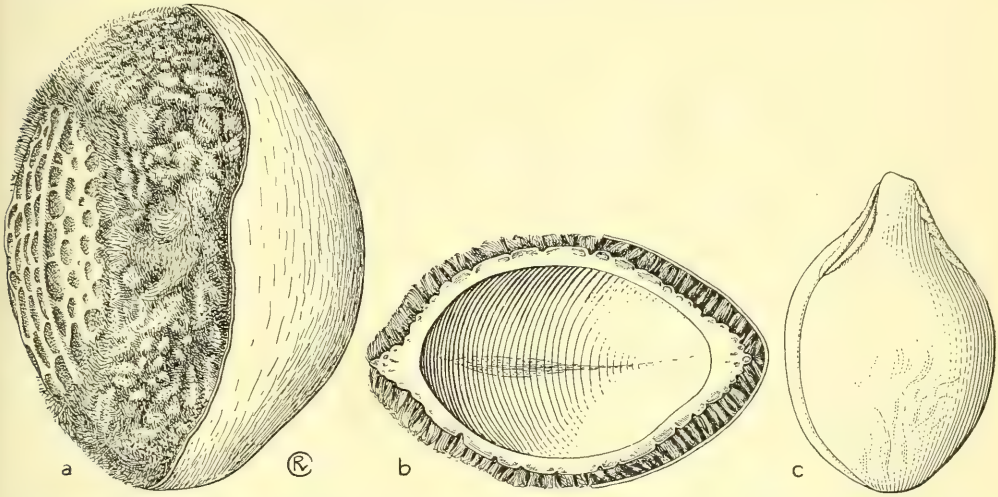

Fig. 17. *Heliciopsis sp.* showing structure of fruit and seed. *a.* Fruit with halfway removed exocarp, showing fibrous tissue of the mesocarp and lacunae of the stony endocarp, *b.* the same in cross-section, *c.* seed, all × $^{2}/_{3}$ (bb. 3076).

No conclusion can be made on the correlation between the leaf dimorphy and age of the plant. Of *H. lanceolata* and *H. velutina* no pinnatisect leaves are known as yet. On the other hand flowers have been collected on trees with pinnatisect leaves showing that these are not restricted to the immature seedling stage. Additional observations in the field are highly desirable.

KEY TO THE SPECIES

1. Bracts linear, subpersistent, (6–)8–10 by ± $^{1}/_{2}$ mm.
  2. Leaves lanceolate or oblanceolate-oblong, 3 times as long as broad, distinctly acuminate, olivaceous, lead-coloured or yellowish green . . . . **1. H. velutina**
  2. Leaves broadly obovate-elliptic, 2 times as long as broad, apex broadly rounded, brown when dry. **2. H. rufidula**
1. Bracts subulate, ± caducous, 1–2 by $^{1}/_{5}$–$^{1}/_{3}$ mm.
  3. Perianth *c.* 14–15 mm long . . . . **3. H. artocarpoides**
  3. Perianth *c.* 8–10 mm.
    4. Simple leaves lanceolate to obovate-lanceolate, mostly with acute apex, blade 10–20(–23) by (2$^{1}/_{2}$–)3$^{1}/_{2}$–5(–8) cm. Pinnatisect leaves unknown. Petiole *c.* 1 mm diam. Nerves ascending under *c.* 45°. Perianth 10–12(–14) mm long. Anthers 2 mm . . . . **4. H. lanceolata**
    4. Simple leaves obovate-lanceolate with blunt apex, (15–)20–30(–45) by (5–)7–12 cm. Leaves dimorphous. Petiole *c.* 1$^{1}/_{2}$–2$^{1}/_{2}$(–4) mm diam. Nerves ascending steeply under *c.* 30°. Perianth 8–10 mm. Anthers 3 mm . . . . **5. H. incisa**

1. Heliciopsis velutina (PRAIN) SLEUM. Blumea 8 (1955) 81.—*Helicia velutina* PRAIN, Kew Bull. (1912) 343; GAMBLE, J. As. Soc. Beng. 75, ii (1914) 346; RIDL. Fl. Mal. Pen. 3 (1924) 143.

Tree (8–)12–23 m by 20–35 cm; branchlets initially rufous-tomentose in the youngest parts, glabrescent, striate, terete. *Simple leaves* oblong or oblanceolate ± broadly, shortly (1$^{1}/_{2}$–2 cm) acuminate, subacute, cuneate at the base, subcoriaceous, glabrous except the midrib, which is ± persistently pubescent on both faces, (10–) 14–22 by (3–)4–7 cm, nerves 12–14(–16) pairs, rather straight below and ± parallel to each other, curved above and manifestly inarching, with some shorter and less distinct ones between them; petiole rufous-tomentose initially, glabrescent, thickened at the base, (1$^{1}/_{5}$–)1$^{1}/_{2}$–2(–3) cm by *c.* 2 mm. *Lobed or pinnatisect leaves* not yet known. *Racemes* solitary or rarely in pairs, axillary or ramiflorous, dense-flowered to nearly their base, (6–)7–12 cm, rufous-tomentose all over. Rhachis in the ♂ inflorescences *c.* 1$^{1}/_{2}$, in the ♀ inflorescences 2–2$^{1}/_{2}$ mm across. Bracts linear, (6–)8–10 by $^{2}/_{5}$–$^{4}/_{5}$ mm, subpersistent. Bracteoles similar, 4–5 mm. Pedicels rather stoutish, 4–5 mm, mostly in twos, free or connate up to their middle. *Perianth* yellowish- or greenish-white, scentless, somewhat glabrescent on top, 10–12 mm, tube *c.* $^{3}/_{5}$ mm diam. in the

♂ flowers, *c.* 1½ mm diam. in the ♀ ones, limb clavate 2–2½ mm diam. Anthers *c.* 2 mm. Disk glands small, broadly obovate-truncate, free, slightly distant from each other. Ovary glabrous. *Fruit* cylindric-ellipsoid, somewhat compressed, brown when dry, rather smooth, *c.* 4 by 2½ cm, *c.* 2 cm thick; exocarp leathery, 1–2 mm; mesocarp 2–3 mm; endocarp hard, woody, 1–2 mm. *Seed* not seen. Fruit-pedicel 8–10 by 3 mm.

Distr. *Malaysia:* Malay Peninsula (Perak, Johore), Borneo.

Ecol. Rain-forest, from the lowland to 750 m. *Fl.* Nov.-April, *fr.* March-Oct.

Vern. *Kĕdalai,* SE. Borneo (Bangar).

2. **Heliciopsis rufidula** Sleum. Blumea 8 (1955) 82.

Tree, (8–)15–35 m by up to 0.9 m; branchlets initially rufous-tomentose, glabrescent, terete, striate. *Simple leaves* obovate or broadly obovate-oblong, ± rounded or very broadly obtusely attenuate at the apex, cuneate at the base, subcoriaceous, dark-brown when dry, initially covered on both faces (specially beneath) with crisp rufous hairs, glabrescent, hairiness subpersistent on midrib and nerves beneath, entire, (12–)15–28 by (6–)7–13 cm; nerves 14–18 pairs at an angle of *c.* 45°, straight and parallel, inarching near the margin, with shorter and less distinct ones between them; petiole rufous-tomentose initially, glabrescent, (1–)1½–3 by ⅕–⅓ cm. *Pinnatisect leaves* with 3 or 4 lobes on each side, *c.* 55 by 35 cm, lobes 12–18 by 5–8 cm; petiole *c.* 11 cm by 5–6 mm. *Flowers* not yet known. *Infructescence* ramiflorous, 8–15 cm. Rhachis striate, rather densely rufous-pilose, 2–3 mm across. Bracts linear, *c.* 6 mm, subpersistent. Pedicels *c.* 8 by 2–3 mm. *Fruit* broad-elliptic, red when fresh, dark brown when dry, 3½–4 by *c.* 2½ cm, *c.* 2 cm thick; exocarp leathery, ½–1 mm; mesocarp *c.* 3 mm; endocarp *c.* 1 mm. *Seed* not seen.

Distr. *Malaysia:* Malay Peninsula (Perak, Selangor, Pahang).

Ecol. In tall, lowland rain-forest. *Fr.* Febr.

Vern. *Bĕlĕmbang,* Selangor, *mĕmpĕning,* Pahang, Kuantan.

3. **Heliciopsis artocarpoides** (Elm.) Sleum. Blumea 8 (1955) 83.—*Helicia artocarpoides* Elm. Leafl. Philip. Bot. 5 (1913) 1826; Merr. En. Philip. 2 (1923) 99; Pl. Elm. Born. (1929) 52.

Small slender tree up to 15 m, or shrub; trunk often crooked; branchlets rufous-tomentellous when young, soon glabrescent, striate. *Simple leaves* (once found, San 10041) obovate-oblong, rounded at the blunt apex, tapering into the petiole and somewhat decurrent, subcoriaceous, glabrous, 30–40 (or more?) by 9–12½ cm, nerves 14–16 pairs slightly curved upwards and ± parallel, excurrent along the edge, crossbar-veined; petiole glabrous, 8–14 cm, thickened at the base. *Pinnatisect leaves* ± shining, glabrous, up to 90 cm long; lobes in 5–8 pairs narrow-oblong or obovate-oblong, shortly acuminate, 15–30 by 3–18 cm, the sinuses ± rounded and mostly 1–3 cm distant from the common midrib, rarely produced to it; nerves 10–15 pairs, mostly straight, inarching in a ± distinct intramarginal vein; petiole 3–5 mm across, ± rufous-pubescent initially, glabrous or glabrescent, (6–)10–18 cm. *Racemes* solitary or 2–3 (rarely up to 10) in a fascicle, rami- and cauliflorous, (5–)15–30(–60) cm, ± dense-flowered, ± densely appressed-rusty-pilose; rhachis 1½–2½ (–3) mm across. Bracts lanceolate, ½–1 mm, ± caducous. Pedicels mostly in pairs, rather slender, free or connate up to ⅔ their length, (3–)5–7(–8) mm. *Perianth* somewhat fragrant, whitish or yellowish, 14–15 mm, tube in the ♂ flowers ⅘–1 mm across, in the ♀ ones *c.* 1½ mm, limb clavate 1½–2¼ mm across. Anthers 2–2½ mm. Disk glands ovate-oblong, free, ± approximate, thus seemingly forming a cup. Ovary glabrous. *Fruit* yellow when ripe, cylindric-ellipsoid, (3–)4–4½ cm by (2–)2½–3 cm (mature?), smooth, shining; exocarp leathery, thin; mesocarp built up by radial rather soft brown fibres *c.* 3 mm in length; endocarp hard, rather woody, reticulate-lacunose, 1 mm.

Distr. *Malaysia:* Borneo, Philippines (Palawan, Mindanao).

Ecol. In rain-forest, up to 900 m, on well-drained slopes, ridges, and steep river-banks, apparently scattered, fairly common in W. Kutei. *Fl.* Febr., Apr.–Oct., *fr.* Oct.

Uses. Leaves and shoots are occasionally used for poulticing yaws, roots for sore eyes, ulcers, and yaws. Fruit said to be edible.

Vern. Borneo: *putat,* Sandakan, *kurunguh,* Dusun Kinab., *ambwitil,* Murut. Philippines: *gunsili,* Sub.

Notes. There are sterile materials both of simple and pinnate foliage from various localities in the Malay Peninsula (Perak: G. Kerbau, Cameron Highlands at *c.* 1200 m alt.), which are similar in general appearance, but whose upperside is more yellowish and markedly varnished; they probably belong to an undescribed species, which is related to *H. artocarpoides.*

4. **Heliciopsis lanceolata** (Koord. & Val.) Sleum. Blumea 8 (1955) 84.—*Helicia lanceolata* K. & V. Bull. Inst. Bot. Btzg *no* 2 (1899) 10; Bijdr. 5 (1900) 320; Koord. Nat. Tijd. N.I. 60 (1901) 389; Exk. Fl. Java 2 (1912) 154; Atlas (1915) t. 598; Back. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 79, p. 5, *nec* Bak. *f.* J. Bot. 63 (1925) Suppl. 89 *quae est Helicia attenuata.*

Tree, 15–27 m, trunk 25–45(–60) cm across; branchlets subterete, striate, ± densely short appressed-rufescent hairy, glabrescent. *Simple leaves* lanceolate or obovate-lanceolate, acuminate, tapering into the petiole, rather dark when dry, glabrous, subcoriaceous, 10–16(–23) by (2⅕–)3½–5(–8) cm, nerves (6–)8–10 pairs, straight and parallel, inarching and anastomosing towards the margin, reticulations dense; petiole glabrous, 1–2(–5) cm, slightly thickened at the base. *Pinnatisect leaves* unknown. ♂ Racemes ramiflorous, 12–26(–30) cm, lax-flowered, densely appressed rufous hairy; rhachis 1–2 mm diam. Bracts subulate, 1–2 mm, ± caducous. Pedicels mostly in

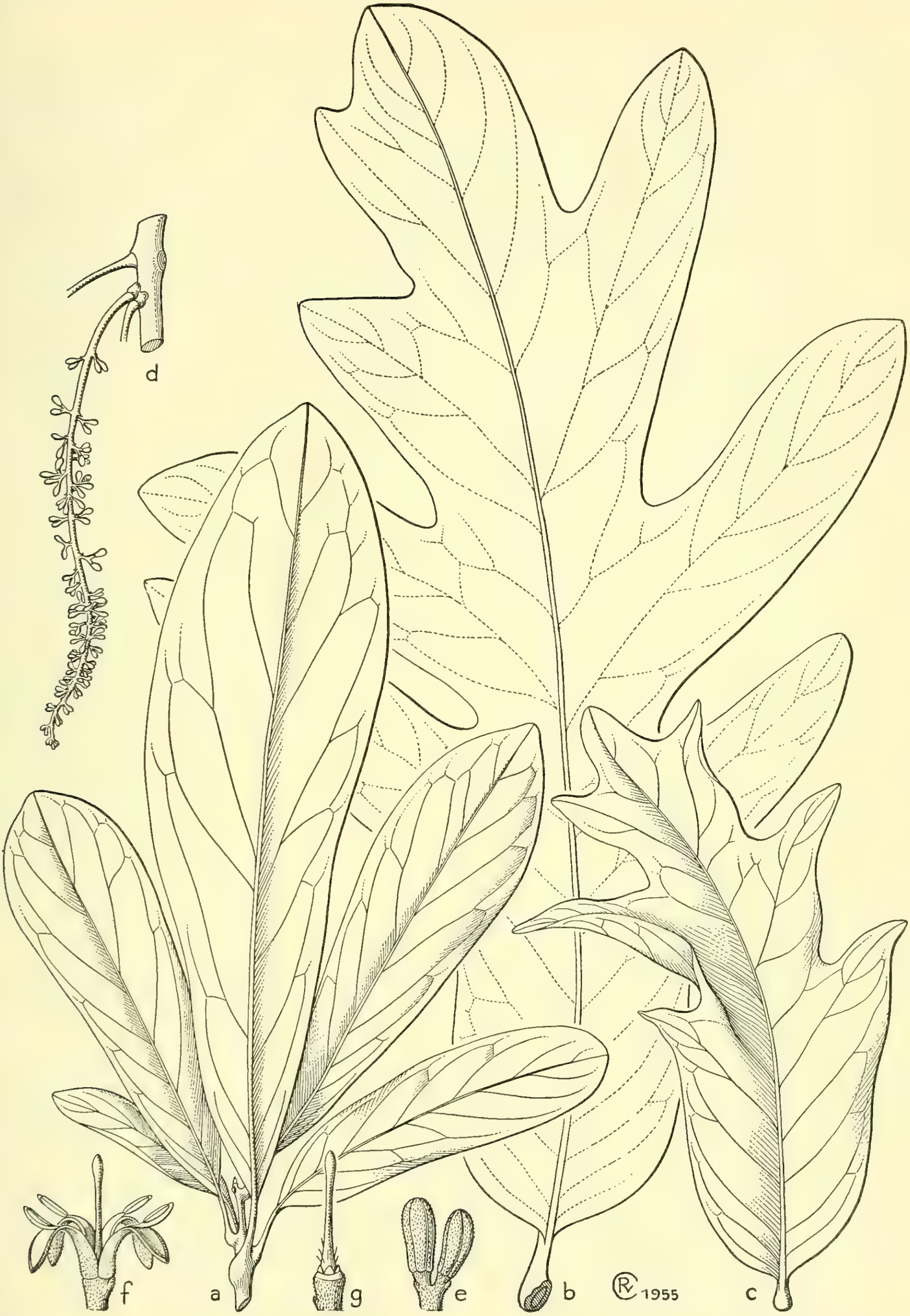

Fig. 18. *Heliciopsis incisa* (K.&V.) SLEUM. *a*. Simple leaves × 2/5, *b*. incised leaf, × 2/5, *c*. intermediate stage, × 2/5, *d*. young inflorescence, × 2/5, *e*. buds, × 2, *f*. open flower, × 2, *g*. pistil with disk glands, × 2 (*a*., *e*. KOORDERS 39067, *b*. *ditto* 6277, *c*. *ditto* 12200, *d*., *f–g*. after KOORDERS Atlas; *a–c*. dense prominent reticulations not drawn).

twos and connate to ½–⅘, (2–)3–4 mm. *Perianth* 8–10 mm, finally glabrescent, pale greenish-yellowish when fresh. Anthers *c.* 2 mm, white when fresh. Disk glands nearly rounded, free, close together. Ovary glabrous. Fruit not yet known.

Distr. *Malaysia:* Java (Preanger, Pekalongan, Besuki).

Ecol. In rain-forest, 600–1200 m. *Fl.* June–Nov.

Vern. *Kĕndung*, S.

Note. VALETON cites and figures the flowers as being 14 mm long. I found them in well-developed racemes from the cultivated tree at Bogor C.H.B. III–B–11 only *c.* 8–10 mm in length.

5. Heliciopsis incisa (K.&V.) SLEUM. Blumea 8 (1955) 85.—*Helicia incisa* K.&V. Bull. Inst. Bot. Btzg *no* 2 (1899) 10; Bijdr. 5 (1900) 317; KOORD. Nat. Tijd. N.I. 60 (1901) 389; Exk. Fl. Java 2 (1912) 154; Atlas (1915) t. 599, 600; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 79, p. 6.—*Artocarpus chaphasha* ?ROXB. *ex* KOORD.-SCHUM. Syst. Verz. 2 (1910) 16.—**Fig. 18.**

Tree up to 15 m by *c.* 25 cm; branchlets stoutish, rufous-puberulous at the tips, soon glabrescent. *Simple leaves* mostly oblanceolate, blunt to rounded at the apex, cuneate towards the base, subcoriaceous, glabrous, (15–)20–30(–45) by (5–) 7–12 cm; nerves 6–9(–10–12) pairs, steeply ascending, anastomosing towards the edge; petiole striate, glabrous, dark when dry, (0–1½–)2–4(–5½) cm by 1½–2½ mm. *Leaves tripartite to pinnatisect* occurring in juvenile trees, up to *c.* 1 by 0.6 m, lobes 1–5 pairs, oblong or ovate, sinuses ± rounded at *c.* 2½ cm distance from the midrib, glabrous; petiole very stout, (0–)½–2(–5) cm. *Racemes* (♀ unknown) mostly cauliflorous, almost always on trees with simple leaves, solitary or 2–3 fascicled, (15–)30–40 cm, laxly appressed-ferrugineous-pilose all over; rhachis *c.* 1½ mm diam. Bracts ovate-lanceolate, minute. Pedicels 3–4 mm, free or connate up to halfway. *Perianth* 8–10 mm, tube ⅗ mm diam., limb clavate 1½ mm diam. Anthers 3 mm. Disk glands bluntly broad-triangular, free. Ovary glabrous or with some scattered hairs. *Fruit* ellipsoid, compressed, *c.* 6½ by 4½ cm, 2½ cm thick; exocarp coriaceous, rather thin; mesocarp 3 mm; endocarp hard, woody, irregularly reticulate-lacunose, 2–3 mm, the lacunae perforated. *Seed* not seen.

Distr. *Malaysia:* Sumatra (East Coast, Palembang, Lampong), Central & E. Java (Banjumas, Besuki).

Ecol. In rain-forest (ravines), from the lowland up to 1000 m. *Fl., fr.* March.

Vern. *Pahit*, Sumatra East Coast, *puwo labi*, Palembang, R. Rawas, *kerbang tikus suloh*, Lampong, *kĕndang*, *wuru kĕndang*, J, *kĕndung*, Md.

Note. No mature fruit has as yet been collected in Java; the description by VALETON and plate by KOORDERS represent a very young stage. Sumatran specimens have, generally, both in pinnate and simple leaves, shorter petioles than those in Java, they even may be sessile.

A specimen with a very similar but larger fruit (11 by 7½ by 5 cm) and leaves rufous-tomentose underneath has been found in Sumatra (East Coast Res.: bb 3076); this is assumed to represent an undescribed species (fig. 17).

6. MACADAMIA

F.v.M. Trans. Phil. Inst. Vict. 2 (1858) 72, *cum tab.*; SLEUM. Blumea 8 (1955) 3–5.—**Fig. 19–21.**

Trees or tall shrubs. *Leaves* verticillate or subopposite, entire or spiny-serrate, markedly reticulate. *Flowers* hermaphrodite, solitary or mostly in pairs on terminal or axillary simple racemes. Bracts small, very caducous. Pedicels free or partly connate, solitary or in twos. *Perianth* regular or slightly irregular, the tube slightly curved, limb club-shaped, slit laterally by the style bulging out, finally splitting completely in 4 linear recurving segments. *Stamens* 4, on short filaments, inserted about the middle of the perianth segments or a little higher below the limb; anthers oblong, connective produced into a gland or very short appendage; exine of pollen smooth or nearly so. *Disk* glands broad, truncate, distinct or united in a cup or ring round the ovary. *Ovary* sessile, style long, straight, clavate, with a small terminal stigma. *Ovules* 2, orthotropous, hanging from the top of the cell. *Fruit* globular, indehiscent, or the ± hard coriaceous pericarp with a narrow lengthwise slit. *Seed* either solitary and globular, or 2 and hemispherical; testa membranous or hard, sometimes stony; cotyledons thick and fleshy.

Distr. About 9 *spp.*, 5 of which in E. Australia (NE. and SE. Queensland to N. New S. Wales), 3 in New Caledonia; in *Malaysia:* one species in Celebes. Fig. 19.

KEY TO THE SPECIES

1. Leaves in whorls of 5–7, entire. Racemes in terminal whorls inserted in the upper leaf-axils. Upper leaves not rarely strongly reduced in size, so that the whorl of racemes seems to be inserted on top of a stout peduncle, which really is the upper internode of a short twig (brachyblast). **1. M. hildebrandii**

1. Leaves in whorls of 3 or 4, or subopposite, entire or spiny. Racemes axillary, rarely subterminal.
   2. Leaves in whorls of 3 or subopposite, never in whorls of 4 in adult plants, irregularly spiny-dentate in earlier stages with up to 10 teeth on each side; nerves 7–12 pairs; petiole 4–15 mm. Inflorescence sparingly puberulous. Testa smooth . . . . **2. M. ternifolia**
   2. Leaves 4 in the highest whorls, 3 in the middle ones, subopposite in the lowest ones, always regularly spiny-dentate with almost 35–40 teeth on each side, nerves in 13–20 pairs; petiole up to 2 mm. Inflorescence markedly loose-pubescent. Testa wrinkled or with shallow depressions. **3. M. tetraphylla**

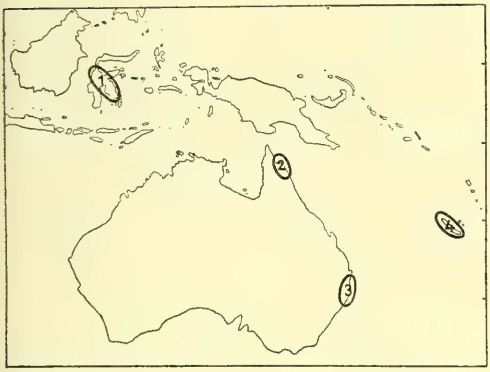

Fig. 19. Distributional area of the genus *Macadamia*: 1. *M. hildebrandii* STEEN.; 2. *M. heyana* (BAIL.) SLEUM. & *M. whelani* (BAIL.) BAIL.; 3. *M. ternifolia* F.v.M., *M. tetraphylla* JOHNS., *M. praealta* (F.v.M.) BAIL.; 4. *M. rousselii* (VIEILL.) SLEUM., *M. vieillardii* (BRONGN. & GRIS) SLEUM., *M. francii* (GUILLAUMIN) SLEUM.

1. Macadamia hildebrandii STEEN. Reinwardtia 1 (1952) 475.—**Fig. 20.**

Tree 3–33 m; clear bole 2–20 m, 10–40 cm across; bark after wounding exuding some sap turning red. *Leaves* obovate to oblanceolate or elliptic, variable in shape and size, apex rounded or bluntly acuminate, sometimes retuse, base rounded to cuneate, coriaceous, glabrous, 7–10 by 4–6 cm to 20–40 by 5–17 cm; nerves in 6–12 pairs, veins distinctly prominent-reticulate on both faces; petiole 0–2 cm. *Racemes* either in a whorl of 5–7 in the axils of normal leaves, or of reduced leaves 1–2 cm long on top of a 'peduncle' (brachyblast) up to 10 cm, generally exceeding the leaves; rhachis 10–40 cm, slender or rather stoutish. Bracts ovate-acute, very small, early caducous. *Flowers* in twos, white or creamy, sweet-scented. Pedicels free, 5–6 mm, appressed-puberulous or almost glabrous, reddish when fresh. *Perianth* segments ligulate, linear, 7–11 by $^1/_2$ mm. Filaments flat, ± 1 mm; anthers ± 2 mm, with pale cells and a dark protruding connective. Ovary sparsely appressed-ferrugineous-hairy, rarely glabrous. Style glabrous. Disk glands united in a short-cylindrical, faintly 4-lobed or irregularly crenate, $^1/_2$ mm high ring. *Fruits* 1–2 per raceme, globular, oblique, with a short hard conical style-base and a prominent longitudinal rib, *c.* $3^1/_2$ cm diam., green-brown when fresh, indehiscent; fruit-pedicel *c.* 8 by 2–3 mm; pericarp hard, *c.* 2 mm thick, consisting of a very thin smooth inner part and a thick outer part containing radial fibres. *Seed* globular, *c.* 3 cm diam., purple-brown when fresh; testa very thin, wrinkled, somewhat thicker and of other structure at the micropylar half as compared with the funicular half.

Distr. *Malaysia:* Celebes. Recently introduced into cultivation in Java by the Forest Service.

Ecol. In primary forest, from sea-level to 1500 m, apparently rare, but occasionally rather common. *Fl.* (mainly) Sept.–Oct., *fr.* March–April.

Vern. *Celebes nut*, E; Celebes: *pérandè*, Tado, *tinapu, tanapu, lila bai, tomaku*, Toradja, *maladewata*, Latimodjong Mts, *kaju balo molaba*, Padoë, *balo molaba, kaju balomotéa*, Tobela, *kandjolée*, Barëe.

Notes. There is reason to assume that the seeds of the Celebes nut are as palatable as the Queensland nut, and it is possibly better adapted to the wet tropical climate than are *M. ternifolia* and *M. tetraphylla.* Although the fruit is indehiscent, the seed of *M. hildebrandii* is rather easily to harvest because it is not protected by a thick and very hard testa as in *M. ternifolia* and *M. tetraphylla.* The seeds of the strongly related *M. whelani* (BAIL.) BAIL. from NE. Queensland, of which the testa is equally thin, are largely used by the Australian aborigines.

2. Macadamia ternifolia F.v.M. Trans. Phil. Inst. Vict. 2 (1858) 72 *cum tab.*; Fragm. 7 (1869) 59; BENTH. Fl. Austr. 5 (1870) 407 *p.p.*; BAIL. Syn. Queensl. Fl. (1883) 432; MAIDEN, Usef. Nat. Pl. Austr. (1889) 40, 566; BAIL. Queensl. Fl. 4 (1901) 1329, t. 57, f. 1; MAIDEN, For. Fl. N.S. Wales 1 (1904) 216, t. 40, f. a–e; DOMIN, Bibl. Bot. 89 (1921) 31; WHITE, Queensl. Agr. J. (1923) 93; FILLA, Flora 120 (1926) 129, f. 51–56 (anat.); HEYNE, Nutt. Pl. (1927) 589; FRANCIS, Proc. R. Soc. Queensl. 39 (1928) 43–52, pl. 1, 10 fig. (seed-anat.); HOWES, Kew Bull. (1930) 219; BURK. Dict. (1935) 1380; KAUSIK, Proc. Ind. Ac. Sc. 8B (1938) 45–62 (flor. anat. & morph.); HARTUNG & STOREY, J. Agr. Res. 59 (1939) 397–406, 4 f., 3 pl. (fruit-development); BACK. Bekn. Fl. Java (em. ed.) 4a

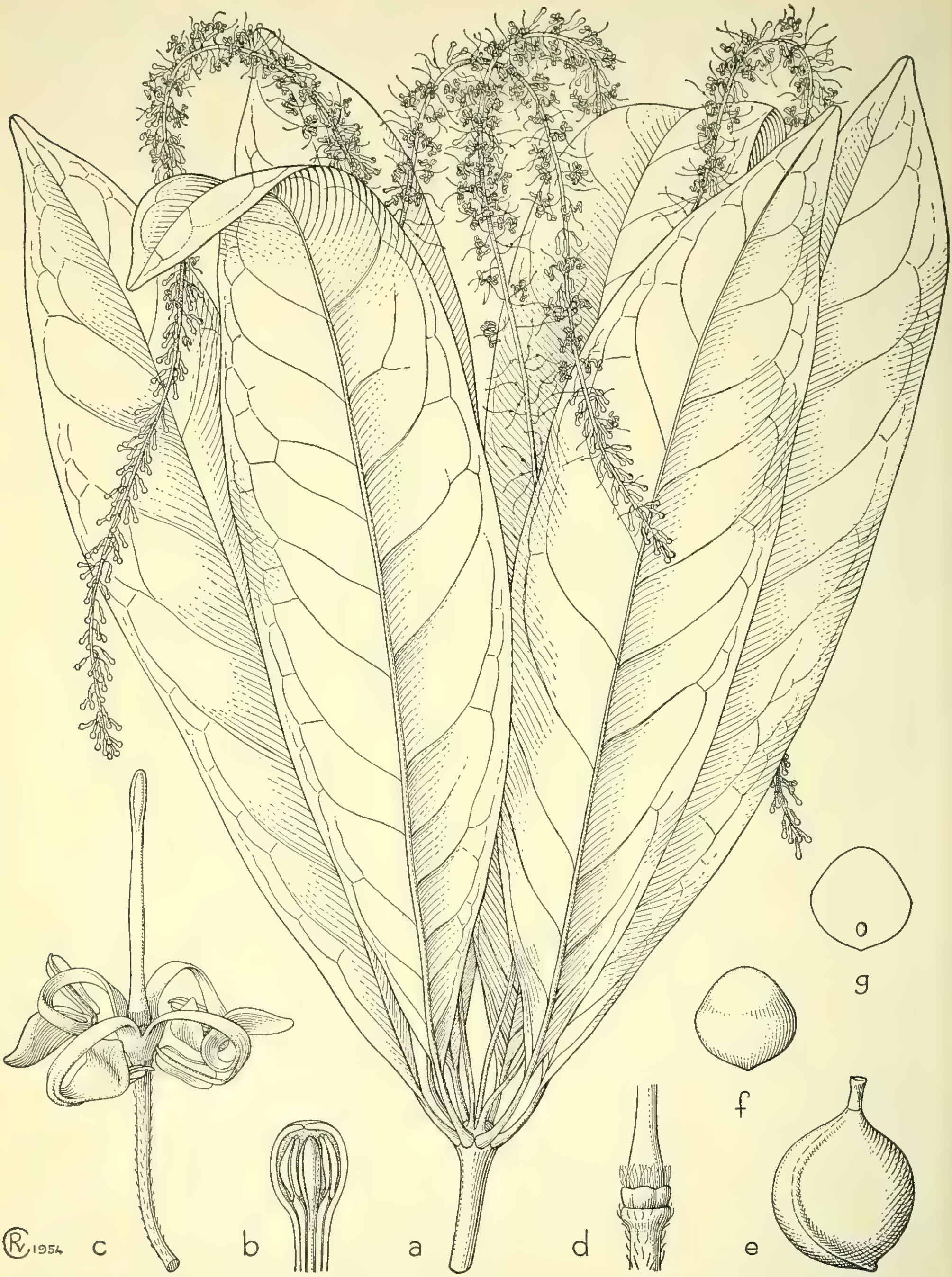

Fig. 20. *Macadamia hildebrandii* STEEN. *a*. Habit, × ¹/₂, *b*. section of bud apex, × 5, *c*. open flower, × 5, *d*. base of ovary and disk, × 8, *e*. fruit, × ¹/₂, *f*. seed, × ¹/₂, *f*. cotyledon with plumule, × ¹/₂ (Cult. Hort. Bog.).

(1942) fam. 79, p. 7; FRANCIS, Austr. Rain-forest Trees (1951) 91, f. 38–45; JOHNSON, Proc. Linn. Soc. N.S.W. 79 (1954) 16.—*M. ternifolia var. integrifolia* (MAID. & BETCHE) MAID. & BETCHE, Proc. Linn. Soc. N.S.W. 24 (1899) 150.—*Helicia ternifolia* F.v.M. Fragm. 2 (1860) 91; *l.c.* 6 (1868) 191.—*M. integrifolia* MAID. & BETCHE, Proc. Linn. Soc. N.S.W. 21 (1897) 64.—**Fig. 21.**

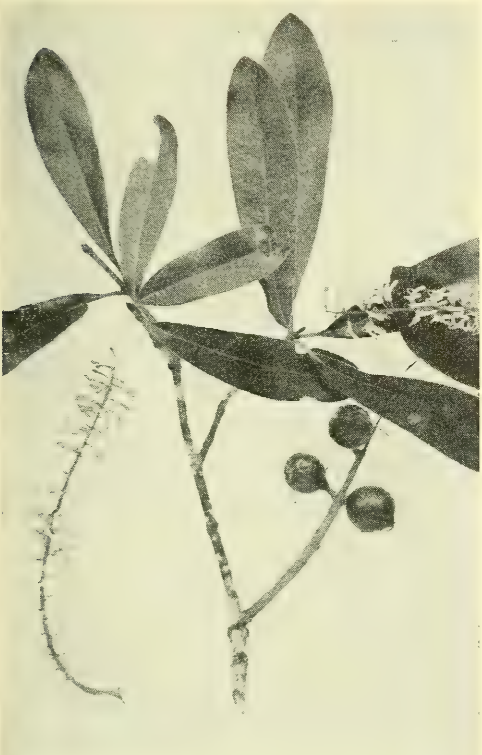

Fig. 21. *Macadamia ternifolia* F.v.M. in fruit and flower, × 1/3 (Cult. Tjibodas Mountain Garden, G 56, Oct. 1954).

Tree 5–15(–20) m by *c.* 30 cm, often several-stemmed; no buttresses. *Leaves* mostly in whorls of 3 or subalternate (very rarely in whorls of 4 on some branchlets of a very young plant), oblong to oblanceolate, acute to obtuse, sometimes retuse, tapering to the base, coriaceous, glabrous or nearly so, in earlier stages irregularly spiny-dentate with up to 10 teeth on each side, in later stages entire, 5–15 by 2–3(–4½) cm; nerves 7–12 pairs; petiole 4–15 mm. *Racemes* axillary, usually near the ends of slender foliated shoots, but occasionally on leafless shoots resulting in a compound inflorescence, ± pendulous, 8–15(–20) cm, sparingly puberulous. *Flowers* in pairs or solitary, cream or whitish. Bracts subovate-subulate, minute. Pedicels free, slender, 3–4 mm. *Perianth* segments finely puberulous outside, 8–11 mm. Stamens inserted *c.* 5 mm above the base of the perianth-segments; connective short, obtuse. Disk glands united in a shortly dentate ring. Ovary rufous-villous; style after anthesis 10–13 mm, rufous-hairy near the base, glabrous elsewhere. *Fruit* globose, green, 2½ cm diam., rarely larger, pericarp *c.* 2–3 mm thick, splitting open on one side. *Seed* mostly 1, globular, rarely 2, semiglobose, with a smooth, hard, thick (2–4(–5) mm) testa.

Distr. Native of SE. Queensland, cultivated both in Australia, *Malaysia*, and other tropical regions as a fruit-tree, preferably in the mountains.

Ecol. In Queensland in rain-forest both under everwet and seasonal conditions; its drought-resisting qualities make it of value for semi-arid regions while its ornamental appearance recommends it for garden-culture in tropical and subtropical areas. *Fl.* May–Oct., *fr.* Jan.–Febr.

Uses. The nuts are similar in shape to hazelnuts, but have a very hard shell; thin-shelled (1 mm) strains are now under cultivation in Australia. The flavour of the nut is said to have a finer aroma than that of the hazelnut. The tree is said to begin to fruit at 3 to 8 years. The timber is of small size, but very useful, red, firm, the structure is fine, and takes a good polish; useful for turning, cabinet- and veneer-work.

Vern. *Queensland nut*, *Australian bush nut*, *popple nut*, E.

3. Macadamia tetraphylla JOHNSON, Proc. Linn. Soc. N.S.W. 79 (1954) 15.—*M. ternifolia* F.v.M. *ap.* BENTH. Fl. Austr. 5 (1870) 406 *et aut. plurim. pro parte.*

High shrub to medium-sized tree, 5–15(–?) m, several-stemmed at the base, specially in cultivation. *Leaves* mostly in whorls of 4, at least the upper ones of a twig, middle ones ± ternate, inferior ones subopposite, oblong-oblanceolate, shortly subacutely acuminate and often mucronate, ± truncate or contracted at the base, coriaceous, glabrous or sparsely provided with fulvous or pallid hairs underneath, regularly spiny-serrate with *c.* 35–40 teeth on each side, 7–25 by 2–4½ cm; nerves 13–20 pairs, reticulations dense, finely prominent; petiole 0–2 mm. *Racemes* axillary or ?ramiflorous, ± pendulous, densely rufous-patent-pilose or nearly tomentose, 12–30 cm incl. the 2–5 cm long peduncle; rhachis rather slender. Bracts subulate to filiform, *c.* 2 mm, irregularly inserted in pseudo-whorls, some of them subtending a pair of flowers. Pedicels in twos, 2–3 mm. *Perianth c.* 8 mm, usually pale lilac, but occasionally creamy or whitish, ± densely appressed-hairy outside, glabrous inside. Filaments *c.* 2½ mm; anthers pale, 1½ mm. Disk glands connate into a cup. Ovary densely fulvous-pilose; style hairy at the base, glabrous towards the clavate top, together with the ovary 8–10 mm. *Fruit* globose, apiculate, *c.* 2–3 cm across, glabrous, somewhat rugose, on a very short thick pedicel. *Seeds* solitary, globose, apiculate, 1½–2 cm diam., brownish, somewhat shining; testa hard, wrinkled or with shallow depressions, 2(–3) mm thick.

Distr. Native on the far N. coast of New South Wales and the adjacent part of Queensland, elsewhere cultivated as an ornamental or fruit-tree.

Ecol. In lowland rain-forest or rain-forest edges. *Fl.* Sept.–Oct., *fr.* Jan.–Febr.

Uses. Similar to those of *M. ternifolia*; the variation in the thickness of the testa (shell) is also similar to that in *M. ternifolia*, specially in cultivated specimens.

Vern. The same as in *M. ternifolia*.

Notes. This species, recently segregated by JOHNSON, occupies a more northern area than *M. ternifolia s.str.* In restricted areas, in the region of contact of the two species, specimens with vegetatively intermediate characters have been found, displaying a considerable variation. These presumed hybrids have only been found in a sterile state.

7. STENOCARPUS

R.BR. Trans. Linn. Soc. 10 (1810) 201, *nom. cons.*—*Cybele* SALISB. in KNIGHT, Prot. (1809) 123, *nom. rejic.*—**Fig. 22–23.**

Trees. *Leaves* spiral, simple or deeply pinnatifid with few lobes, in the younger stages often twice and thrice pinnate, with very narrow pinnae. *Peduncles* terminal or in the upper axils, sometimes several in an umbel or short raceme, each bearing an umbel of pedicellate flowers. Bracts 0 or very early caducous. *Perianth* slightly irregular, the tube opening along the abaxial side, limb nearly globular and recurved, segments at length separating. Anthers broad, sessile, within the concave limb; connective not produced beyond the anther-cells. *Disk* glands united in a short semi-annular disk or cup, or almost obsolete. *Ovary* stipitate, tapering into a long style dilated at the top into a flat, oblique disk stigmatic in the centre. *Ovules* several, laterally attached at or near the top of the cell, imbricate downwards in 2 rows. *Fruit* a usually narrow-oblong, coriaceous follicle. *Seeds* produced at the lower end into a membranous wing, separated from each other by a thin lamella.

Distr. About 22 *spp.*, *c.* 16 of which are endemic in New Caledonia, 4 *spp.* are restricted to N. and E. Australia, 2 *spp.* in *Malaysia* (New Guinea and Aru Islands), both also in Australia.

KEY TO THE SPECIES

1. Nerves 10–15 pairs, pinnate. Perianth robust, 2¹/₂–3 cm long . . . . **1. S. sinuatus**
1. Leaves 5-plinerved. Perianth slender, *c.* 1 cm long . . . . **2. S. moorei**

1. Stenocarpus sinuatus ENDL. Gen. Pl. Suppl. 4 (1847) 88; MEISN. in DC. Prod. 14 (1856) 451; F.v.M. Fragm. 5 (1866) 154 (*sphalm. sinuosus*); BENTH. Fl. Austr. 5 (1870) 539; BAIL. Queensl. Fl. 4 (1901) 1355; DOMIN, Bibl. Bot. 89 (1921) 40, f. 126; SLEUM. Bot. Jahrb. 70 (1939) 130; BACK. Bekn. Fl. Jav. (em. ed.) 4a (1942) 8; FRANCIS, Austr. Rain-forest Trees (1951) 97, f. 51–53.

Tree, 10(–20–30) m by 30 cm; branchlets terete, younger parts tomentulose, soon glabrescent. *Leaves* either undivided, oblong-lanceolate, 13–27 by 3–7 cm—or irregularly pinnatisect and up to 30 cm long, with 1–4 oblong lobes on each side—mostly obtuse at the apex, attenuate into the petiole at the base, subcoriaceous, glabrous; forks in divided leaves with a (?hydathodal) gland; nerves 10–15 pairs, pinnate, with more or less conspicuous intermediate ones between, slightly prominent underneath, veins finely and densely reticulate on both faces; petiole glabrous, 1¹/₂–2¹/₂ cm. *Peduncles* axillary or terminal on lateral short-shoots, glabrescent, either 2 or more together in an umbel, or several at some distance forming a short broad raceme, each peduncle 5–10 cm bearing an umbel of (6–)12–20 bright red or orange-red *flowers*. Pedicels *c.* 1¹/₄ cm, radiating in one plane from the dilated apex of the peduncle. *Perianth*-tube shortly rusty-pubescent, straight, narrowed upwards, incl. the limb (2¹/₂–)3 cm in anthesis; limb recurved, globular, about 4 mm across. Anthers yellow. Disk gland semi-annular, blackish when dry, *c.* 2 mm high. Ovary densely brownish-pubescent, on a less densely pubescent to glabrescent, thick, up to 2 cm accrescent stipe. Style glabrous, *c.* 2 cm. Ovules 12–14. *Fruit* dry, *c.* (6–)10 cm long, 2–2¹/₂ cm broad, narrow-oblong, attenuate at both ends, opening lengthwise on one side and then boat-shaped, but flattening out after maturity, hard-coriaceous. *Seeds* thin, closely packed and overlapping, *c.* 25 by 7 mm.

Distr. Australia (coastal scrubs of Queensland and New S. Wales), and in *Malaysia:* SE. New Guinea (Port Moresby area: Boridi), twice found.

Ecol. In primary and secondary rain-forest at 1000–1400 m. *Fl.* Oct.–Nov. in New Guinea, but in Febr. in Australia.

Uses. Wood of a light colour, close in grain, tough and firm, good for cabinet-work, brake-blocks, building, framing, flooring. Often cultivated for its brilliant and remarkably symmetrical inflorescences, similar to a wheeled umbel, therefore called *wheel-tree*. According to BACKER *l.c.* sometimes cultivated in the mountains of W. Java as an ornamental tree.

Vern. *Tulip-flower*, *fire-tree*, *white silky oak*, Queensland.

2. Stenocarpus moorei F.v.M. Fragm. 1 (1859) 134; *ibid.* 5 (1866) 154.—*S. salignus* R.BR. *var. moorei* BENTH. Fl. Austr. 5 (1870) 540; BAILEY, Queensl. Fl. 4 (1901) 1356.—*S. papuanus* LAUT. Bot. Jahrb. 50 (1913) 329; DIELS, Bot. Jahrb. 54 (1916) 199; Nova Guinea 14 (1924) 74; SLEUM. Bot. Jahrb. 70 (1939) 131.—**Fig. 22–23.**

Shrub or small tree 2–15(–25) m; branches terete, tips finely appressed-pubescent, soon glabrescent. *Leaves in mature specimens* simple, ovate-oblong or elliptic to ovate-lanceolate, obtusely or rarely subacutely slightly acuminate, tapering into the petiole, subcoriaceous, brown when dry, finely appressed-puberulous when young, soon glabrous, 8–16 by ($2^1/_2$–)3–6 cm, 5-plinerved from

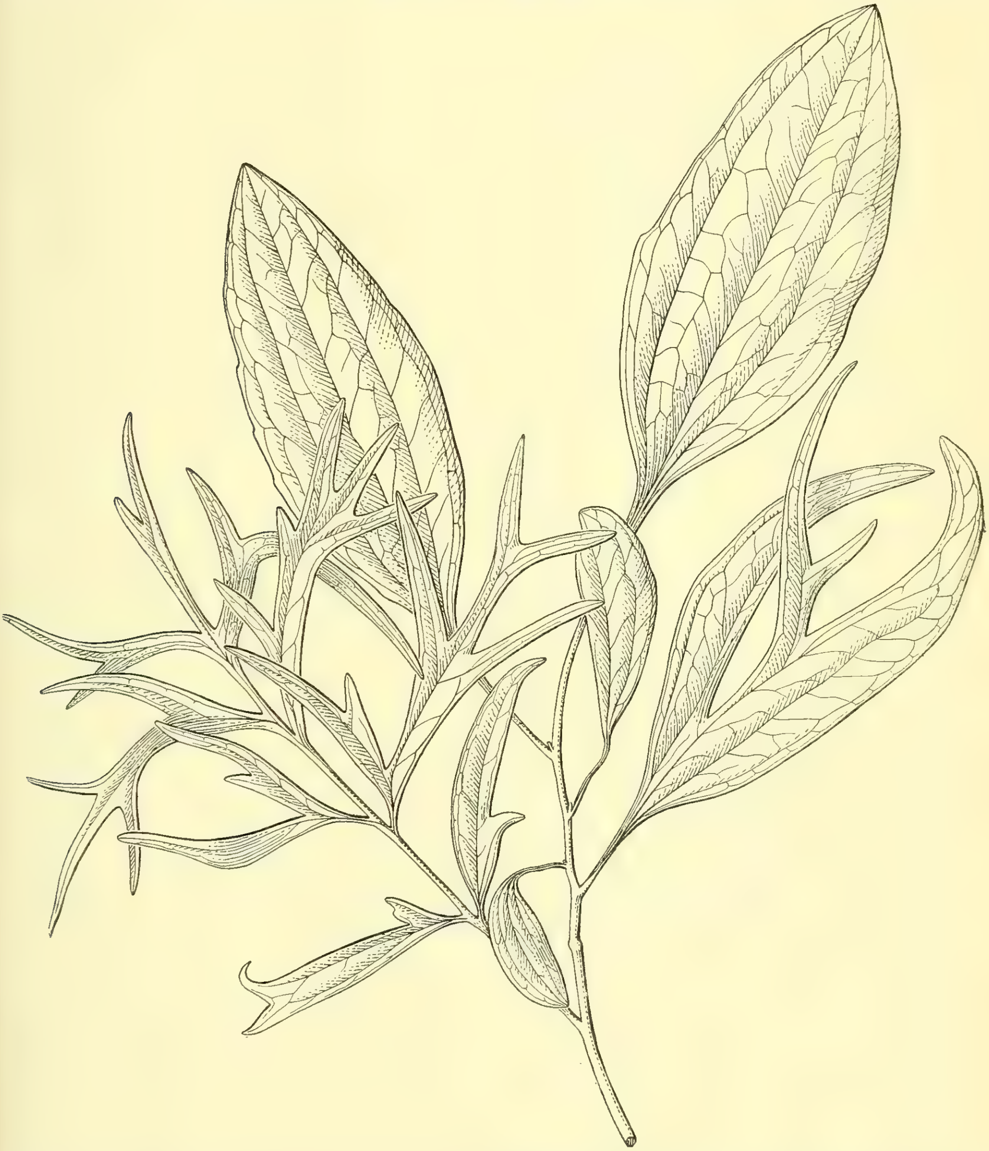

Fig. 22. *Stenocarpus moorei* F.v.M. Twig from a juvenile specimen showing dimorphous foliage, × $^2/_3$ (GJELLERUP 82a).

the base. *Leaves from young specimens* or sprouts repeatedly pinnately dissected and fern-like, quite different from the normal leaves, segments sometimes only 2 mm broad; petiole ³/₄–2 cm. *Inflorescences* axillary, densely and persistently sericeous by a mixture of whitish and rusty hairs, consisting of a solitary umbel or of a short raceme of 2–4 umbels. Peduncles slender, 1–2 cm, bearing an umbel of (10–)15–20(–30) green or brownish-yellowish flowers. Pedicels *c.* 4–5 mm, slender,

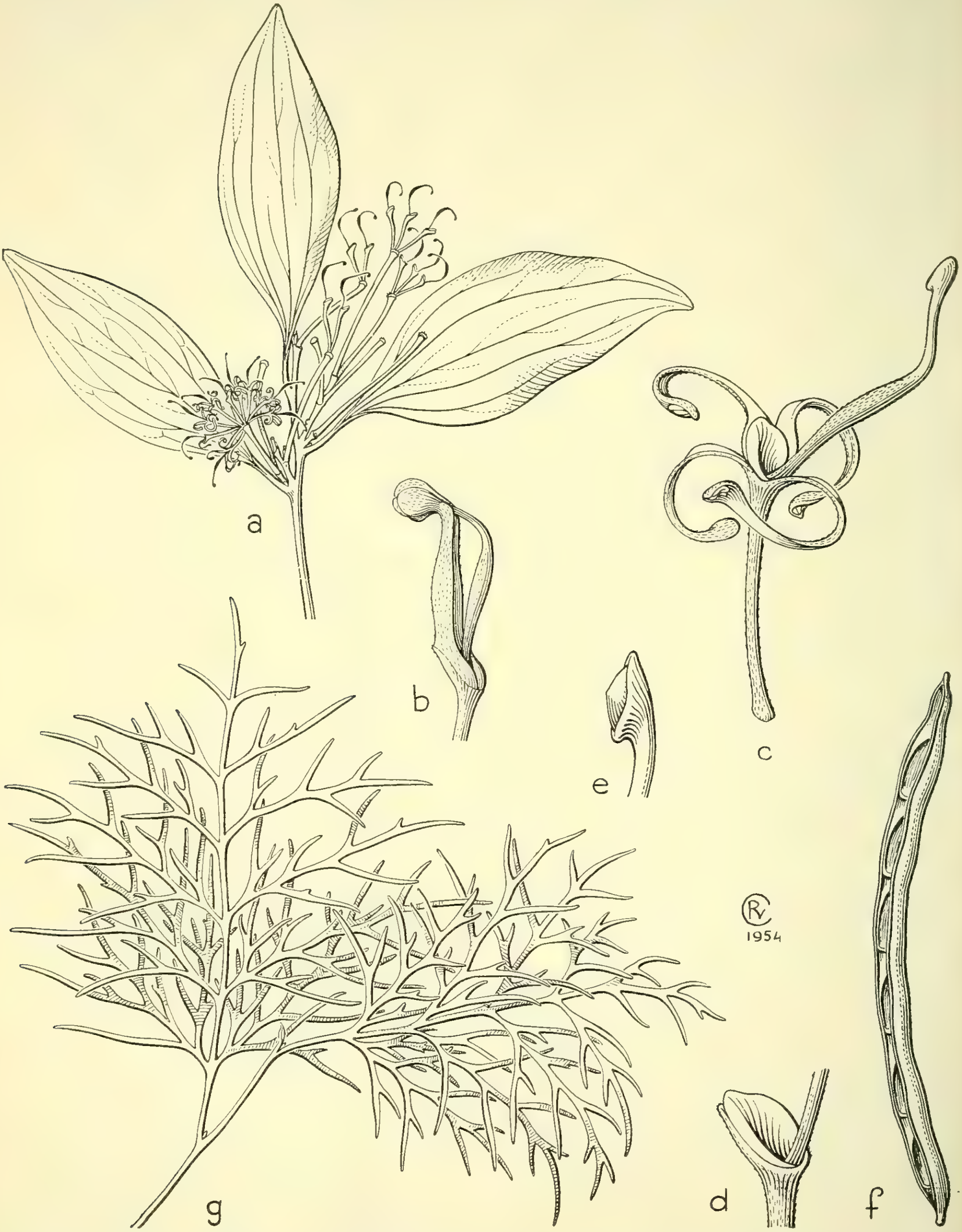

Fig. 23. *Stenocarpus moorei* F.v.M. *a*. Flowering twig, × ²/₃, *b*. bud, × 5, *c*. open flower, × 5, *d*. torus with disk, × 7, *e*. stigmatic style apex, × 9, *f*. opened fruit with imbricate seeds, × ²/₃, *g*. leaf from juvenile specimen, × ²/₃ (*a–e*. after BRASS 8882, *f*. BRASS 8556, *g*. BRASS 8813A).

thickened at the apex into a very oblique torus bearing the thick, unilateral, horseshoe-shaped disk. *Perianth* incl. the limb 6–7 mm, tube 3/5 mm diam., limb globular 1 1/2 mm diam. Stipe 5–6 mm, ferrugineous-sericeous as is the ovary, inserted in the lowest part of the torus; style slender, glabrous, 4–5 mm after anthesis. *Fruits* pod-like, several together, narrow-oblong, subterete, curved with slight constrictions, acuminate, 4–12 cm by *c.* 4–5 mm across, glabrous, woody, splitting unilaterally lengthwise, the halves flattening out. *Seeds* subquadrate, very thin, *c.* 5 mm across.

Distr. Queensland and New South Wales, in *Malaysia:* New Guinea, S. Moluccas (Aru Isl.: P. Trangan).

Ecol. Both in river-side rain-forest and on open slopes of grass and ferns, once found on serpentine rock covered with humus, from the lowland up to 1000 m, occasionally common. *Fl.* June–July, *fr.* Dec.

Vern. *Nanhanga*, Trangan Isl. (Aru), *beefwood*, Queensland.

Notes. Sterile and fruiting specimens show a remarkable similarity with some broad-leaved phyllodinous *Acacias*, but can easily be recognized by the absence of an adaxial gland at the apex of the petiole and more strictly falcate leaves.

The Papuan material is exactly matched by the type specimen collected by C. MOORE near Illawarra, New South Wales (K). Specimens from Mt Lindsay (Macpherson Range, N.S.W.) and Rockingham Bay (NE. Queensland) are very similar but differ by rather glabrous inflorescences.

S. moorei is closely allied to *S. salignus* R.BR. The indument of the inflorescences in the latter species, although sparse in general, is apparently rather variable in density. Pending a detailed study of the *S. salignus*-complex (incl. the New Caledonian *S. trinervis* (MONTR.) GUILLAUMIN) *S. moorei* is kept specifically distinct from *S. salignus*; leaves of *S. moorei* are 2–3 times as long as broad, those of *S. salignus* 4–8 times.

8. OREOCALLIS

R.BR. Trans. Linn. Soc. 10 (1810) 196.—**Fig. 24.**

Trees or shrubs. *Leaves* spiral, simple, lobed, or pinnate. *Racemes* rather short, solitary or fascicled, axillary in the upper leaf-axils, or solitary and terminal. Bracts rudimentary, early caducous. *Flowers* showy in pairs, pedicelled, free. *Perianth* splitting completely into 4 segments at anthesis, tube cylindrical, straigth, limb somewhat oblique, subglobose. *Anthers* sessile within the concave limb, ovate, connective not or very shortly produced. *Disk* semi-annular or horseshoe-shaped, fleshy, inserted on the thickened, very oblique torus. *Ovary* on a long stipe, attenuate into a long style. *Ovules* ascending, imbricate, 4 or more in each of 2 rows. Style manifestly thickened and nearly truncate at the apex, with a disk-like lateral swelling bearing the rather minute stigma in its centre. *Follicle* stipitate, narrow-oblong, opening lengthwise at one side, with 4 or more superposed seeds on each half. *Seeds* suborbicular, flat-compressed, separated from each other over their whole length by a thin lamella, with an oblong unilateral and terminal wing; wing of the basal seed nearly as long and wide as the fruit, but gradually shorter in the upper seeds; funiculus ascending obliquely to the upper part of the wing.

Distr. About 5 *spp.*, 2 of which in S. America (Ecuador-Peru), 2 in Australia (NE. and SE. Queensland to N. New South Wales), in *Malaysia:* 1 in New Guinea and the S. Moluccas (Aru Isl.). Fig. 1.

Note. The American, Australian and Papuan species are similar in all characters of the flower and the fruit, but show a remarkable divergence in so far as the American *spp.* have their nerves, veins and veinlets prominent on both faces, whereas in the latter the venation is minutely but visibly impressed above and underneath.

1. Oreocallis brachycarpa (SLEUM.) SLEUM. Bot. Jahrb. 76 (1954) 203.—*Embothrium brachycarpum* SLEUM. *l.c.* 70 (1939) 130.—**Fig. 24.**

Tall, rather slender tree, 20–40 m by 40–50 cm; bark hard, brown to greyish, rough, shedding in thin scales. Branchlets terete, slightly pubescent at the tips, glabrous elsewhere. *Leaves* elliptic- to obovate-oblong, blunt to rounded at the apex, cuneate at the base and decurrent into a 1 1/2–3 cm long petiole, subcoriaceous to coriaceous, entire, glabrous, (6–)8–13(–15) by 2 1/2–4(–5) cm; nerves *c.* 10–11, rather straight, inarching before the margin, with other less distinct ones between them. *Racemes* mostly solitary, closely together at the twig-ends, each 8–20(–25)-flowered; rhachis *c.* 2–3 mm thick, woody, rusty-tomentose, 2 1/2–5 cm. Pedicels rather slender, (2–)2 1/2–3 cm, minutely ferrugineous-pubescent; torus 2 mm diam. Anthers ovate, 1 1/2 mm, sessile or nearly so. *Flowers* orange-red, glabrous or minutely ferrugineous- or fuscous-pubescent, somewhat fleshy. *Perianth*-tube 4–5 cm, limb oblique, subglobose, 2–3 mm across. Disk glabrous. Ovary fusiform, glabrous; stipe *c.* 2 cm; style *c.* 2 cm, thickened. *Fruit* narrow-oblong, somewhat broadened towards the acute apex, cuneate at the base, smooth, 8–12(–14) by 2–2½ cm, *c.* 1½ cm thick; exocarp coriaceous, *c.* 1½ mm; mesocarp stiff, nearly woody, *c.* 1 mm; endocarp

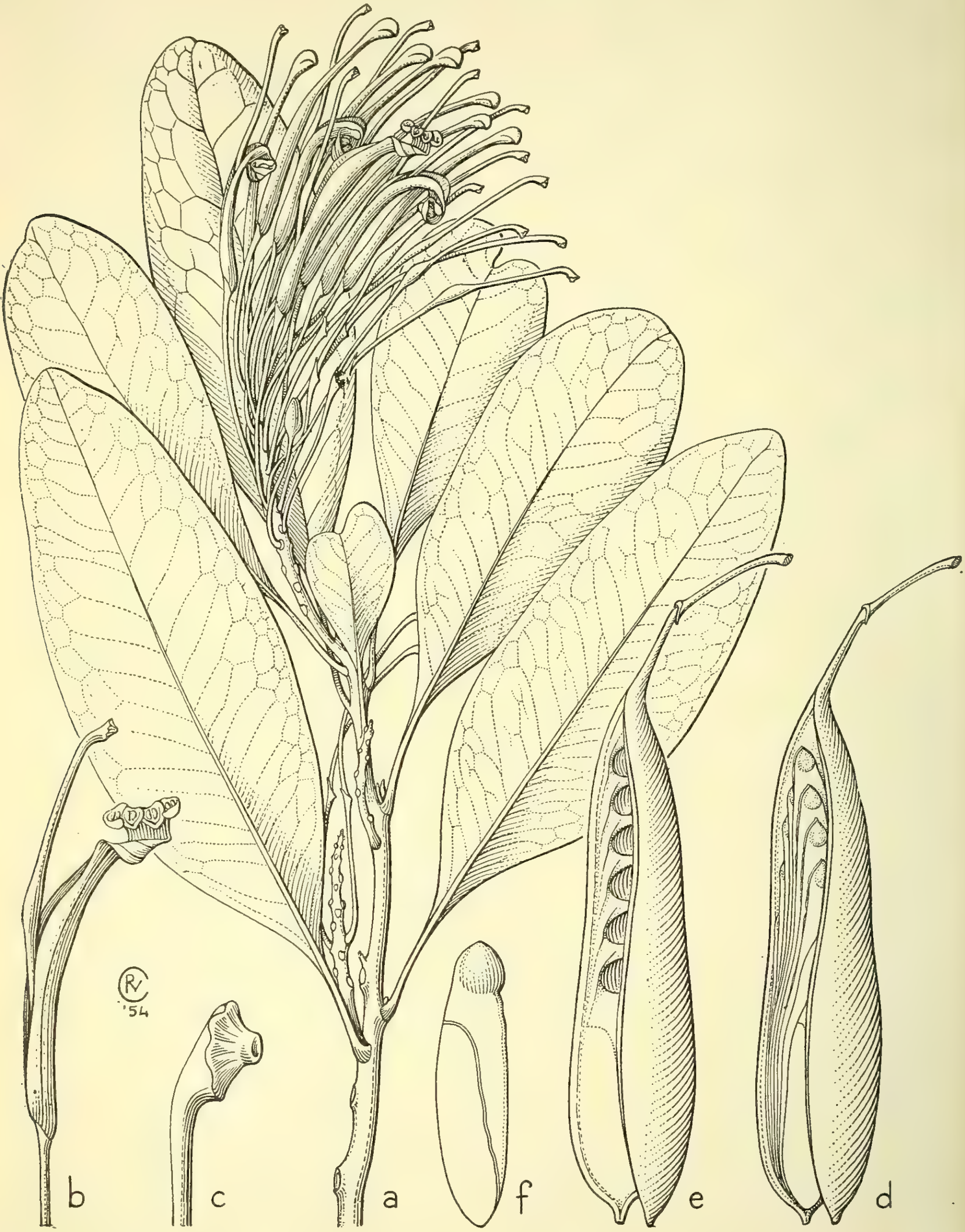

Fig. 24. *Oreocallis brachycarpa* (SLEUM.) SLEUM. *a.* Habit, × ²/₃, *b.* flower, nat. size, *c.* apex of style and stigma, × 5, *d.* opened fruit with 2 rows of imbricate seeds, × ²/₃, *e.* empty fruit with pitted endocarp, × ²/₃, *f.* seed, × ²/₃ (*a–c.* after BRASS 8170, *d–f.* after VAN ROYEN 4780).

soft, *c.* 1 mm. *Seeds* in 2 rows of 5–7, impressed in pits in the endocarp, rounded, ± flattened, *c.* 3–4 mm across, *c.* 2–3 mm thick, with an oblong, terminal, ± stiffly membranous wing which reaches nearly the full length and width of the fruit in the basal seed, but diminishes gradually in size in the upper ones, every seed separated from the next one by a menbranous lamella the size of the wing; fruit-stipe woody, $1^1/_2$–2 cm by 2 mm; pedicel woody, 2–$2^1/_2$ cm by *c.* $1^1/_2$ mm.

Distr. *Malaysia:* S. New Guinea (Upper Merauke River, Lower Fly River and Oriomo River), S. Moluccas (Aru Isl.: P. Trangan).

Ecol. In mixed rain-forest of dry inland ridges or high banks of rivers not subject to inundation, also found in a bamboo-Eucalypt-forest, at low elevations. *Fl.* Aug.–Oct., *fr.* Aug.–Febr.

Uses. Sapwood pale straw-coloured merging into red; heart-wood said to resemble that of *Stenocarpus.* No use is known as yet, but possibly it is a good timber as is the related *O. wickhamii* HILL & F.v.M., the 'Pink Silky Oak' from NE. Queensland, which is described as yielding a very light, very soft and yet the most durable timber of the so-called 'Northern Silky Oaks' (*cf.* FRANCIS, Austr. Rain-forest Trees 1951, 390, under *Embothrium*).

Vern. *Anga*, Trangan, *kawoli*, Merauke (Jedialect).

Note. The epithet '*brachycarpa*' unfortunately alluded to galled, not well developed fruits attached to the type-sheet. Such anomalous fruits, reaching only 2 cm in length and containing no seeds, have recently been collected along with normal fruits. As a matter of fact *O. brachycarpa* has the biggest fruits known in the genus.

9. BANKSIA

LINNÉ *f.* Suppl. (1781) 15.—**Fig. 25–28.**

Trees or shrubs. *Leaves* spiral or irregularly whorled, simple, lobed, pinnatifid or pinnate, entire or toothed, mostly with numerous nerves. *Spikes* densely flowered, terminal, cylindric-oblong or globular, terminal and sessile above the uppermost leaf, rarely lateral or on short, lateral branches. *Flowers* sessile, in pairs, each pair subtended by a persistent, pointed bract and 2 lateral, rather small, persistent bracteoles, all densely packed in parallel or spiral or rarely vertical rows. *Perianth*-tube ± straight, slender, dehiscing into 4 segments, or along the lower

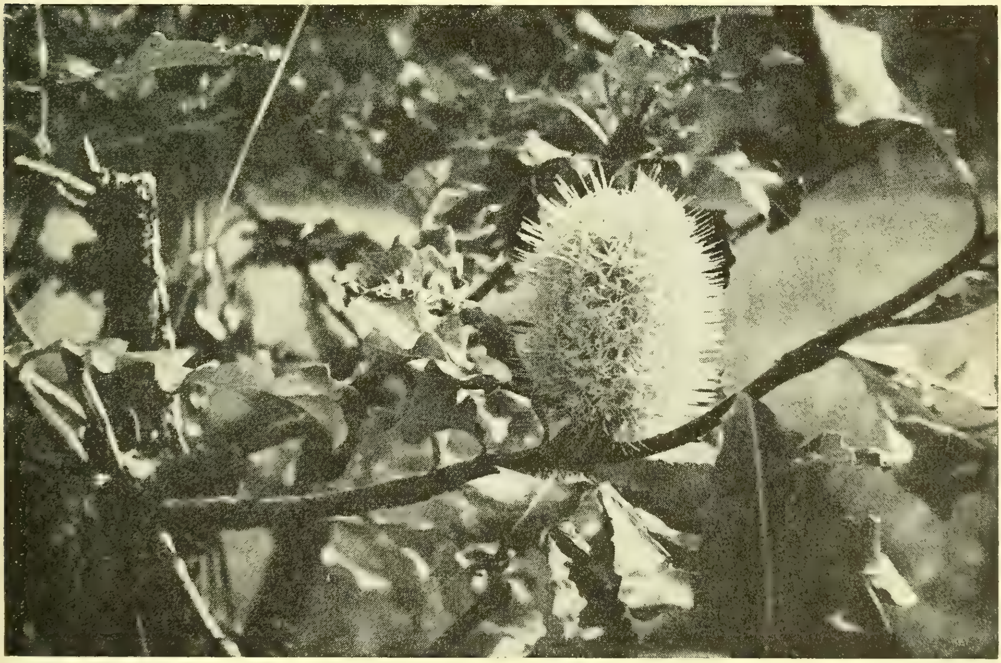

Fig. 25. *Banksia dentata* L. *f.* in a small pyrogenic savannah near Wau, between Crystal Creek and Magnetic Creek, *c.* 1160 m, associated with *Cycas* (photogr. P. VAN ROYEN, June 1954).

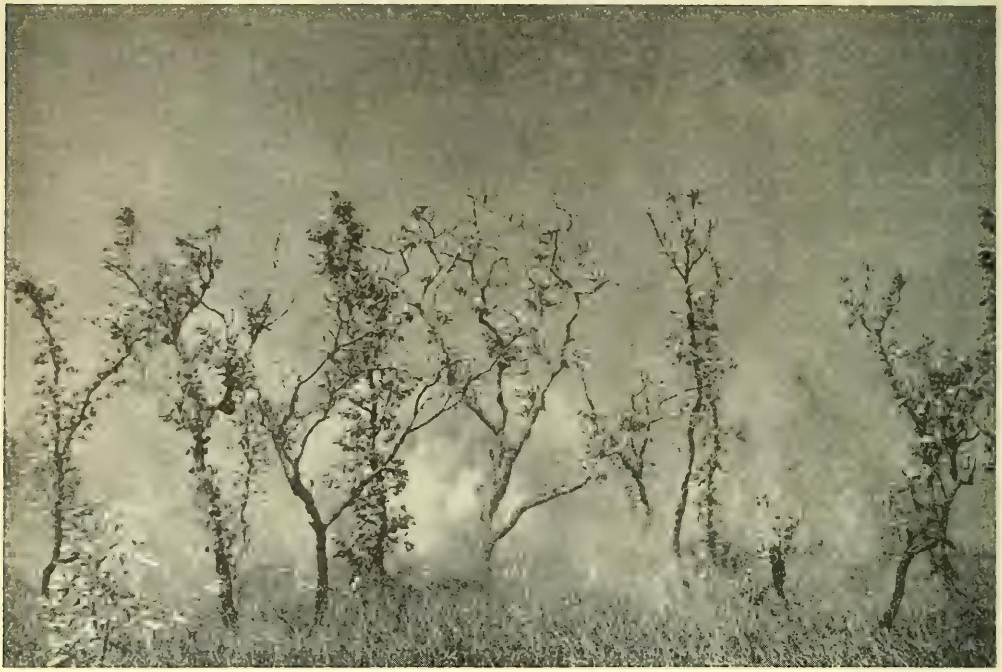

Fig. 26. Hunter's fire raging on *Banksia dentata* savannah, trees *c*. 5 m high (photogr. BRASS, Sept. 1936).

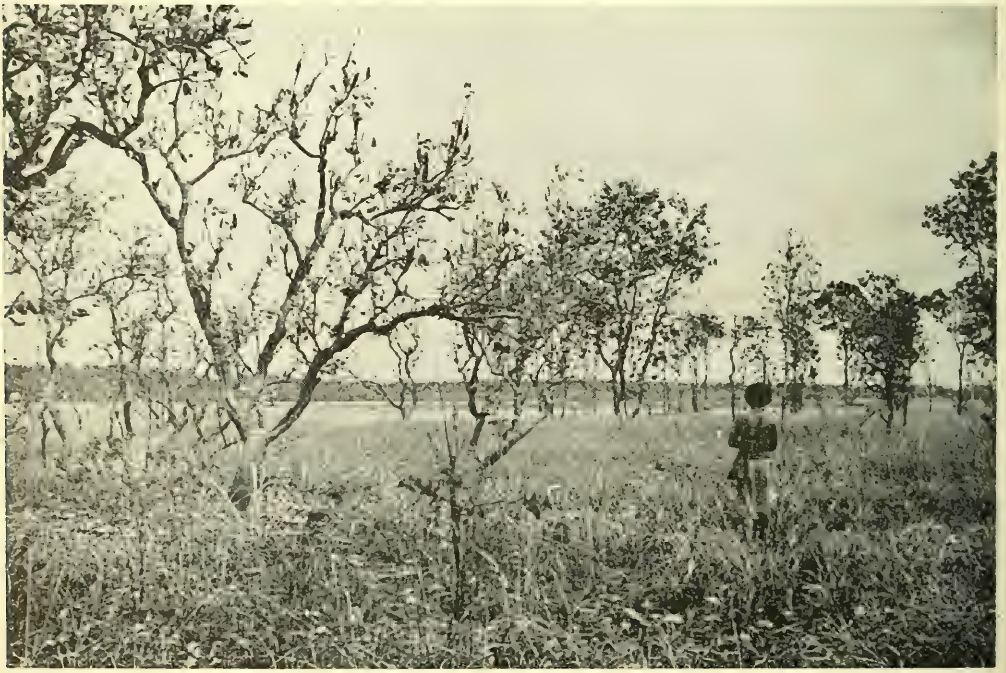

Fig. 27. Fruiting *Banksia dentata* L. *f*. with charred trunks on recently burned savannah of a low lateritic ridge, Lake Daviumbu, Middle Fly River, Papua (photogr. BRASS, Sept. 1936).

side only; limb ovoid-oblong or linear, remaining long coherent. *Anthers* narrow, sessile in the concave limb segments; connective thick, usually very shortly produced beyond the anther-cells. Disk glands 4, membranous. *Ovary* very small, sessile. Style usually longer than the perianth, hard, elastic, needle-like, remaining hooked until the end is set free by the separation of the laminae; stigma small, terminal, punctiform. *Ovules* 2, collaterally attached about the middle of the cell. *Fruit* compressed, capsule-like, opening at the broad end in 2 hard, often woody horizontal halves, transverse on the spike. *Seeds* usually 2, compressed, with a terminal membranous wing, broad and rounded like the valves, separated by a membrane of the same shape. Bracts and bracteoles consolidated in fruit with the stout rhachis into a thick woody cone (in Mal. *sp.*), the valves of the capsules protruding somewhat beyond the bracts.

Distr. About 50 *spp.* in Australia, 1 of them in *Malaysia:* New Guinea and S. Moluccas (Aru Isl.).

1. Banksia dentata Linné *f.* Suppl. (1781) 127; R.Br. Trans. Linn. Soc. 10 (1810) 210; Benth. Fl. Austr. 5 (1870) 555; F.v.M. Descr. Not. 1 (1876) 28; Becc. in d'Albertis, Nuova Guinea 2 (1880) 398; Bailey, Queensl. Fl. 4 (1901) 1360; Laut. Nova Guinea 8 (1910) 285; Bot. Jahrb. 50 (1913) 334; White, Proc. R. Soc. Queensl. 34 (1922) 27; J. Arn. Arb. 10 (1929) 210; Kaneh. & Hatus. Bot. Mag. Tokyo 52 (1938) 354; Sleum. Bot. Jahrb. 70 (1939) 148.—**Fig. 25–27.**

Branched shrub or small, often crooked or stunted tree, 2–5 m by 10–20 cm, with sparse foliage; bark rough, tuberculate, flaky in rectangular pieces. *Leaves* sessile or nearly so, spiral or in whorls, cuneate-oblong, rounded-obtuse or sometimes retuse at the mucronate apex, tapering gradually towards the base, subcoriaceous, margin irregularly coarsely spiny-toothed to subentire, undulate and often slightly recurved, upper surface glabrous, undersurface white or slightly pale brownish, arachnoid-tomentose, except on the nerves, 10–25 by (2–)2½–8 cm, nerves straight, numerous, at about right angles to the midrib, arched. *Spikes* oblong or cylindrical, covered by a thick, rusty, detersile wool when young, 6–10 cm long, 1–1½ cm thick in anthesis. Bracts and bracteoles tomentose. *Perianth* slender, silky, greenish- or creamish-yellow when open, 2–2½ cm. Style yellow, 3–4 cm. *Fruit*-cone oblong, *c.* 7–10 by 1½–2 cm, tomentose.

Distr. Australia (Northern Territory & Queensland), in *Malaysia:* New Guinea & S. Moluccas (Aru Isl.: P. Trangan).

Ecol. Open savannah lands, savannah ridges or open grassland, in savannah forest adjoining rainforest, secondary forest, sometimes together with *Pandanus*, mainly in the lowland from the coast inland, also at 600 and up to 1200 m, sometimes gregarious (Lake Daviumbu, Astrolabe Range), mainly restricted to areas which are subject to a distinctly dry season, in New Guinea therefore specially in the southern part from Merauke beyond Moresby, also in the lower montane zone near Bulolo and Wau. *Fl.* Jan.–Sept., *fr.* May–Sept.

Both in Australia and in New Guinea it grows often associated with *Melaleuca* and certain species of *Eucalyptus* in open or woody savannahs which are regularly swept by raging hunting fires (fig. 26–27) and shrubs are charred and grow stunted or crooked. By its resistance against these fires it may gain local predominance. The woody spikes belong to the macrobiocarpous type, the seeding of which is adapted to the pyrogenic habitat (*cf.* Fl. Mal. I, 4, p. xxiv).

The immense number of flowers in each spike produces abundant honey attracting insects as well as honey birds (*Nectarinidae*, *Zosteropidae*, *Meliphagidae*), but also the honey-mouse, the smallest arboricolous type of marsupial belonging to the *Phalangeridae*, which sucks honey with its long, thin, worm-shaped tongue. These small marsupials have been observed both on *Banksia dentata* and on the above-mentioned associated *Myrtaceae*. Facts about these most interesting biological conditions have been summarized by

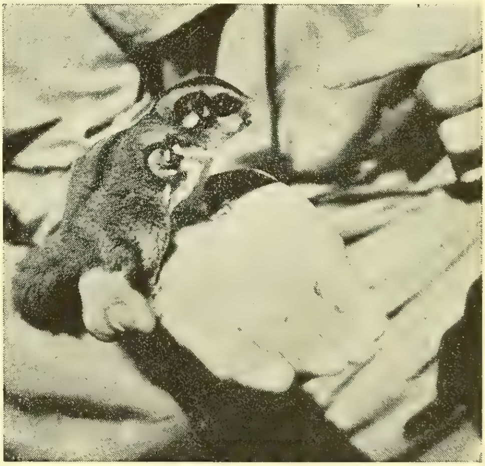

Fig. 28. The silvergrey 'glider' or 'flying phalanger' *Petaurus breviceps* Waterhouse, always found in flowering *Banksias*, same place as in fig. 25 (photogr. P. van Royen).

O. PORSCH (Jahrb. Wiss. Bot. 70, 1929, 190; Biol. Gener. 10, 1934, 673–679). Similar conditions prevail in New Guinea where these biological communities have the same composition. Dr VAN ROYEN found always mouse-like marsupials in the *Banksias* near Rona (fig. 28).

Uses. Sapwood pale to straw, heart-wood deep red or red-brown, prettily marked. In Australia used for cabinet-work.

Excluded

Polypodium spinulosum BURM. *f.* Fl. Ind. (1768) 233, t. 67, f. 1 = *Synaphea spinulosa* (BURM. *f.*) MERR. Proc. Linn. Soc. N.S.W. 44^2 (1919) 354; Philip. J. Sc. 19 (1921) 347 (*syn. S. polymorpha* R.BR.).

An Australian species erroneously attributed by BURMAN to Java.

BETULACEAE (C. G. G. J. van Steenis, Leyden)

1. ALNUS

EHRH. Oec.-Pfl. Hist. 2 (1753) 211; GAERTN. Fruct. 2 (1791) 54.—**Fig. 1.**

Monoecious, mostly deciduous shrubs or trees with perular buds. Pith triangular in section. Innovations often resiniferous. *Leaves* simple, (in Mal. *spp.*) spiral, penninerved, crenate or dentate, rarely entire, mostly with domatia in the nerve-axils beneath, in bud mostly folded along the midrib and plicate, often glandular-lepidote beneath. Stipules caducous. Catkins unisexual, at least the pendent ♂ ones in terminal panicles above the ♀ ones, the latter mostly in stiff, axillary, poor racemes or terminal on short-shoots.—♂ *Flowers* in triads, each sustained by a bract. Perianth segments 4 (or less by abortion), mostly connate at the base. Stamens 4, epitepalous; filaments short; anthers glabrous, 2-celled; cells parallel, dehiscing lengthwise. No rudiment of ♀.—♀ *Flowers* in diads sustained by a bract concrescent with 4 bracteoles, accrescent and woody in fruit, densely packed and imbricate. Perianth 0. *Ovary* 2-celled, each cell with one anatropous, pendent ovule attached near the apex of the cell; styles 2, free, short, cylindric. *Fruiting catkins* cone-like. *Nut* small, compressed, 1-seeded, mostly winged and crowned by the styles. Seed without endosperm; embryo straight, cotyledons flat; testa membranous; embryo straight; endosperm 0; cotyledons flat.—

Distr. About 20 *spp.* mainly on the N. hemisphere except in the New World, mostly extra-tropical, in SE. Asia southward to Bengal, N. Assam, Tonkin, and Formosa, in *Malaysia* only cultivated.

KEY TO THE SPECIES

1. Leaves shallowly crenate to subentire, intervenium glaucous and rather densely, finely, brown-lepidote. Nerves 12–16 pairs . . . . **1. A. nepalensis**

1. Leaves distinctly dentate, undersurface not glaucous and hardly or laxly lepidote. Nerves 6–7 pairs. **2. A. maritima**

1. Alnus nepalensis D. DON, Prod. Fl. Nep. (1825) 58; WALL. Pl. As. Rar. 2 (1831) 27, t. 131; HOOK. *f.* Fl. Br. Ind. 5 (1890) 600; HUB. WINKL. Pfl. R. Heft 19 (1904) 108, f. 25; CAMUS, Fl. Gén. I.-C. 5 (1931) 1041, f. 118.

Tree, 8–15 m; timber white; twigs glabrescent, ribbed, hardly triangular. *Leaves* spiral, ovate to oblong, acute or short-acuminate, rounded or cuneate at the base, 7–21 by 4–10 cm; nerves 12–16 pairs, beneath as the prominent crossbar-veins laxly puberulous (glabrescent) and vein-axils bearded; midrib and nerves sulcate and glabrous above; petiole strong, *c.* 5–10 times as short as the blade, $1^{1}/_{2}$–2 cm. ♂ *Catkins* up to 10 cm by 3–5 mm, in a terminal panicle up to 16 cm. ♀ *Inflorescences* short, axillary, bearing 3–8 oblong, 3–6 mm peduncled catkins 10–17 by 6–7 mm. *Nuts* obtrapezoid, emarginate, incl. the wing 2 mm through, crowned by the style base.

Distr. Himalayan region, Assam, Tonkin and Yunnan, in *Malaysia* locally cultivated in W. Java for trial by the Forestry Service.

Uses. Imported for experiments of reafforestation on eroded slopes under everwet climatic conditions, growing well into thick trees between 700 and 1800 m.

Vern. *Nepalese alder*, E.

2. Alnus maritima (MARSH.) NUTTALL, North Am. Sylv. 1 (1842) 34, t. 10*bis*; REGEL, in DC. Prod. 16, 2 (1868) 186, *incl. var.*; BURKILL, J. Linn. Soc. Bot. 26 (1899) 500, *incl. var. formosana*; WINKLER, Pfl. R. Heft 19 (1904) 114.—*Betula alnus (non* L.) THUNB. Fl. Jap. (1784) 76.—*Betula-Alnus maritima* MARSH. Arb. Am. (1785) 20.—*Betula japonica* THUNB. Bot. Act. Soc. Sc. Ups. 6 (1799) 45, t. 4.—*A. japonica* STEUD. Nom. ed. 2, 1 (1841) 55; WINKL. Pfl. R. Heft 19 (1904) 114.—*A. oblongata* WILLD. *ex* REGEL, Nouv. Mém. Soc. Nat. Mosc. 13, 2 (1861) 171, t. 6 f. 3–9 (repr. 113).—*A. formosana* MAKINO, Bot. Mag. Tokyo 26 (1912) 390.—**Fig. 1.**

Shrub or small tree, 3–10 m; twig-ends glabrous or subglabrous, rather sharply triangular. *Leaves* spiral, ovate-oblong to elliptic-oblong, rather distinctly acuminate, broadly or obtusely cuneate to subrotundate at the base, soon glabrous, with small, haired domatia in the nerve-axils beneath, 6–$9^{1}/_{2}$ by $2^{3}/_{4}$–5 cm; nerves 6–7 pairs, slightly prominent above, more so beneath, crossbar-veins slightly prominent; petiole slender, *c.* 2–5 times as short as the blade, $1^{1}/_{4}$–$2^{3}/_{4}$ cm. ♂ *Catkins* 3–5 cm by 3–5 mm. ♀ *Catkins* in a terminal raceme, on short-shoots, *c.* $^{1}/_{2}$ cm peduncled, oblong, $1^{1}/_{2}$–$2^{1}/_{2}$ by 1 cm. *Nuts* obovate-orbicular, not emarginate, *c.* 3 mm diam. incl. the wing *c.* $^{1}/_{2}$ mm broad.

Distr. Manchuria, Korea, Japan, Formosa, cultivated in Europe and elsewhere, in *Malaysia* introduced in the Philippines (Luzon, Benguet Prov., Mt Santo Tomas km 8 & Baguio-Bontoc road) and ?Java.

Ecol. Planted in secondary forest and on eroded slopes, *c.* 1000–1500 m, in the Philippines apparently not deciduous, frost-resistant. *Fl. fr.* July–Nov.

Uses. Planted by the Forest Service for Reafforestation purposes.

Vern. *Japanese alder*, E.

Notes. Some authors keep the N. American and E. Asiatic specimens specifically distinct, but already REGEL reduced *A. japonica* and *A. maritima* to varieties of one species and BRITTON & BROWN questioned their specific status. The N. American race is vaguely distinguishable by more elliptic to obovate, acute or very short-acuminate leaves; this leaf-shape is also found, however, among E. Asiatic specimens.

The Luzon material answering to the description given above belongs to the E. Asiatic population.

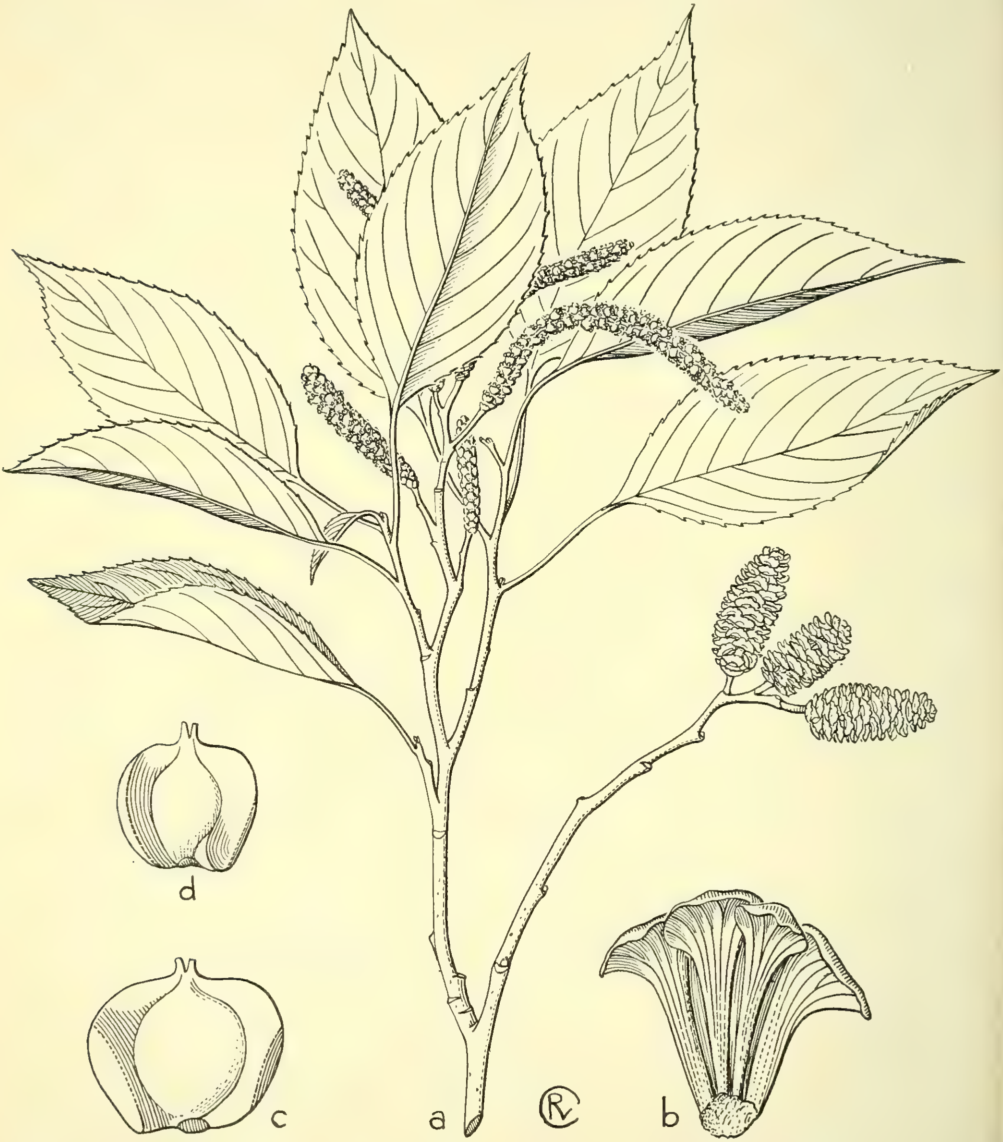

Fig. 1. *Alnus maritima* (MARSH.) NUTT. *a.* Habit, × ²/₃, *b.* bract of ♀ fruiting spike, × 7, *c–d.* nuts, × 7 (B. BRITTON 292).

BURSERACEAE (P. W. Leenhouts, Leyden, in collaboration with C. Kalkman and H. J. Lam, Leyden)

Dioecious, rarely monoecious trees or shrubs. *Bark* of twigs with a whorl of resiniferous ducts, bordered on the outer side by a distinct, closed or more or less interrupted sinuous sclerenchymatic cylinder. *Pith* of the twigs, petioles and petiolules not rarely with vascular strands, those in the twigs mostly amphivasal with mainly sclerenchymatic xylem, those in the petioles and petiolules collateral and consisting of abundant phloem, the strands predominantly reduced to mere vestigial resiniferous ducts. *Leaves* imparipinnate, sometimes 1-foliolate; spirally arranged, very rarely in pseudowhorls, usually more or less crowded at the ends of the branchlets. *Stipules* absent, *Garuga* and *Canarium* excepted (see Morph.); in addition in *Garuga* stipellas are often present (fig. 6a). *Inflorescences* paniculate, if poor tending towards racemes or spikes (*Canarium*), axillary, often crowded at the ends of the branchlets, sometimes pseudoterminal (the subtending leaves or bracts early caducous), or terminal (apparently by suppression of the terminal bud). *Bracts* and *bracteoles* usually deltoid to subulate, in *Canarium subg. Canarium* often ovate to orbicular (see Morph.). *Flowers* 3–5-merous, generally greenish to creamy, usually unisexual (in *Malaysia* only *Garuga* excepted) with remains of the other sex, the androecium in ♀ flowers always only slightly reduced, the gynaecium in ♂ ones very slightly to entirely reduced. *Sepals* valvate, mostly connate. *Petals* in Mal. *spp.* free, induplicate-valvate, in the central part sometimes (especially *Canarium*) irregularly imbricate. *Stamens* usually twice as many as the petals, 1-whorled or indistinctly 2-whorled (in *Triomma* and a very few *Santirias* and *Canariums* as many as petals); filaments free or more or less united, not rarely adnate to the disk; anthers usually dorsifixed near the base (adnate in *Santiria sect. Icicopsis*), dehiscing lengthwise, introrse. *Disk* intrastaminal, *Triomma* excepted, variable in size and shape, in ♂ *Canarium* flowers often either consolidated with the remains of the pistil (*ovariodisk*), or replacing the latter, though usually still provided with a narrow central canal (fig. 20). *Ovary* usually isomerous, rarely meiomerous, each cell with 2 axile, epitropous, descending ovules; style simple, stigma globular, often slightly lobed. *Fruits* (in Mal. *spp.*) drupaceous with non-dehiscent, fleshy pericarp (in *Haplolobus* dry, in *Triomma* woody and dehiscent) and crustaceous to papyraceous endocarp; cells 1-seeded, often partly reduced. *Seed* exalbuminous; cotyledons entire or not, fleshy, containing oil.

Distr. About 16 genera and *c.* 550 *spp.* distributed through the tropics. The family is subdivided in 3 tribes:

The **Protieae** (6 genera) are centred in Central and S. America, the exceptions being *Garuga* (SE. Asia to Melanesia) and a few species of *Protium* (Madagascar, the Mascarenes, and SE. Asia to New Guinea inclusive).

The **Bursereae** (5 genera) are centred in Africa and continental S. Asia, with the exceptions of *Triomma* (W. Malaysia) and *Bursera* (Central and S. America).

The **Canarieae** (5 genera: *Dacryodes*, *Santiria*, *Haplolobus*, *Scutinanthe*, and *Canarium*) are nearly exclusively palaeotropical (*Dacryodes sect. Dacryodes*, comprising 2 *spp.* in Central and S. America), and especially Malaysian; a small number of species (in *Dacryodes*, *Santiria*, and *Canarium*) is African and very few, mainly Malaysian species, occur in Australia and the SW. Pacific Islands.

Ecol. Almost all Malaysian species are native of the tropical rain-forests at low to medium altitudes (rarely above *c.* 1000 m). *Protium javanicum* and *Garuga floribunda* apparently prefer monsoon forests or even (*Protium javanicum*) more open and periodically rather dry park- and woodlands. Among the non-Malaysian genera, *Bursera*, *Boswellia*, and *Commiphora* are confined to rather arid regions.

Dispersal. Fruits of Malaysian representatives are predominantly drupaceous. The only exception is *Triomma* with capsular fruits and seeds surrounded by a broad membranous wing facilitating dispersal by wind.

The drupaceous type of fruit is adapted to dispersal by animals, either in the air or on the ground. According to RIDLEY (Dispersal 1930, 346, 460) starlings feed on the fruit of *Canarium* in Ceylon, in which island it has also been observed that monkeys eat the drupes. In the Banda Islands TEMMINCK (Coup d'Œil 3, 1849, 294) found that pigeons swallow canary fruits, as do cassowaries and megapodes which pick them from the ground. WALLACE (Mal. Arch. ed. 5, 1874, 342) observed fruit pigeons in Batjan eating canary fruits, and WHITEHOUSE observed Torres Street pigeons eating the drupes of *Canarium australianum.* According to GUPPY (Obs. Nat. Pac. 2, 1906, 400) fruit pigeons have been observed to swallow *Canarium* drupes in the Solomon and Fiji Islands; stones obtained from crops of Fijian pigeons measured 3 by 2¹/₂ cm. He says: 'In the Solomon Islands birds stock the interior of the coral islets with trees of this genus and the ground below the trees is often strewn with disgorged stones.' GUPPY assumes the large drupes to have no capacity for dispersal by water. Though by compression of the sterile cells the stones will, generally, have no air compartments preventing them to sink in water, the fruits of some species may possess buoyancy capacity by virtue of the fibrous pericarp as is for example found in *Canarium megacarpum* and *C. kaniense var. globigerum* (fig. 21 a–e).

Long-distance dispersal seems not very likely and this fits with the fact that *Burseraceae* are exceedingly scarce in oceanic islands beyond continental reach. In Polynesia they are absent, in Micronesia only specimens of (a Philippine form of) the widely distributed *Canarium hirsutum* and a doubtful *Haplolobus* have been found. It is significant that in the continental or subcontinental islands of Melanesia quite a number of representatives have been found, some even endemic. Thus in Samoa three genera are represented, *viz Garuga*, *Haplolobus*, and *Canarium.* It is remarkable indeed that this distribution eastwards towards the Pacific as far as Palau and Samoa is an exact replica of the situation found in the *Proteaceae* with similar fruit structures, *cf.* p. 147.

Wood anatomy. DEN BERGER, Determinatietabel Malesië, Veenman, Wageningen (1949) pp. several (hand lens). DADSWELL & INGLE, Austr. J. Sc. Res. 1 (1948) 413; HEIMSCH, Lilloa 8 (1942) 122; METCALFE & CHALK, 1 (1950) 345; JANSSONIUS, Blumea 6 (1950) 431; MOLL & JANSSONIUS, Mikr. Holzes 2 (1908) 87; WEBBER, Lilloa 6 (1941) 441 with many ref. up to 1940. See also under genera and species.— The identification by JANSSONIUS, Key to Jav. woods, Brill, Leiden (1952) 45, 52, 53 is not exhaustive because no specimens-with-radial-gum-ducts seem to have been available (*cf.* MOLL & JANSS. *l.c.*).— The family is characterized by septate wood fibres constituting the ground tissue, and a paucity of wood parenchyma and so its genera are readily distinguishable from most of those of the *Anacardiaceae.* According to DADSWELL & INGLE *l.c.* confusion might arise only with *Microstemon*, *Odina* and *Pentaspadon.* These genera of the *Anacardiaceae* might be distinguished at present from the *Burseraceae* through the vessels with spiral thickenings (*cf.* HEIMSCH *l.c.*) in *Microstemon* and *Pentaspadon* and the combined occurrence of radial gum ducts and rather a large number of vessels per sq.mm in *Odina.* With the hand lens a distinction of the taxa is not always possible (*cf.* DEN BERGER *l.c.* several pp.)— C.A.R.-G.

Uses. Economically the family is not very important. Some species, especially of *Canarium*, are popular wayside trees. The wood of most species is rather soft and often cross-grained and commercially unimportant. The resin, which is abundant in many species, is of more importance (*Manila elemi* is produced by *Canarium luzonicum*). Of several species the seeds, which are rich in oil, are eaten.

Taxonomy. Though the *Burseraceae* are accepted to be taxonomically most closely related to the *Simaroubaceae* and the *Meliaceae*, in the herbarium *Burseraceae* are frequently confused with *Anacardiaceae*, specially in the sterile state; palynologically they are indistinguishable. The only decisive character is the number of ovules, which is two in every cell in the *Burseraceae* and one in the *Anacardiaceae.* Both families are characterized within the *Terebinthales* by the anatomy of the bark, containing a whorl of resiniferous ducts near the inner side which is closely surrounded by a very distinct, light-coloured, sinuous, sclerenchymatic band; in the *Anacardiaceae* this structure is often somewhat irregular. Moreover, the pith in the *Burseraceae* is usually rather compact and dull in cross-section; in the *Anacardiaceae* it is often more loose and shining (like elder-pith). In the forest both families are apparently more readily distinguishable; both are resiniferous, but the resin of the *Anacardiaceae* very quickly turns to black, that of the *Burseraceae* remains colourless or yellow, or, more rarely, turns slowly to black. Moreover, burseraceous resin seems to be more readily combustible. In the field *Burseraceae* are apparently rather well characterized by their almond-like smell, and by their bark, which is usually light-grey and rather smooth.

Though a distinct taxonomical relationship between *Burseraceae* and *Anacardiaceae* is declined by most authors, the characters mentioned above point rather to the reverse.

Burseraceae often possess buttresses (fig. 39), sometimes stilt-roots (fig. 11) or, more rarely, small pencil-like adventitious roots on warts of the trunk (fig. 26 & 30).

The subdivision of the family is exclusively based upon the structure of the fruits (see under Morph.). As a whole this subdivision seems to be rather natural, possibly with the exception of *Scutinanthe*, classified in the *Canarieae*, which in its other characters seems to be more closely related to *Garuga* of the *Protieae.*

Morphology. In a very few cases (especially *Canarium*) representatives of this family are said to be climbers. In nearly all these cases there is reason to doubt the reliability of the field notes. *Cf*, p. 282a, 292b, and 296a. This point deserves the full attention of collectors!

The *vegetative buds* are naked or may be partly enclosed by the broadened, concave basal parts of the petioles; only in *Canarium subg. Canarium* the stipules usually serve as bud-scales.

As in the related families, *stipules* are wanting in most of the *Burseraceae*. If they are present the following cases can be observed (see fig. 22):

In a few species the lowest pair of leaflets is inserted at the very base of the petiole, forming a pair of *pseudostipules* (*Garuga*, *Dacryodes laxa*, *Canarium decumanum*); these leaflets are small and very caducous (fig. 22a). In *Dacryodes laxa* only the blades of these leaflets are very caducous, and the petiolules are persistent. These petiolules closely resemble the stipules of the next type.

In the second type the stipules are subulate (*Canarium sect. Pimela*) (fig. 22b–c). I doubt whether their resemblance to those of *Dacryodes laxa* points to a homology with the above mentioned petiolules or whether they are real stipules, as those species of *sect. Pimela* which are apparently most primitive (*C. balsamiferum* and *oleosum*) are devoid of stipules. Particularly the species with subulate stipules inserted remote from the base, I regard as probably the least primitive.

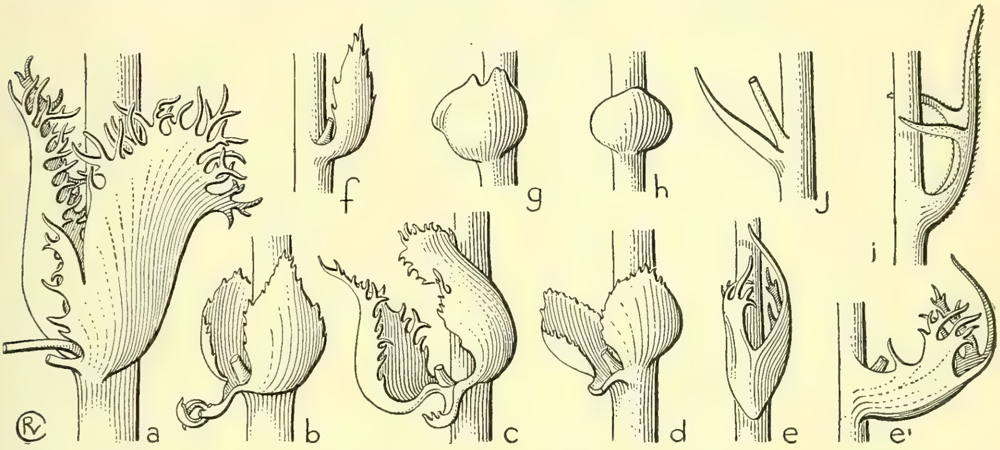

Fig. 1. Types of bracts in *Burseraceae*, illustrated by those of *Canarium*. *a–h:* a series of transitions from a stage with a reduced caducous bract between normal stipules *(a)* to the normal pseudobract of *sect. Canarium* consisting of 2 connate stipules without vestige of the original bract *(h)*, all in *C. kaniense* LAUT. (CLEMENS 1288), *i.* much reduced leaf consisting of the base of the petiole and a pair of subulate stipules illustrating the assumed origin of the subulate bract as shown in *j*, the latter representing the type of bract typical for the rest of the family (*i–j.* after the Siamese *C. subulatum* GUILLAUM.: KERR 5405). (In most figures the pedicel or peduncle has been cut; all × 2.)

The third type is represented by the foliar stipules of *Canarium sect. Canarium* (fig. 22d–k). In my opinion these are real stipules. In *C. littorale*, probably the most primitive species of this section, they are small, caducous, and inserted on the twig near the base of the petiole (fig. 22d). The main tendencies in this type of stipule are either to become larger and more or less deeply incised (fig. 22f–k), or to be pushed on the petiole (the shrivelled auricle-shaped ones, fig. 22e, & 25); in both cases they tend to become persistent.

The *bracts* are usually representing reduced leaves (probably the basal part of the petiole); in *Canarium sect. Canarium* they are derived from the connation of a pair of stipules, however, and therefore often resemble these very much, especially in the dentation of the margin (*pseudobracts*). Fig. 1.

The *disk* is nectariferous and is the only bright-coloured part (usually orange or red) of the flower.

The structure of the *fruits* is rather divergent in the different tribes (which are based on this character). The types are the following (see fig. 2):

1. In the *Protieae* the pyrenes are separate, and are only formed by the crustaceous endocarp; pericarp and mesocarp are fleshy or dry, and in the latter case dehiscent (fig. 2a, b).
2. In the *Bursereae* the endocarpous pyrenes are more or less, yet not intimately, connate; pericarp and mesocarp are dry and dehiscent. In the subtribe *Commiphorinae* (no Malaysian genera) the receptacle of the flower takes no part in the forming of the fruit proper; in the subtribe *Burserinae* (in Malaysia: *Triomma*), an outgrowth of the receptacle forms the central fistulose part of the fruit and has produced wings between the pyrenes (fig. 2c).

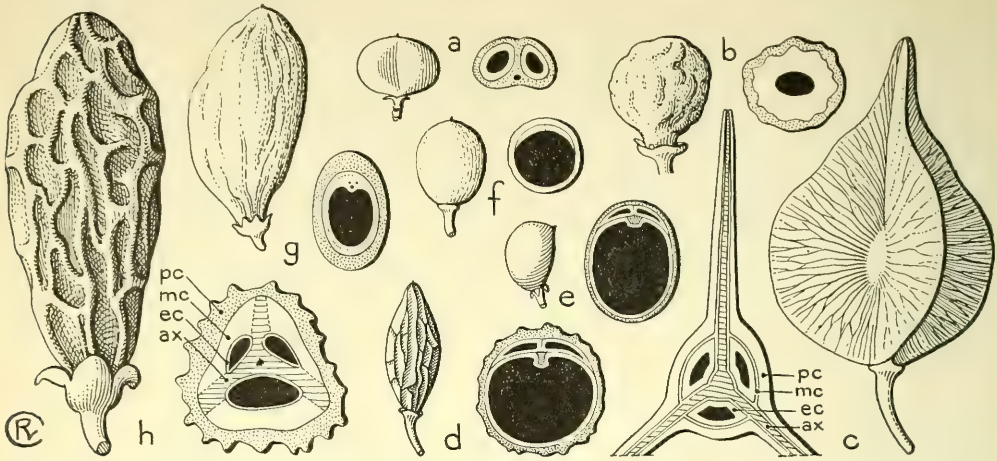

Fig. 2. Fruit structure in the Malaysian genera of *Burseraceae*. *a*. *Protium connarifolium* (PERK.) MERR., *b*. *Garuga floribunda* DECNE, *c*. *Triomma malaccensis* HOOK. *f*., *d*. *Dacryodes rostrata* (BL.) H. J. LAM, *e*. *Santiria rubiginosa* BL., *f*. *Haplolobus floribundus* (K.SCH.) H. J. LAM, *g*. *Scutinanthe brunnea* THW., *h*. *Canarium pseudopatentinervium* H. J. LAM (*pc* = pericarp; *mc* = mesocarp; *ec* = endocarp; *ax* = axial part; dotted: fleshy parts; shaded: axial parts; black: cells; *b* × 2, cross-sections of *c*, *d*, and *e* × 4/3, all others × 2/3).

3. In the *Canarieae* the pericarp is fleshy and the solitary pyrene consists of the mesocarp and the endocarp, which are fully fused. In the subtribe *Dacryodiinae* (in Malaysia: *Dacryodes*, *Santiria*, *Haplolobus*, *Scutinanthe*) the receptacle takes no part in the forming of the fruit proper (fig. 2d–g); in the subtribe *Canariinae* (only *Canarium*), an outgrowth of the receptacle forms the central part of the pyrene and has produced wings between the cells as far as the surface of the pyrene, thus dividing the mesocarp into 3 (dehiscent) lids. These axial wings are usually quite distinct on the surface of the pyrene as the 'angle-ribs'; sometimes there is a distinct suture between them and the mesocarpal lids (fig. 2h).

An extensive treatment on the morphology of this family has been given by H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931–32) 23–56 and 97–226.

Notes. As nearly all the species are dioecious, and moreover ♀ trees very rarely bear flowers and fruits at the same time, the keys to the species are, as far as possible, primarily based on vegetative characters. It appeared to be impossible, however, to frame a key to the genera based only on vegetative characters; without an intimate knowledge of the species it is indeed often very difficult and not rarely even impossible to refer sterile specimens definitely to a genus.

Accordingly, sterile material has a very much limited value; fruits are of primary importance.

When the trees are in flower, collectors should be aware, that they are dioecious!

The authors, responsible for the different genera, are: C. KALKMAN, Leyden, for *Garuga*, *Triomma*, *Dacryodes*, and *Santiria*, H. J. LAM, Leyden, for *Haplolobus*, and P. W. LEENHOUTS, Leyden, for the genera *Protium*, *Scutinanthe*, and *Canarium*; all wood-anatomical remarks are, as usual, by Mrs C. A. REINDERS-GOUWENTAK, Wageningen.

Thanks to the generous co-operation of Mr F. HUYSMANS, Head of the Photographic Division of Kebun Raya Indonesia, Bogor, excellent photographs of living material were obtained.

KEY TO THE GENERA

1. Flowers 5–4-merous. Fruits with 1 or more pyrenes. Pith of the branchlets without vascular strands.
 2. Stipules present; stipellas often present. Flowers bisexual. Pith of the petioles usually with some vascular strands; margin of the leaflets mostly distinctly crenate-serrate . . . . **2. Garuga**
 2. Stipules and stipellas absent. Flowers unisexual. Pith of the petioles without vascular strands; margin of the leaflets mostly entire.
  3. Stamens 5. Disk extrastaminal. Fruits 3-winged . . . . **3. Triomma**
  3. Stamens 8 or 10. Disk intrastaminal. Fruits globular or ellipsoid.
   4. Receptacle of the flowers cupular. Pistil 3-merous. Fruits ellipsoid, 1-seeded. Leaflets not mucronulate . . . . **7. Scutinanthe**
   4. Receptacle of the flowers flat. Pistil 4–5-merous. Fruits globular or oblique, with 1–5 one-seeded pyrenes. Leaflets often mucronulate . . . . **1. Protium**
1. Flowers 3-merous. Fruits with 1 pyrene. Pith of the branchlets with or without vascular strands.

5. Pyrene thick-walled, bony, 3–1-seeded; sterile cells slightly to strongly reduced. Pith of the branchlets almost always with vascular strands. Leaves often stipulate. Receptacle in ♀ flowers not rarely cupular. Disk and pistil often pilose; in ♂ flowers the pistil usually strongly reduced, sometimes fused with or replaced by the strongly developed disk . . . . **8. Canarium**

5. Pyrene thin-walled, papyraceous to crustaceous; 1-seeded; sterile cells totally flattened. Pith of the branchlets usually without vascular strands. Leaves exstipulate, *Dacryodes laxa* excepted. Receptacle always flat. Disk always, pistil nearly always glabrous, the latter in ♂ flowers usually moderately, never entirely reduced.

6. Stigma on the fruits always distinctly excentric; pericarp smooth when dry . . . **5. Santiria**

6. Stigma on the fruits apical or nearly so; pericarp smooth or coarsely wrinkled when dry.

7. Dry fruits smooth; pyrene papyraceous; cotyledons entire, flat. Inflorescences axillary, usually small (*c.* 5–10 cm), mostly branched from the very base . . . . **6. Haplolobus**

7. Dry fruits coarsely wrinkled; pyrene cartilaginous; cotyledons compound and folded. Inflorescences usually larger and distinctly paniculate, axillary or terminal . . . . **4. Dacryodes**

1. PROTIUM

BURM. *f.* Fl. Ind. (1768) 88; SWART, Rec. Trav. Bot. Néerl. 39 (1942) 189, 228; LEENH. Blumea 7 (1952) 154.—*Tingulonga* O.K. Rev. Gen. Pl. 1 (1891) 107.—**Fig. 4.**

Trees, occasionally shrubs. *Pith of the branchlets* without vascular strands. *Leaves* without stipules; pith of the petioles without vascular strands; tips of the leaflets usually distinctly mucronulate. *Inflorescences* axillary, sometimes pseudo-terminal. *Flowers* 5–4-merous, possibly not always fully unisexual. *Sepals* more or less connate. *Stamens* twice as many as the petals, free, in ♀ flowers very slightly reduced, possibly sometimes fertile. *Disk* intrastaminal, annular, truncate to undulate, glabrous. *Pistil* isomerous, glabrous or pubescent, in ♂ flowers usually slightly reduced, often with sterile ovules in the cells. *Fruits* drupaceous, globose to ovoid, when dry the number of lobes coinciding with the number of developed stones; pericarp fleshy, containing the thin-walled, bony pyrenes; usually 1 or 2 cells nearly totally reduced; calyx persistent, not enlarged, lobes reflexed. *Cotyledons* plicate, lobed to palmatifid.

Distr. About 85 *spp.* especially in the American tropics, furthermore in Madagascar and the Mascarenes, in SE. Asia from India through *Malaysia* as far as New Guinea.

All Malaysian and both continental Asiatic species belong to *sect. Protium* (*sect. Eu-Protium* SWART, *l.c.* p. 189). Fig. 3.

Ecol. In Malaysia both under everwet and seasonal conditions, up to *c.* 800 m. Apparently *fl.* and *fr.* throughout the year, though flowers seem to be most abundant in the dry season and fruits in the wet season.

Note. There seems no necessity to keep the generic name *Protium* under the *nomina generica conservanda* of the code.

KEY TO THE SPECIES

1. Leaflets cuspidate, acumen 1–1½ cm long. Flowers 4-merous (rarely some 5-merous flowers in the same specimen) . . . . **3. P. connarifolium**

1. Leaflets short- and broadly acuminate, acumen often blunt. Flowers 5-merous (rarely some 4-merous flowers in the same specimen).

2. Petiolules of the lateral leaflets 1–3(–5) mm. Ovary and fruits glabrous . . . **1. P. javanicum**

2. Petiolules of the lateral leaflets 5–18 mm. Ovary pubescent, fruits glabrescent. **2. P. macgregorii**

1. Protium javanicum BURM. *f.* Fl. Ind. (1768) 88; DC. Prod. 2 (1825) 78; BL. Mus. Bot. 1 (1850) 229; MIQ. Fl. Ind. Bat. 1, 2 (1859) 654; ENGL. in DC. Mon. Phan. 4 (1883) 70, t. 2 f. 8–10; K. & V. Bijdr. 4 (1896) 22; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 207, f. 2^1, 3–5; Rev. Gén. Bot. 22 (1910) 454, f. 4; Not. Syst. 2 (1913) 265; MERR. Int. Rumph. (1917) 305; DOCT. v. LEEUWEN, Zoocecidia (1926) 263, f. 440; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 16 f. 129; Bull. Jard. Bot. Btzg III, 12 (1932) 322, t. 4 f. 6; SWART, Rec. Trav. Bot. Néerl. 39 (1942) 248; MEYER-DREES, Comm. For. Res. Inst. *no* 33 (1951) 43; LEENH. Blumea 7 (1952) 155, f. 1^5.—*Tingulong* RUMPH. Herb. Amb. 7 (1755) 54, t. 23 f. 1.—*Amyris protium* L. Mant. Pl. (1767) 65.—*Bursera javanica* BAILL. Hist. Pl. 5 (1874) 296.—*P. zollingeri* ENGL. in DC. Mon. Phan. 4 (1883) 71.—*Tingulonga zollingeri* O.K. Rev. Gen. Pl. 1 (1891) 108.—*Tingulonga protium* O.K. Rev. Gen. Pl. 1 (1891) 108.—**Fig. 4a–f.**

Shrub to rather large tree, up to 25 m by 1.15 m;

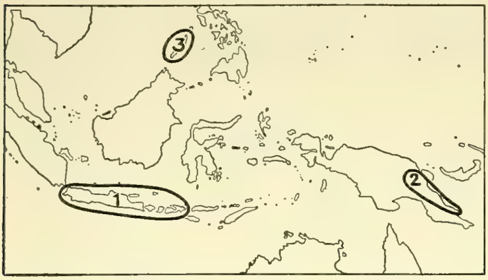

Fig. 3. Distribution of *Protium* in Malaysia. 1. *P. javanicum* BURM. *f.*, 2. *P. macgregorii* (F. M. BAIL.) LEENH., 3. *P. connarifolium* (PERK.) MERR.

bole often short and crooked. *Branches* glabrescent, in young plants with up to $2\frac{3}{4}$ cm long spines. *Leaves* (0–)2–4(–5)-jugate, glabrous. Lateral *petiolules* 1–3(–7) mm. *Leaflets* ovate to elliptic, $3\frac{1}{4}$–11 by $1\frac{1}{2}$–$4\frac{1}{2}$ cm, rather stiff chartaceous; base usually cuneate; margin entire to crenate or serrulate, specially near the apex; apex gradually short-acuminate; nerves 8–13 pairs, straight, abruptly arched near the margin. *Inflorescences* axillary, glabrous to pubescent, ♂ broadly paniculate, (6–)10–15(–25) cm long, ♀ narrowly paniculate, lax, $2\frac{1}{2}$–14 cm long. *Flowers* (4–)5-merous, 2–$2\frac{1}{2}$ mm long, glabrous to faintly puberulous. *Sepals* up to halfway connate, $\frac{1}{2}$ mm long. *Pistil* glabrous, in ♂ flowers cylindrical, up to 1 mm high. *Fruits* oblique-ovoid to nearly globular (dependent on the number of developed fruit-cells), 8–14 mm long, pointed, glabrous, 2–4-seeded.

Distr. *Malaysia:* Java (in W. Java only on the N.-coast from Djakarta eastward, and near Palabuhanratu), Madura, Bawean, Kangean, Bali, Lombok, Sumbawa. Fig. 3.

Ecol. In primary and secondary forests, in more open land, along roads, along the inner border of tidal forests, sometimes on the beach, up to 800 m, distinctly preferring periodically dry regions and in Java mostly associated with teak. *Fl. fr.* throughout the year.

Wood anat. DEN BERGER, Med. Proefst. Thee 97 (1926) 68 & Atlas Pl. 12, fig. 46, Med. Proefst. Boschw. 13 (1926) 68 & Atlas Pl. 12, fig. 46, Determinatietabel Malesië, Veenman, Wageningen (1949) 42; REYES, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 160 (hand lens); MOLL & JANSSONIUS, Mikr. Holzes 2 (1908) 98.

Uses. Though the wood is hard and does not easily split, it is not frequently used and for small tools only, as long, straight boles are rare. Apparently, the young leaves and the fruits are sometimes eaten, the old leaves are said to be used in native medicine.

Vern. *Katos (kĕtos, gĕtos), tanggulun (tangulong, tengulung),* S, *bĕrnang, gulun (bĕrnang), katos* (also *kĕtos*), *trengulon* (also *tenggulun, tenggulon, tinggulun(g), tingulon, tengolon, tranggulun, trenggulun),* J, *tanggulun* (also *tangulon, tangkhulon, t(r)engkhulun),* Md, *tanggolon, tangkhulon,* Kangean, *tengulun,* Bawean, *trenggulon,* Bali, *ketimis, lo(w)a,* Sumbawa.

Notes. *P. zollingeri* represents a more pilose form, which is apparently restricted to E. Java (Besuki); this pubescence occurs, however, to various degree.

2. Protium macgregorii (F. M. BAIL.) LEENH. Act. Bot. Neerl. 2 (1953) 305.—*Bursera macgregorii* F. M. BAIL. Queensl. Agr. J. 3 (1898) 282.—*Santiria schlechteri* LAUT. Bot. Jahrb. 56 (1920) 333.—*P. connarifolium* (*non* MERR.) H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 320–321, *pro specim. novoguin.*; SWART, Rec. Trav. Bot. Néerl. 39 (1942) 258, 260, *ditto.*—*P. schlechteri* LEENH. Blumea 7 (1952) 157.

Moderate to large tree. Young *branchlets* slightly pubescent, older ones scabrous. *Leaves* (1–)2–3-jugate. Lateral *petiolules* $\frac{1}{2}$–$1\frac{3}{4}$ cm. *Leaflets* ovate to lanceolate, 5–$11\frac{1}{2}$ by $2\frac{1}{4}$–$5\frac{1}{2}$ cm, herbaceous to subcoriaceous, glabrous; base slightly oblique, cuneate to rounded; margin entire; apex with a short and broad, blunt to

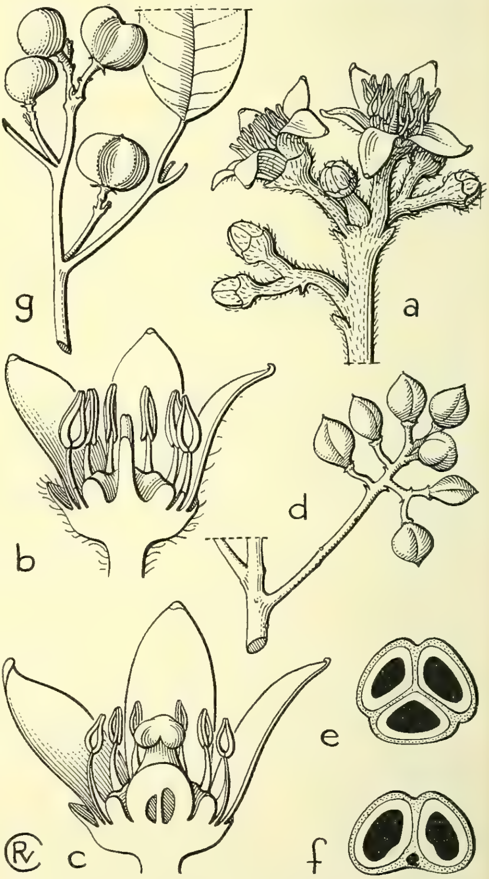

Fig. 4. *Protium javanicum* BURM. *f.*, *a* & *b*. ♂, *c*. ♀, *d–f*. fruits.—*Protium connarifolium* (PERK.) MERR., *g*. fruits (*a*, *e* & *f* × 2, *b* & *c* × 10, *d* & *g* × $\frac{2}{3}$).

emarginate acumen; nerves 8–11 pairs, nearly straight, arched at some distance from the margin. *Inflorescences* axillary, paniculate, minutely puberulous, ♂ 5–15 cm, shortly stalked, ♀ more lax, 4–8 cm, peduncle up to half as long as the inflorescence. *Flowers* (♀ unknown) 5-merous, 2 mm long, nearly glabrous. *Sepals* nearly halfway connate, $\frac{1}{2}$ mm. *Pistil* only very slightly reduced (always sterile?), minutely puberulous. *Fruits* obliquely ellipsoid, monopyrenous, 7 by 5 mm, or 2–4-lobed and 2–4-pyrenous, 8 by 8 mm, sparsely ferrugineous-pilose, glabrescent.

Distr. *Malaysia:* NE. New Guinea (Morobe District mainly). Fig. 3.

Ecol. Mostly in parkland, sometimes in secondary forest, from low altitudes up to 800 m. *Fl.* and *fr.* May–Nov.

Uses. Planted as a shade-tree. Fruits eaten by the natives. Timber hard, used in house-building.

Vern. *Kaibas, kaigabu gabu, tawaia.*

Note. Allied to *P. javanicum* BURM. *f.*

3. Protium connarifolium (PERK.) MERR. Philip. J. Sc. 10 (1915) Bot. 30; En. Philip. 2 (1923) 348; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 94; Bull. Jard. Bot. Btzg III, 12 (1932) 320, t. 4 f. 5, *excl. specim. pap.*; SWART, Rec. Trav. Bot. Néerl. 39 (1942) 258, *ditto*; LEENH. Blumea 7 (1952) 155. —*Canarium connarifolium* PERK. Fragm. Fl. Philip. 2 (1904) 92.—*P. philippinensis* ELM. Leafl. Philip. Bot. 7 (1915) 2571.—**Fig. 4g.**

Rather large tree. *Branchlets* tomentose at the tip, glabrescent; pith scalariform to disappearing. *Leaves* (0–)1–2(–3)-jugate. Lateral *petiolules* ($\frac{1}{2}$–) 1–1$\frac{1}{2}$(–2) cm. *Leaflets* ovate to oblong, 3$\frac{3}{4}$–11$\frac{1}{4}$ by 1–5$\frac{3}{4}$ cm, subcoriaceous, glabrous; base cuneate; margin entire; apex gradually long-acuminate, tip cuneate, acute; nerves 7–10 pairs, slightly curved, vaguely arched near the margin. *Inflorescences* axillary, ♀ sometimes pseudo-terminal, narrowly paniculate, thinly tomentose, ♂ 3$\frac{1}{2}$–4$\frac{1}{2}$ cm, ♀ 1–6 cm. *Flowers* 4–(rarely 5–)-merous, *c.* 3 mm long, thinly tomentose. *Calyx* 1 mm high. *Pistil* tomentose, in ♂ flowers moderately reduced, though containing ovules. *Fruits* 7–8 by 5–13 mm, sparsely puberulous to glabrescent, 1–4-pyrenous.

Distr. *Malaysia:* Philippines (Palawan). Fig. 3.

Ecol. In forest along rivers at low altitudes, up to 600 m. *Fl. fr.* Febr.–May.

Vern. *Marangub*, Tag.

Note. This species stands taxonomically rather isolated.

2. GARUGA

ROXB. Pl. Corom. 3 (1811) 5, t. 208; KALKMAN, Blumea 7 (1953) 459, 498; Taxon 3 (1954) 124, *nom. cons. prop.*—*Capraria* RUMPH. Herb. Amb. 2 (1741) 139.—*Katou-kalesiam* ADANS. Fam. Pl. 2 (1763) 510, 534, *nom. rej. prop.*—**Fig. 2b, 5–6.**

Deciduous shrubs or trees. *Branchlets* without vascular strands in the pith. *Leaves* mostly stipulate and often with transitions from stipules to normal leaflets; margin of the leaflets crenate-serrate; stipellae often present. *Inflorescences* axillary, crowded at the ends of the branchlets, appearing before the leaves. *Flowers* bisexual, 5-merous, with a concave, globose or cupular receptacle. *Sepals* free. *Stamens* 10, free, inserted at the margin of the receptacle. *Disk* adnate to the receptacle, glabrous, with 10 lobes between the stamens. *Ovary* shortly stalked, 5-celled. *Fruits* drupaceous, pericarp fleshy. Pyrenes 1–5, small, furrowed, bony. *Cotyledons* contortuplicate, compound.

Distr. Four *spp.* in continental SE. Asia, a variety of one of these in *E. Malaysia* to N. Australia and Melanesia (Solomons, New Hebrides, Samoa, and Tonga).

1. Garuga floribunda DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 477; BL. Mus. Bot. 1 (1850) 228; MIQ. Fl. Ind. Bat. 1, 2 (1859) 655; BENTH. Fl. Austr. 1 (1863) 377; ENGL. in DC. Mon. Phan. 4 (1883) 6; F. M. BAIL. Queensl. Fl. 1 (1899) 222; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 96b, t. 14 f. 110, t. 15 f. 118c; Bull. Jard. Bot. Btzg III, 12 (1932) 326, t. 4 f. 7A; in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 3; WALKER, For. Solom. Isl. (1948) 102; MEIJER DREES, Comm. For. Res. Inst. *no* 33 (1951) 43; KALKMAN, Blumea 7 (1953) 463, f. 1 & 3.—**Fig. 2b, 5, 6.**

var. **floribunda.**—*Capraria* RUMPH. Herb. Amb. 2 (1741) 139.—*Guaiacum abilo* BLANCO, Fl. Filip. (1837) 364.—*Icica abilo* BLANCO, Fl. Filip. ed. 2 (1845) 256.—*G. mollis* TURCZ. Bull. Soc. Imp. Nat. Mosc. 31, 1 (1858) 475; ENGL. in DC. Mon. Phan. 4 (1883) 6.—*Boswellia javanica* TURCZ. Bull. Soc. Imp. Nat. Mosc. 36, 2 (1863) 612; ENGL. in DC. Mon. Phan. 4 (1883) 7.—*G. pinnata* ROXB. *var. mollis* KURZ, J. As. Soc. Beng. 44, ii (1875) 141.—*G. pinnata* (*non* ROXB.) K. & V. Bijdr. 4 (1896) 17; DOCT. V. LEEUWEN, Zoocecidia (1926) 263; HEYNE, Nutt. Pl. (1927) 883.—*G. pacifica* BURK. J. Linn. Soc. Bot. 35 (1901) 30; CHRISTOPHERSEN, Bull. Bish. Mus. *no* 128 (1935) 111.—*G. abilo* MERR. Publ. Gov. Lab. Philip. *no* 35 (1905) 73; Sp. Blanc. (1918) 208; En. Philip. 2 (1923) 356; HEYNE, Nutt. Pl. (1927) 882.—*G. lit-*

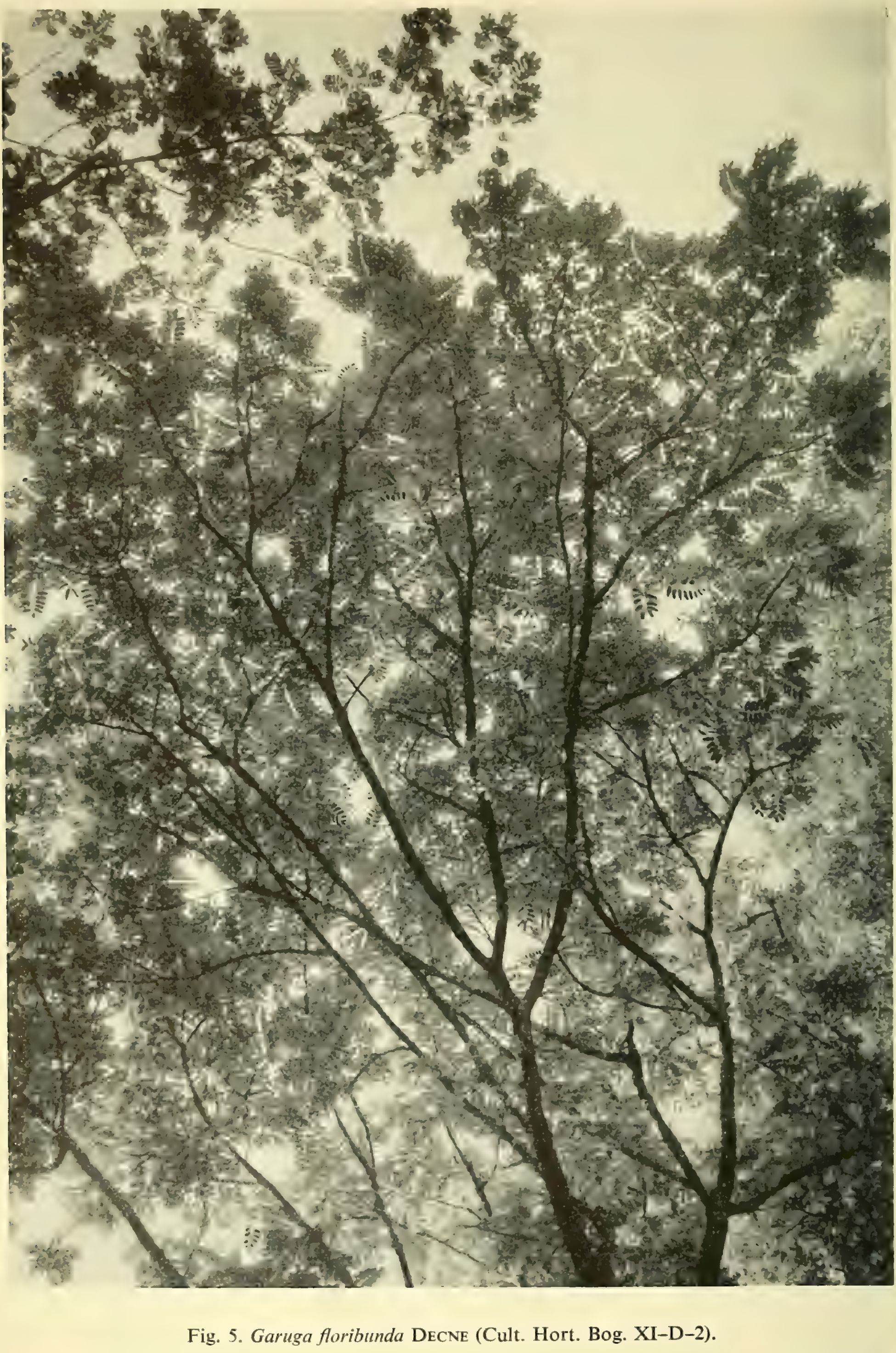

Fig. 5. *Garuga floribunda* DECNE (Cult. Hort. Bog. XI–D–2).

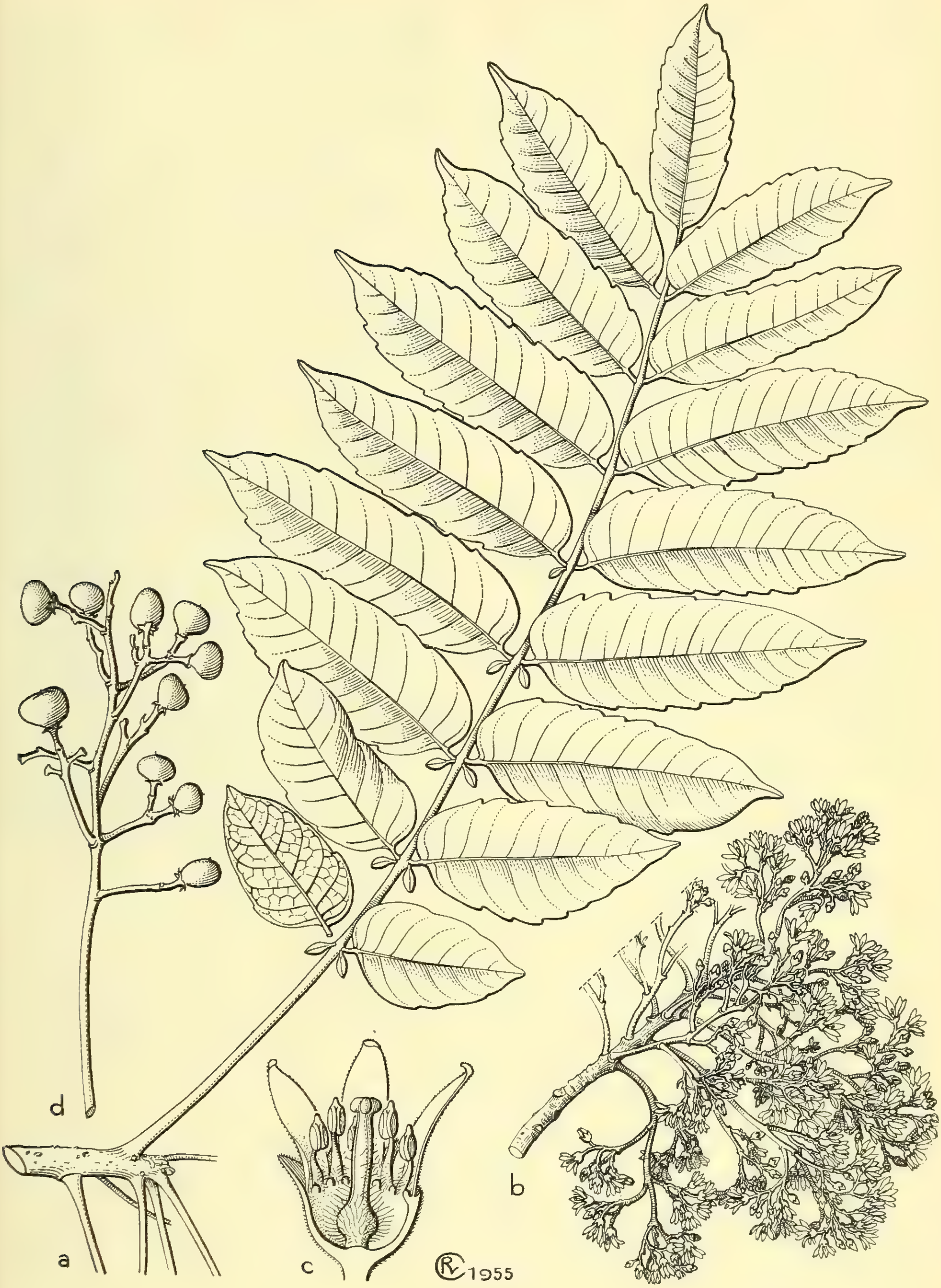

Fig. 6. *Garuga floribunda* DECNE. *a.* Leaf with stipellae and scars of the stipules, one leaflet underneath, *b.* apex of a leafless twig with a number of small lateral panicles; the terminal bud of the twig will develop into a leafy continuation, *c.* flower cut lengthwise, *d.* infructescence (*a–b* & *d* × 2/3, *c* × 7).

toralis MERR. Philip. J. Sc. 10 (1915) Bot. 27, *incl.* also *var. paucijuga*; En. Philip. 2 (1923) 356.—*G. clarkii* MERR. Philip. J. Sc. 10 (1915) Bot. 29; En. Philip. 2 (1923) 356.—*G. sp.* LANE-POOLE, For. Res. (1925) 99; CHRISTOPHERSEN, Bull. Bish. Mus. *no* 128 (1935) 111.

Buttressed tree, up to 35 by 1½(–2¼) m. *Branchlets* ½–1½ cm thick, minutely tomentose at the tips, glabrescent, often rough by many leaf-scars. *Leaves* crowded at the ends of the branchlets 4–10(–15)-jugate, usually tomentose when young and glabrescent, but indumentum very variable. *Stipules* inserted at the base of the petiole, oblong, 5–8 mm, caducous, basal pairs of leaflets often forming transitions to the stipules and caducous; stipellae often present. *Leaflets* elliptic, oblong-lanceolate or lanceolate, 5–19 by 2–5½(–7) cm, rather stiff; base oblique, cordate to rounded (to cuneate); margin sometimes nearly entire; apex gradually acuminate, tip long and slender, blunt; nerves 10–20 pairs, slightly curved, not distinctly arching. *Panicles* 4–21(–30) cm, tomentose to glabrous; peduncle ½–9 cm. *Flowers* 3½–6 mm, receptacle cupular, 1½–2 mm high. *Sepals* 1½–2½ mm. *Petals* inside tomentose, at least at the base. *Filaments* tomentose at the base. *Ovary* glabrous to pilose; style slightly tomentose to pilose. *Fruits* obliquely pear-shaped, 5–9 by 5–12 mm, glabrous or with some scattered hairs (to densely pubescent).

Distr. Melanesia, N. Australia, and *Malaysia:* Central and E. Java, Lesser Sunda Islands, NE. Borneo (Gaya Isl., once collected), Philippines, Celebes, Moluccas, and New Guinea.

A second variety, *var. gamblei* (KING *ex* SMITH) KALKMAN, is known from E. India, Sikkim, E. Pakistan, W. China, and Hainan.

Ecol. In primary and secondary, rain- and monsoon-forests, specially in periodically dry regions, up to 400(–1200) m. *Fl.* mainly July–Nov. (Philippines March-June), *fr.* mainly Oct.–April (Philippines March–Oct.).

Wood anat. DEN BERGER, Med. Proefst. Thee 97 (1926) 67 & Atlas Pl. 12 fig. 45, Med. Proefst. Boschw. 13 (1926) 67 & Atlas Pl. 12 fig. 45 (*G. pinnata* ROXB.); REYES, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 164 & Pl. 25 fig. 2 (hand lens); MOLL & JANSSONIUS, Mikr. Holzes 2 (1908) 93 (*G. pinnata* ROXB.); PEARSON & BROWN, Comm. Timb. India 1 (1932) 221.

Uses. Sometimes used as a shade tree. Timber rather good, moderately hard, heavy; in the ground it apparently decays very slowly. The bark is used in native medicine. A black dye is made out of a decoction of the leaves. The fruits are eaten.

Vern. *Ki langit*, W. Java, *biru*, *wiju*, W. & Central Java, *djaran*, *mangir*, Central Java, *surěn*, Central & E. Java, *kluntjing (klontjing)*, E. Java, *běru*, *wuru*, Bali, *bogela*, Sumba, *(ai-)feu*, *bilu*, *beook*, *wiu*, *wo'o*, Timor, *héu*, Wetar, *balo*, Borneo; Philippines: *(g)abilo*, *bagulibas*, *ligason*, Tag., *baro*, *bulu*, *taliñganan*, Sul., *barus*, *bugu*, Ibn., *bio*, *biu*, *burus*, Ilk., *bitaurang*, Bag., *bogo*, *bugo*, P. Bis., C. Bis., *bogo*, Mag., Kuy., *bugo*, Chab., *dulit*, Pang., *malabolo*, Bik., *tumbarila*, Tagb.; *adju barru*, *bogu*, *bo'oh*, *buku*, *empo*, *(kaju) kambing*, *(tě)tul*, *(kětul*, *tělul)*, *wou*, Celebes, *tatula*, Talaud, *kambing*, Morotai, *wowoho*, Ternate, *ngowojo*, Tidore, *maruapisa*, W. New Guinea, *kagi-kagi*, Papua.

Excluded

Garuga javanica BL. Bijdr. (1826) 1165 = *Jagera javanica* (BL.) BL. Mus. Bot. 1 (1850) 227 (*Sapindac.*).

3. TRIOMMA

HOOK. *f.* Trans. Linn. Soc. 23 (1860) 171.—**Fig. 2c, 7–8.**

Dioecious tree. *Pith of the branchlets* without vascular strands. *Stipules* absent. *Inflorescences* axillary, together pseudoterminal. *Flowers* 5-merous. *Sepals* free. *Stamens* 5, episepalous, base of the filaments adnate to the disk. *Disk* 5-lobed, extrastaminal, lobes emarginate. *Pistil* triangular, 3-celled, in ♂ flowers entirely reduced. *Fruits* 3-winged, dry, woody, dehiscing with 3 woody valves. *Seeds* 3, broadly winged. *Cotyledons* folded, probably entire.

Distr. Monotypic, confined to *W. Malaysia.*

1. Triomma malaccensis HOOK. *f.* Trans. Linn. Soc. 23 (1860) 171; ENGL. in DC. Mon. Phan. 4 (1883) 30, t. 1 f. 22; KING, J. As. Soc. Beng. 62, ii (1894) 236; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 246, f. 143; ed. 2, 19a (1931) 419, f. 196; STAPF in HOOK. Ic. Pl. 29 (1906) t. 2824–2825; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 267, f. 49; RIDL. Fl. Mal. Pen. 1 (1922) 369; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 96a, t. 13 f. 102 B2, t. 16 f. 130; Bull. Jard. Bot. Btzg III, 12 (1932) 332, t. 4 f. 8; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 32, *cum fig.*; KALKMAN, Blumea 7 (1954) 499.—*Arytera ? macrocarpa* MIQ. Sum. (1861) 510.—*Canarium mahassan* MIQ. Sum. (1861) 526; ENGL. in DC. Mon. Phan. 4 (1883) 148.—*Boswellia malaccensis* MARCH. Adansonia 8 (1867) 25.—*T. macrocarpa* BACK. *ex* THORENAAR, Med. Proefst. Boschw. *no* 16 (1926) 93, f. 9 & 9a; HEYNE, Nutt. Pl. (1927) 882.—**Fig. 2c, 7, 8.**

Very large tree, up to 60 m high and 1 m or more in diam.; buttresses 1–3 m high, often very broad. *Branchlets* slender, pilose to glabrous. *Leaves* (1–)2–5-jugate, petioles, rhachis, petiolules and midrib pilose to glabrous. *Leaflets* ovate to

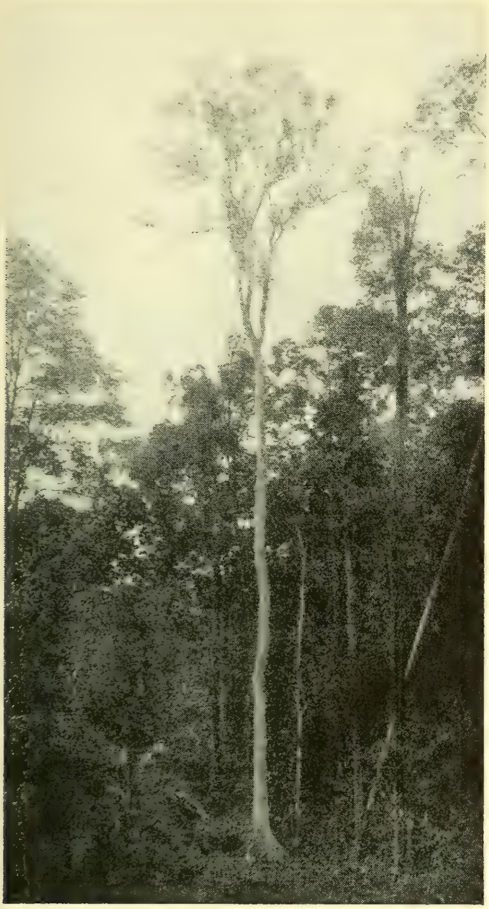

Fig. 7. *Triomma malaccensis* HOOK. *f.* Tree, *c.* 32 m high, Palembang (S. Sumatra) (Photogr. THORENAAR *a.* 1923).

oblong, (2–)4–15$^1/_2$ by (1–)2–5$^1/_2$(–6$^1/_2$) cm, chartaceous; base obliquely rounded, decurrent; margin entire; apex shortly blunt-acuminate; nerves 7–12 pairs (angle 60–80° near base to 30–50° near apex), usually slightly curved, not arching except the apical ones. *Inflorescences* repeatedly branched from the base, densely glandular-tomentose and sometimes also pilose, ♂ ones 10–30 cm long, branches 6–10 cm, slender, ♀ ones 4–22 cm, branches 1–8$^1/_2$ cm, less slender. *Flowers* ♂ 2 mm long, ♀ 3 mm. *Sepals* and *petals* densely tomentose on either side. *Stamens* glabrous, in ♂ flowers often twisted. *Pistil* glabrous. *Infructescences* with a few fruits; calyx caducous. *Fruits* 5$^1/_2$–7$^1/_2$ cm long, wings 2–2$^1/_2$ cm broad. *Seeds* with broad, membranous wings, rounded at the base and acuminate at the apex.

Distr. *Malaysia:* Sumatra, Banka, Malay Peninsula, and Borneo.

Ecol. Frequent in old, rarely in secondary, forests; mostly on dry ground, rarely in permanently inundated places, up to 150(–400) m. *Fl.* Febr.–Nov., *fr.* Dec.–May.

Wood anat. DESCH, Mal. For. Rec. 15^1 (1941) 65, pl. 14 fig. 1 (hand lens); WEBBER, Lilloa 6 (1941) 450.

Uses. Timber rather soft, used for indoor constructions. Resin sometimes used for torches.

Vern. Sumatra: *rĕsong, risung, r. batu, r. bunga,* Langkat, *andalhi batu, damar siap mata,* Batak, Asahan, *bajung* (or *majung*), *b. damar, b. kapur, damar asĕm,* Djambi, Palembang, *mĕrasam* (or *mahasan*), *m. itam, m. pujo, tĕta tundju lanang,* Palembang, *asĕm (bulĕt),* Lampong; Banka: *mĕdang ampal, rĕngas, sudur bajan*; Malay Peninsula: *kĕdondong kejai, k. karet*; Borneo: *bĕsilok,* W. Born., *buno, damar lilin, damar umpak, djĕlmu pipit, kamandung, kapas mĕlajang, lamai, ranggarai,* SE. Born., *batu, kĕmbajau, marasam, njamut, pudurling,* Kutai, *bansision, binsian, maitus, mĕmpas, tĕrosob,* Br. N. Born., *kĕmendrung,* P. Laut.

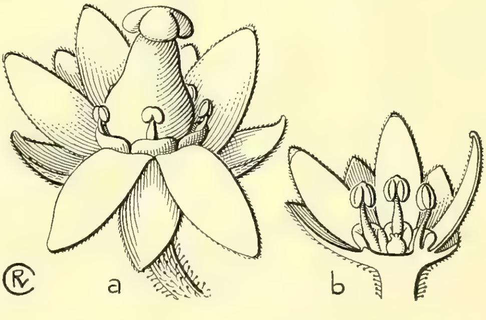

Fig. 8. *Triomma malaccensis* HOOK. *f. a.* ♀ flower, *b.* longitudinal section of ♂ flower, both × 10.

4. DACRYODES

VAHL, Skrift. Dansk. Nat. Hist. Selsk. 4 (1810) 116; ENGL. in DC. Mon. Phan. 4 (1883) 151; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 334; KALKMAN, Blumea 7 (1954) 500.—*Pachylobus* G. DON, Gen. Syst. 2 (1832) 89; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 242; ed. 2, 19a (1931) 450.—*Canarium sect. Tenuipyrena* ENGL. in DC. Mon. Phan. 4 (1883) 104, *p.p.*—*Santiridium* PIERRE, Bull. Soc. Linn. Paris 2 (1896) 1282, *nom. illeg.*—*Curtisina* RIDL. J. Str. Br. R. As. Soc. *no* 82 (1920) 180.—*Hemisantiria* H. J. LAM, in Merr. Pl. Elm. Born. (1929) 118.—**Fig. 2d, 10, 11.**

Dioecious trees. *Pith of branchlets* without or with some, rarely with many, vascular strands. *Leaves* exstipulate, very rarely with a tendency to form pseudostipules. *Petioles* usually flattened to canaliculate, pith usually with few, sometimes with many, rarely without vascular strands. *Leaflets* entire. *Panicles* axillary and/or terminal. *Flowers* 3-merous. *Sepals* free or connate. *Petals* with a usually slightly thickened and inflexed apex. *Stamens* 6, glabrous; filaments free or their base to various degree connate with the disk. *Disk* intrastaminal, glabrous. *Pistil* 3(–2)-celled, usually glabrous, usually moderately reduced in the ♂ flowers; stigma sessile. *Fruits* drupaceous, oblong or ellipsoid, 1-seeded, stigma apical or nearly so; pericarp fleshy and rather thick, coarsely wrinkled when dry, glabrous; pyrene containing 1 fertile and 2 reduced cells; mesocarp membranous; endocarp cartilaginous; calyx caducous. *Seed* round in cross-section; cotyledons folded or contortuplicate, 3-partite, palmate or palmatifid.

Distr. About 40 *spp.* in tropical America (*c.* 2 *spp.: sect. Dacryodes*), tropical Africa (*c.* 22 *spp.: sect. Pachylobus* H. J. LAM, Ann. Jard. Bot. Btzg 42, 1932, 202) and in tropical Asia (*sect. Tenuipyrena* ENGL. in DC. Mon. Phan. 4, 1883, 104; 15 *spp.*, distributed in Cochin-China and *Malaysia*, with the exception of Central and East Java, the Moluccas, and the Lesser Sunda Islands). Fig. 9.

Ecol. Mainly trees of lowland rain-forests.

Wood anat. DESCH, Mal. For. Rec. 15¹ (1941) 63 (hand lens); HEIMSCH, Lilloa 8 (1942) 122. See also under the species.

Uses. The wood of some species is said to be used as a timber, but apparently it is not of great value. The fruits of some species are edible.

KEY TO THE SPECIES

1. Petioles longer than 18 cm.
 2. Flowers glabrous.
  3. Pith of the branchlets with some vascular strands. Petioles 19–38 cm. Leaflets 20–60 cm long, with 18–38 pairs of nerves . . . . **5. D. kingii**
  3. Pith of the branchlets without vascular strands. Petioles 3–19 cm. Leaflets 6–30(–40) cm long, with 8–14 pairs of nerves . . . . **14. D. longifolia**
 2. Flowers tomentose. Pith of the branchlets with some to many vascular strands. Petioles (3–)6–14(–26) cm. Leaflets generally not longer than 20 cm, with 5–20 pairs of nerves . . . **9. D. rostrata**
1. Petioles up to 16(–18) cm.
 4. Lower surface of the leaflets puberulous to pubescent or with patent hairs on all nerves and veins.
  5. Inflorescences axillary or lateral, vegetative terminal bud present.
   6. Leaf-rhachis not with swollen nodes.
    7. Leaves 5–9-jugate. Leaflets 10–20 cm long, with abruptly acuminate apex, undersurface pubescent throughout or at least on the midrib and main nerves, upper surface with a manifest to prominent reticulation. Fruits 1³/₄ cm or longer . . . . **9. D. rostrata**
    7. Leaves 1–4-jugate. Leaflets 5–12 cm long, with gradually acuminate apex, undersurface puberulous on all nerves and veins, upper surface smooth, with a hardly conspicuous reticulation. Fruits 1¹/₂ cm long. . . . . **3. D. puberula**
   6. Leaf-rhachis with swollen nodes . . . . **1. D. rugosa**
  5. Inflorescences terminal, sometimes with smaller additional axillary and/or lateral ones, vegetative terminal bud absent.
   8. Leaflets dull brown above. Flowers yellowish when dry. Branchlets ± persistently densely tomentose . . . . **7. D. rubiginosa**
   8. Leaflets shining, usually greenish. Flowers darkbrown when dry. Branchlets pubescent when young.
    9. Leaf-rhachis with distinctly swollen nodes. Petioles flattened or nearly terete. Leaflets usually elliptic, 6–22 × 2¹/₂–11 cm. Stamens adnate to the disk . . . . **1. D. rugosa**
    9. Leaf-rhachis not or indistinctly swollen on the nodes. Petioles strongly flattened at the base. Leaflets ovate to elliptic, 3–14 × 1¹/₂–6 cm. Stamens free . . . . **2. D. costata**
 4. Lower surface of the leaflets glabrous or hairy on the midrib only.
  10. Inflorescences terminal, sometimes with smaller additional axillary and/or lateral ones, vegetative terminal bud absent.
   11. Fruits more than 3 cm long.
    12. Leaflets brown when dry. Petioles puberulous, 9–14¹/₂ cm, leaves further glabrous. Infructescences puberulous . . . . **8. D. elmeri**
    12. Leaflets greenish when dry. Petioles, rhachis, petiolules and stalks of the inflorescences nearly always densely pilose, glabrescent. Petioles 1–14 cm . . . . **4. D. laxa**

11. Fruits up to 3 cm long, generally less than 2½ cm.
  13. Stamens free from the disk.
    14. Petioles 4–8½(–15½) cm. Leaflets nearly always brown when dry. Veins conspicuous, not prominent underneath, transversely reticulate. Flowers 2–4 mm, cinnamon-brown when dry. Pedicels angular, ½–1 mm thick . . . . **6. D. incurvata**
    14. Petioles 1–5(–6½) cm. Leaflets in a dry state nearly always olive-green underneath with a brownish nervation. Veins very prominent underneath, distinctly transverse. Flowers 1½–2½ mm, darkbrown when dry. Pedicels terete, usually much less than ½ mm thick. **2. D. costata**
  13. Stamens connate with the disk.
    15. Leaf-rhachis with distinctly swollen nodes. Petioles flattened to nearly terete, with the leaf-rhachis and the inflorescences ± minutely pubescent to puberulous, glabrescent. Fruits 1½–2½ cm long . . . . **1. D. rugosa**
    15. Leaf-rhachis without swollen nodes. Petioles strongly flattened, with leaf-rhachis, petiolules and inflorescences nearly always densely pilose and glabrescent. Lowest pair of leaflets usually much smaller and rather early caducous. Fruits 2½–4½ cm long. . **4. D. laxa**
10. Inflorescences axillary or lateral, vegetative terminal bud present.
  16. Leaflets 3–6 times as long as wide.
    17. Pith of the branchlets without vascular strands. Undersurface of the leaflets without pitted dots on the intervenium . . . . **14. D. longifolia**
    17. Pith of the branchlets with some to many vascular strands. Intervenium of the undersurface of the leaflets provided with fine pitted dots . . . . **9. D. rostrata**
  16. Leaflets less than 3 times as long as wide.
    18. Pith of the branchlets and the petioles with some to many vascular strands.
      19. Petioles glabrous or puberulous and glabrescent.
        20. Upper surface of the leaflets with distinctly conspicuous to prominent venation, lower surface with fine pitted dots. Petioles terete or somewhat flattened. Fruits 1¾–3½(–4) cm long . . . . **9. D. rostrata**
        20. Venation not very conspicuous on the smooth upper surface of the leaflets, no pitted dots on the lower surface. Petioles strongly flattened. Fruits 4–4¾ cm long . . **8. D. elmeri**
      19. Petioles densely pubescent, strongly flattened . . . . **10. D. crassipes**
    18. Pith of the branchlets without vascular strands, some or none in that of the petioles.
      21. Fruits shorter than 2 cm.
        22. Leaf-rhachis with swollen nodes. Base of the leaflets usually cuneate, apex rather abruptly, narrowly long-acuminate . . . . **1. D. rugosa**
        22. Leaf-rhachis not swollen at the nodes. Base of the leaflets rounded, decurrent. Acumen rather broad . . . . **15. D. breviracemosa**
      21. Fruits longer than 2 cm.
        23. Leaf-rhachis with swollen nodes . . . . **1. D. rugosa**
        23. Leaf-rhachis not swollen at the nodes.
          24. Pith of the petioles without vascular strands. Ultimate base of the leaflets ± rounded. **13. D. papuana**
          24. Pith of the petioles with one or some vascular strands. Ultimate base of the leaflets cuneately or acuminately contracted.
            25. Petals thick, with strongly inflexed apiculum and margins (less so in *var. merrillii*). Filaments confluent with the disk. Leaflets nearly orbicular to ovate, obovate or elliptic-oblong, with 6–10(–13) pairs of nerves . . . . **11. D. macrocarpa**
            25. Petals with slightly inflexed apiculum, margins not inflexed. Filaments free from the disk. Leaflets oblong to oblong-lanceolate, with 10–17 pairs of nerves. **12. D. expansa**

1. Dacryodes rugosa (BL.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 203, t. 11 f. 64; Bull. Jard. Bot. Btzg III, 12 (1932) 345, t. 4 f. 12; in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 3; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 16, *cum fig.*; KALKMAN, Blumea 7 (1954) 505.—*Santiria rugosa* BL. Mus. Bot. 1 (1850) 212; ENGL. in DC. Mon. Phan. 4 (1883) 164.—*Santiria virgata* BL. Mus. Bot. 1 (1850) 213; ENGL. in DC. Mon. Phan. 4 (1883) 158.—*Canarium rugosum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 649, *incl.* also *var. sumatranum*; Sum. (1861) 527.—*Canarium virgatum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 650.—*Santiria fasciculata* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 539; ENGL. in DC. Mon. Phan. 4 (1883) 164; KING, J. As. Soc. Beng. 62, ii (1894) 255; RIDL. Fl. Mal. Pen. 1 (1922) 377, *var. puberula excl.*; HEYNE, Nutt. Pl. (1927) 881.—*Santiria longepaniculata* BAKER *f.* J. Bot. 62 (1924) Suppl. 17.—*Hemisantiria rugosa* H. J. LAM in Merr. Pl. Elm. Born. (1929) 119.—*Canarium moultonii* RIDL. Kew. Bull (1930) 83.

Tree 5–20(–35) m by 8–40(–100) cm, sometimes a large shrub; no buttresses. *Branchlets* 3–5 mm thick, smooth, long remaining pubescent; pith without vascular strands. *Leaves* (0–)2–4-jugate. *Petioles* terete to ± flattened at base, 3–9½ cm, pubescent or puberulous to glabrous, pith with 1 or few, rarely without vascular strands; base of the petiole, nodes of the rhachis, and ends of the petiolules distinctly swollen. *Leaflets* obovate or ovate to oblong-lanceolate, 6–22 by 2½–11 cm, chartaceous, often bullate; indumentum variable; base oblique, cuneate to rounded; apex more or less abruptly acuminate, acumen ½–3½ cm by 1–3 mm, often slightly broadened at the tip, blunt; nervation usually distinctly prominent beneath, nerves 7–12 pairs (angle 50–80°), slightly curved, often arching near the margin. *Panicles* axillary, together pseudoterminal, rarely terminal, densely and minutely pubescent, ♂ slender, 15–60 cm long, laxly branched from the base, branches up to 25 cm long, flowers usually clustered; ♀ ones pyramidal, lax and relatively few-flowered, 2–25 (–40) cm, peduncle 0–4 cm, branches up to 9 cm long. *Flowers* 1½–2½ mm, sparsely pubescent to glabrous. *Calyx* in ♂ flowers ¾–1 mm, in ♀ ones 1–1½ mm. *Stamens* adnate to the disk, episepalous ones slightly longer. *Disk* cupular, thick. *Pistil* in ♂ flowers moderately to entirely reduced. *Fruits* ovoid, slightly oblique, 1½–2½ by ¾–1½ cm, rounded at both ends; flower remains long persistent. *Cotyledons* consisting of 3 separate, petioluled lobes, contortuplicate.

Distr. *Malaysia:* S. Sumatra, Malay Peninsula, W. Java, and Borneo.

Ecol. Primary forests up to 900 m. *Fl.* mainly Sept.–Dec., *fr.* mainly May–July.

Wood anat. HEIMSCH, Lilloa 8 (1942) pl. 8 fig. 51.

Uses. Timber of little value.

Vern. Sumatra: *gita tjilok, kabau, kaju manau, k. napo, rihil*; Malay Peninsula: *kĕdondong, k. bulau puteh, k. mata hari, lĕlĕtup*; Borneo: *dayau, kambayu burong, kĕmanyan, langsat burung, maram putis, owas-owas, paninasan burong, patiu, pitong kalaout, punan ratjang, sarè djani, talang sai, tompulan, tuli, tutu, watuk*.

Notes. Sterile specimens of this rather variable species are sometimes difficult to distinguish from *D. costata*. The petioles of *D. rugosa* are usually not so strongly flattened as those of *D. costata*; the leaf-rhachis is much more distinctly swollen on the nodes in *D. rugosa*, which generally makes a more slender impression. *D. costata* has—generally spoken—smaller leaves, shorter and less slender petioles, interjugae and petiolules, and smaller leaflets. In some cases the identification of sterile specimens remains doubtful.

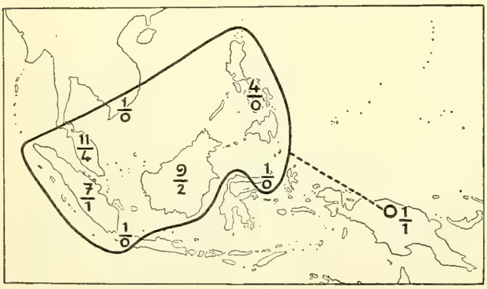

Fig. 9. Distribution of *Dacryodes sect. Tenuipyrena*. Above the hyphen the total number of species, below the hyphen the number of endemic species in each district or island.

Two varieties can be distinguished:

var. **rugosa**.—All synonyms except those of *var. virgata*.

Leaflets glabrous or more or less appressedly pubescent underneath.

Distr. *Malaysia:* as the species.

var. **virgata** (BL.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 203; Bull. Jard. Bot. Btzg III, 12 (1932) 348.—*Santiria virgata* BL.—*Canarium virgatum* MIQ.

Leaflets with erect hairs on midrib and nerves underneath.

Distr. *Malaysia:* Borneo.

2. Dacryodes costata (BENN.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 204, t. 14 f. 106e; Bull. Jard. Bot. Btzg III, 12 (1932) 359, t. 5 f. 17; KALKMAN, Blumea 7 (1954) 508.—*Santiria costata* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 537; ENGL. in DC. Mon. Phan. 4 (1883) 157; KING, J. As. Soc. Beng. 62, ii (1894) 260; RIDL. Fl. Mal. Pen. 1 (1922) 380.—*Canarium costatum* RIDL. Kew Bull. (1930) 82.—**Fig. 10.**

Tree 20–30(–40) m by 20–100 cm, rarely with small buttresses. *Branchlets c.* ½ cm thick, minutely pubescent; pith without vascular strands. *Leaves* (1–)2(–4)-jugate, more or less densely pubescent except the upper surface of the leaflets. *Petioles* 1–5(–6½) cm, much flattened at base, pith with few vascular strands. *Leaflets* broadly elliptic to oblong, 3–16 by 1½–7½ cm, rigid, chartaceous to subcoriaceous, underneath more or less woolly pubescent on midrib and nerves, glabrescent; base hardly oblique, broadly cuneate to rounded; apex abruptly, shortly, and bluntly acuminate; nervation prominent beneath, nerves 6–13 pairs (angle *c.* 60°, at the base up to 90°), strongly curved, not arching except some apical ones. *Panicles* terminal and often in the uppermost leaf-axils, usually branched from the base, densely woolly pubescent, flowers in clusters; ♂ ones 6½–30 cm, much branched, branches spreading, up to 12 cm; ♀ ones 4–21 cm, narrowly paniculate to subracemose, branches up to 4 cm. *Flowers* small, slightly pubescent. *Calyx* ½–1 mm high. *Petals* glabrous. *Filaments* free from the disk. *Disk* annular to 6-lobed, thick. *Pistil* in ♂ flowers very reduced. *Infructescences* densely woolly pubescent. *Fruits* ovoid, hardly or not oblique, 12–19 by 8–12 mm, rounded at the base, more or less obtusely acute at the apex; wall of the pyrene rather thick and hard. *Cotyledons* folded, 3-lobed.

Distr. *Malaysia:* Sumatra, Banka, Billiton, Malay Peninsula, Borneo, and the Philippines (Leyte).

Ecol. Primary forests up to 100(–500) m. *Fl.* March–Oct., *fr.* apparently the whole year.

Uses. In Borneo the timber is used for light constructions, the bole for building proahs.

Vern. *Kĕdondong bĕsi, kĕning kĕrak, mĕrasam pujo, rasak babi, rĕsung, sĕpah* (or *sĕpat) burung*,

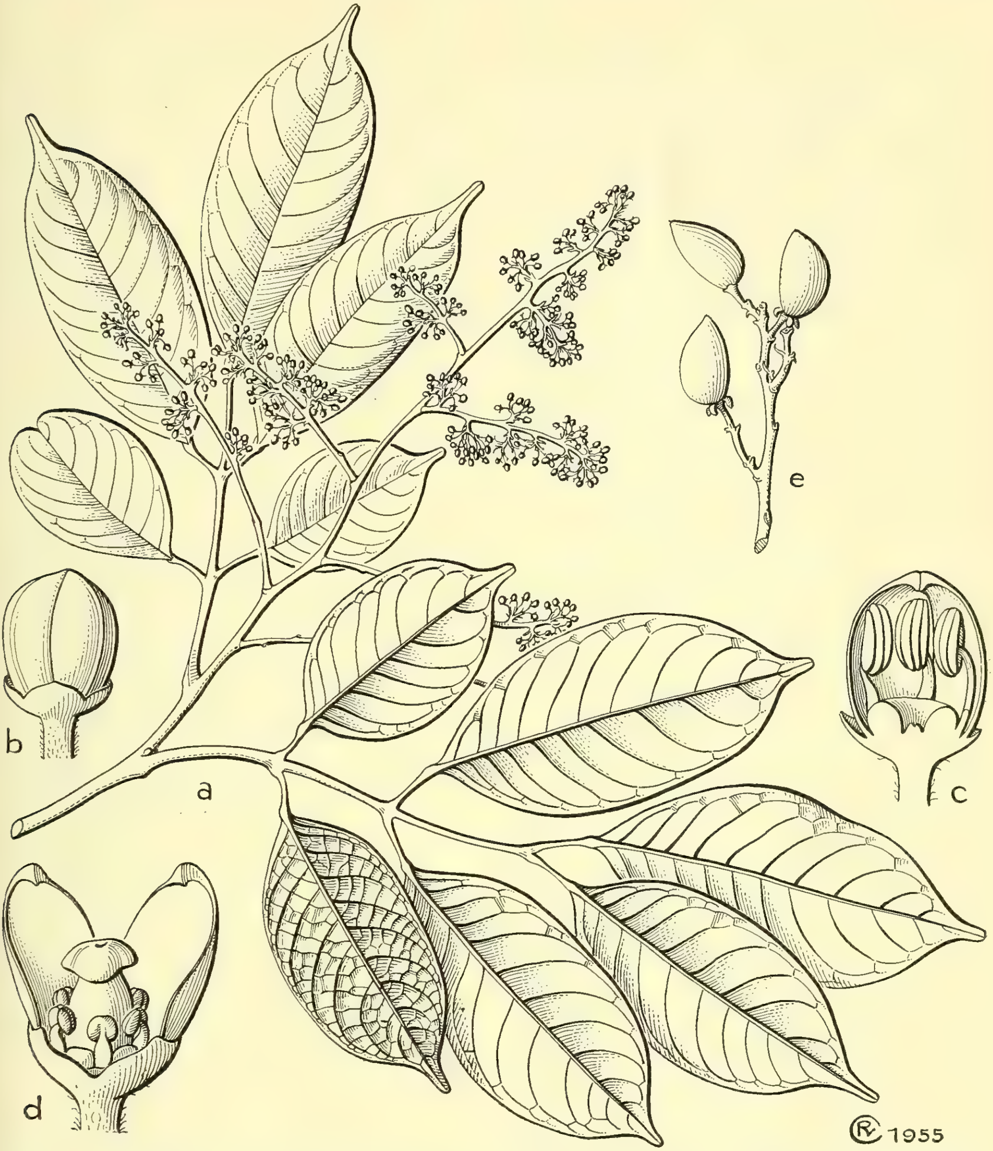

Fig. 10. *Dacryodes costata* (BENN.) H. J. LAM. *a*. Twig with ♂ flowers, *b*. ♂ bud, *c*. ♂ bud in section, *d*. ♀ flower, one petal removed, *e*. infructescence (*a* and *e* × 2/3, *b* × 10, *c–d* × 13).

si katjang, *tjak sibui*, *tjĕtjibui*, Sum., *binjau*, *bunjau*, *sĕkibai*, *sudur bajan*, Banka, *bĕrbing pinggan*, Billiton, *kĕdondong (mata-hari)*, Mal. Pen., *basi-basi*, *batu*, *bĕlanak*, *buah*, *kĕdundung*, *kramu*, *limat*, Born.

Note. Sterile specimens are sometimes hard to distinguish from *D. rugosa* H. J. LAM; for the differences see under that species.

3. Dacryodes puberula (BENN.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 204; Bull. Jard. Bot. Btzg III, 12 (1932) 354, t. 4 f. 14 (*c. excl.*); WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 18, *cum fig.*; KALKMAN, Blumea 7 (1954) 512.—*Santiria puberula* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 537; ENGL. in DC. Mon. Phan. 4 (1883) 161; KING, J. As. Soc. Beng. 62, ii (1894) 256; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 258, f. 39².—*Santiria fasciculata* BENN. *var. puberula* RIDL. Fl. Mal. Pen. 1 (1922) 377.

Tree, 15–21 m, with small buttresses. *Branchlets* 2–3 mm thick, puberulous, glabrescent; pith without or with one vascular strand; terminal bud rather long and narrow. *Leaves* 1–4-jugate. *Petioles* slender, 2–6½ cm, flattened at the base, puberulous and glabrescent, pith with one to some vascular strands. *Leaflets* elliptic to ovate, 4½–12½ by 2½–6½ cm, thin, upper surface slightly pubescent on the base of the midrib, undersurface puberulous on nerves and veins; base usually very oblique, one half rounded to broadly cuneate, the other half cuneate; apex gradually to subabruptly acuminate, acumen short and blunt; nerves 7–11 pairs (angle 45–80°), curved near the margin, apical ones arching. *Panicles* (♀ unknown) axillary, 3½–12 cm, puberulent to glabrous; peduncle 0–2½ cm, branches few, spreading and lax, up to 5 cm. *Flowers* (♀ unknown) 2 mm, pubescent. *Calyx* minute. *Stamens* adnate to the disk. *Disk* with undulate rim. Rudiment of the *pistil* small. *Infructescences* 3–5 cm long, puberulous, peduncle 0–1½ cm. *Fruits* ellipsoid, *c.* 1½ by 1 cm, style-rudiment nearly apical; pericarp coarsely rugose when dry; wall of the pyrene rather thick.

Distr. *Malaysia:* Malay Peninsula (the Sumatra specimen mentioned by H. J. Lam, Bull. *l.c.*, belongs to *Santiria apiculata* Benn.).

Ecol. Forests at low altitudes. *Fl.* Nov.–Dec., *fr.* Jan.

Uses. Timber very hard and durable, used in house-building.

Vern. *Kĕdondong*, *k. krut*, *k. sĕrong.*

4. Dacryodes laxa (Benn.) H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) 204, t. 15 f. 114, *incl.* also *var. forbesii*; Bull. Jard. Bot. Btzg III, 12 (1932) 355, t. 5 f. 15; Husson & H. J. Lam, Blumea 7 (1952) 166; Wyatt-Smith, Man. Mal. Timb. Trees, Burser. (1953) 19, *cum fig.*; Kalkman, Blumea 7 (1954) 503.—*Canarium laxum* Benn. in Hook. *f.* Fl. Br. Ind. 1 (1875) 535; Engl. in DC. Mon. Phan. 4 (1883) 139.—*Canarium fragile* Engl. in DC. Mon. Phan. 4 (1883) 138.—*Santiria laxa* King, J. As. Soc. Beng. 62, ii (1894) 254; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 12, t. 16; Ridl. Fl. Mal. Pen. 1 (1922) 377.—*Santiria forbesii* Baker *f.* J. Bot. 62 (1924) Suppl. 16.

Small tree, up to 15(–30) m by up to 62 cm diam. *Branchlets* 5–8 mm thick, young parts rather densely pilose to glabrous, as are the leaves (leaflets excepted), inflorescences and infructescences; pith sometimes with a few small, usually peripherally arranged vascular strands. *Leaves* 2–5(–7)-jugate, the lowest pair of leaflets tending towards pseudostipules, often rather early caducous except their petiolules. *Petioles* 1–14 cm long, at base much swollen and flattened to deeply furrowed, pith with some vascular strands. *Leaflets* (ovate to) oblong-lanceolate or oblanceolate, 5–20(–32½) by 2–6(–11) cm, rigidly chartaceous to pergamaceous, sometimes slightly bullate, glabrous or slightly pilose on the midrib beneath; base cuneate to rounded; apex (sub)-abruptly acuminate, acumen 1½–2½ cm, slender; nervation much prominent below, nerves (8–)10–24 pairs, straight or curved, more or less distinctly arching. *Panicles* terminal, branched from the base, usually pilose, ♂ 35–80 cm long, main branches up to 40 cm, ♀ 10–85(–140) cm, main branches up to 30 cm long. *Flowers* long-stalked, ♂ 4 mm long, ♀ 6 mm. *Calyx* slightly pilose, 1–1½ mm high. *Petals* glabrous. *Filaments* adnate to the disk. *Disk* in ♂ flowers annular, in ♀ ones cupular, always thick. *Pistil* in ♂ flowers slightly reduced. *Fruits* oblong-ovoid, not or slightly oblique, usually slightly contracted at the apex, 2½–4½ by ¾–2 cm. *Cotyledons* contortuplicate, palmatifid.

Distr. *Malaysia:* Sumatra, Batu Islands, Malay Peninsula, Borneo.

Ecol. In primary forests at low and medium altitudes, in N. Sumatra and on Mt Kinabalu ascending to 900–1200 m, in Brunei once collected in swampy habitat. *Fl.* Febr.–April, Aug.–Oct., *fr.* May–Jan.

Vern. *Landoa*, Bencoolen, *kĕdondong*, *k. hutan*, *k. bulu*, *poko gumo*, *punting bĕliong*, Mal. Pen., *ibabu*, SE. Borneo.

5. Dacryodes kingii (Engl.) Kalkman, *nov. comb.* —*Santiria floribunda* King, J. As. Soc. Beng. 62, ii (1894) 254, *nom. illeg.*; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 16, t. 21; Ridl. Fl. Mal. Pen. 1 (1922) 376; *non Santiria floribunda* K.Sch. (1881), *quae est Haplolobus floribundus.*—*Santiria kingii* Engl. in E. & P. Pfl. Fam. ed. 2, 19a (1931) 453.—*D. floribunda* H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) 204; Bull. Jard. Bot. Btzg III, 12 (1932) 357, t. 5 f. 16; Kalkman, Blumea 7 (1954) 521.

A small tree or large shrub, up to 12 m by 20 cm. *Branchlets c.* 2 cm thick, puberulous to glabrous; pith with some small, peripherally arranged vascular strands. *Leaves* 6–8-jugate. *Petioles* stout, 19–21 cm, much flattened and swollen at the base, pulverulent and glabrate, pith with many vascular strands. *Leaflets* oblong, 20–60 by 5½–13 cm, rigidly chartaceous, glabrous or slightly pubescent on the midrib underneath; base obliquely rounded; apex shortly and acutely acuminate; midrib and nerves very prominent beneath, nerves 18–38 pairs (angle from 90° near the base to 55–60° near the apex), curved. *Panicles* terminal, pendulous, lax, 35–120 cm long, minutely pulverulent, glabrescent, branches up to 55 cm long. *Flowers* (long-)stalked, glabrous, waxy, red, ♂ *c.* 3 mm, ♀ 5–6 mm. *Calyx* in ♂ flowers ½ mm high, in ♀ ones 2 mm. *Stamens* free, sometimes slightly adnate to the disk. *Disk* cupular, thick, more or less radially furrowed. *Pistil* not exsert from the disk in ♂ flowers. *Fruits* oblong, contracted and acute at the apex, hardly oblique, 2–2¾ by 1–1¼ cm. *Cotyledons* folded, 3-lobed.

Distr. *Malaysia:* Malay Peninsula.

Ecol. Primary and secondary forests up to 400 m. *Fl.* April–July, *fr.* May, June, Sept.–Dec.

Uses. Leaves used for roofing.

6. Dacryodes incurvata (Engl.) H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) 204; Bull. Jard. Bot. Btzg III, 12 (1932) 362, t. 5 f. 19; Kalkman, Blumea 7 (1954) 506.—*Canarium incurvatum* Engl.

in DC. Mon. Phan. 4 (1883) 138.—*Santiria nitida* Merr. Publ. Gov. Lab. Philip. *no* 35 (1906) 29; En. Philip. 2 (1923) 356.—*Canarium nitens* Merr. Philip. J. Sc. 10 (1915) Bot. 24; En. Philip. 2 (1923) 352.—*Hemisantiria nitida* H. J. Lam in Merr. Pl. Elm. Born. (1929) 118.—*Canarium angulatum* Ridl. Kew Bull. (1931) 493.—*D. angulata* H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) 204; Bull. Jard. Bot. Btzg III, 12 (1932) 364, t. 5 f. 20.

Tree 10–30 m by 25–100 cm, buttresses 1–2 m high. *Branchlets* $2^1/_2$–5 mm thick, pubescent to glabrous; pith with some to many, rarely without vascular strands. *Leaves* 1–4-jugate. *Petioles* ($3^1/_2$–)$4^1/_2$–$8^1/_2$(–$15^1/_2$) cm, usually strongly flattened at the base, pubescent, glabrescent, pith with some to many vascular strands. *Leaflets* lanceolate or elliptic to oblong, 4–22 by 2–$9^1/_2$ cm, rigidly pergamaceous, glabrous; base (subcordate to) rounded (to cuneate); apex usually rather abruptly, shortly and bluntly acuminate; nervation prominent beneath, nerves (6–)8–18 pairs (angle 60–90°), sinuous, curved, faintly arching near the margin. *Panicles* terminal, sometimes with additional axillary ones, often branched from the base, ♂ ones 3–17 cm, ♀ ones 8–21 cm. *Flowers* 2–4 mm, densely minutely tomentose. *Calyx* 1–$1^1/_4$ mm high. *Filaments* free from the disk or slightly confluent with it. *Disk* cupular, 6-lobed. *Ovary* tomentose, pistil in ♂ flowers strongly reduced. *Fruits* ovoid, sometimes oblique, ($1^1/_2$–)$1^3/_4$–$2^3/_4$ by $^3/_4$–$1^3/_4$ cm, acute at the apex, rounded at the base. *Cotyledons* contortuplicate, palmatifid (?).

Distr. *Malaysia:* Sumatra, Malay Peninsula, Borneo, and the Philippines (Mindoro, Luzon, Sibuyan, Negros, Panay, Mindanao).

Ecol. Primary forests, sometimes swampy, up to 100(–475) m. *Fl.* Febr.–March, *fr.* mainly Oct.–April.

Wood anat. Reyes, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 162, Pl. 24 fig. 2 (hand lens).

Vern. *Balan pĕlapah, bantan burung, kĕdondong kidjai, sau,* Sum., *rèsak paja,* Riouw-Lingga, *kĕdondong, k. kĕrut, k. matahari, kĕrantai,* Mal. Pen., *bumbun, djĕlmu pipit, kĕmbajau* (or *kĕmbojou*), *malinas, pongaluwon, pudauling, rawai, rèsak mĕrkujung, tokul-gunung, unggit-unggit,* Born.; Philippines: *alùpug-matsíng, kamingi, korig* (or *kurig*), *mayagyat,* Tag., *baùli,* Sul., *kuragal,* Sbl., *sàyong,* P.Bis.

7. Dacryodes rubiginosa H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) 204; Bull. Jard. Bot. Btzg III, 12 (1932) 361, t. 5 f. 18; Wyatt-Smith, Man. Mal. Timb. Trees, Burser. (1953) 20, *cum fig.*; Kalkman, Blumea 7 (1954) 521.—*Canarium rubiginosum* Benn. in Hook. *f.* Fl. Br. Ind. 1 (1875) 535, *nom. illeg.*; Engl. in DC. Mon. Phan. 4 (1883) 136; King, J. As. Soc. Beng. 62, ii (1894) 248; Ridl. Fl. Mal. Pen. 1 (1922) 374; *non Canarium rubiginosum* Miq. Fl. Ind. Bat. 1, 2 (1859) 651, *quae est Santiria rubiginosa* Bl.

Tree, 20–35 m by 25–60 cm. *Branchlets* $^1/_2$ cm thick, young parts densely tomentose; pith with some very small, scattered vascular strands. *Leaves* 2–4-jugate, densely pubescent. *Petioles* 3–$8^1/_2$ cm, much flattened at the base, pith with some vascular strands. *Leaflets* ovate or obovate to oblong, 4–20 by 2–7 cm, chartaceous, midrib and nerves on the undersurface densely pubescent; base cuneate to ± rounded; apex rather abruptly, shortly, and bluntly acuminate; nervation prominent beneath, nerves (7–)10–13 pairs (angle *c.* 70°), curved, not arching. *Panicles* (♀ unknown) terminal, lax, up to 30 cm long, branched from the base, branches up to 14 cm, densely tomentose. *Flowers* (♀ unknown) $2^1/_2$–3 mm, tomentose. *Calyx* 1 mm high, nearly truncate. *Stamens* free. *Disk* cushion-shaped to cupular, radially furrowed. Rudimentary *pistil* very small. *Infructescences* terminal, broadly paniculate, 8–$17^1/_2$ cm long, stout, densely tomentose. *Fruits* ellipsoid, 2–$2^1/_2$ by 1–$1^1/_4$ cm, rounded at base and apex, style-remains terminal. *Cotyledons* contortuplicate, palmatifid.

Distr. *Malaysia:* Malay Peninsula and Borneo.

Ecol. Primary forests up to 175 m. *Fl.* Jan., April, *fr.* May, Oct.

Vern. *Kĕdondong, suryan,* Mal. Pen., *bĕngaja, bĕnung, huwung, kumbajan,* Born.

Note. Closely related to *D. incurvata* H. J. Lam, the differences being the dense tomentum of the branchlets, inflorescences and infructescences, the pubescence of the undersurface of the leaflets, and the broader and less slender infructescences in *D. rubiginosa.*

8. Dacryodes elmeri H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) 203; Bull. Jard. Bot. Btzg III, 12 (1932) 344, t. 4 f. 11; Kalkman, Blumea 7 (1954) 521.—*Hemisantiria prob. nov. sp.* H. J. Lam in Merr. Pl. Elm. Born. (1929) 199.

Tree, 75 cm in diam. *Branchlets c.* 1 cm thick, densely minutely villous, pith with many scattered vascular strands; terminal bud $1^1/_2$ cm long, densely pubescent. *Leaves* 3–4-jugate. *Petioles* 9–$14^1/_2$ cm, strongly flattened at the base, puberulous, glabrescent, pith with many vascular strands. *Leaflets* oblong, 12–22 by 5–$8^1/_2$ cm, stiff chartaceous, glabrous; base oblique, cuneate or one half rounded; apex abruptly and shortly blunt-acuminate; nervation prominent beneath, nerves 13–18 pairs (angle 60–75°), curved, basal and apical ones arching. *Inflorescences* and *flowers* unknown. *Fruiting panicles* axillary (?), puberulous, 17–45 cm, peduncle $^3/_4$–2 cm. *Fruits* ovoid, 4–$4^3/_4$ by 2–$2^1/_2$ cm, base rounded, apex ± rounded, pericarp thin; pyrene crustaceous. *Cotyledons* contortuplicate, palmatifid.

Distr. *Malaysia:* N. Borneo (Elphinstone Prov.: Tawao), once collected.

Note. I have seen only parts of the infructescences. Regarding the relationship of this species with *D. incurvata* H. J. Lam and *D. rubiginosa* H. J. Lam, which have terminal inflorescences, I doubt whether they are axillary here, as is stated by Lam, *l.c.*

9. Dacryodes rostrata (Bl.) H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) 203, t. 11 f. 59, t. 13 f. 101,

t. 14 f. 106d and 111b; Bull. Jard. Bot. Btzg III, 12 (1932) 349, t. 4 f. 13; GUILLAUMIN, Fl. Gén. I.-C. Suppl. 1 (1946) 675, f. 83^{1-2}; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 17, *cum fig.*; KALKMAN, Blumea 7 (1954) 519.—*Santiria rostrata* BL. Mus. Bot. 1 (1850) 213; THORENAAR, Med. Proefst. Bosw. *no* 16 (1926) 91, f. 8 (anat. of bark).—*Santiria montana* BL. Mus. Bot. 1 (1850) 212.—*Dracontomelon ? cuspidatum* BL. Mus. Bot. 1 (1850) 232; MIQ. Fl. Ind. Bat. 1, 2 (1859) 640.—*Canarium montanum* KORTHALS *ex* MIQ. Fl. Ind. Bat. 1, 2 (1859) 649.—*Canarium gilvescens* MIQ. Fl. Ind. Bat. 1, 2 (1859) 650.—*Canarium rostriferum* MIQ. Sum. 1 (1861) 526; ENGL. in DC. Mon. Phan. 4 (1883) 137, *incl.* also *var. cuspidatum*; GUILLAUMIN, Fl. Gén. I.-C. 1 (1911) 711.—*Canarium kadondon* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 535; ENGL. in DC. Mon. Phan. 4 (1883) 138; KING, J. As. Soc. Beng. 62, ii (1894) 247; RIDL. Fl. Mal. Pen. 1 (1922) 373; BURK. Dict. (1935) 430.—*Canarium minahassae* KOORD. [Minah. (1898) 376, 622, *nomen*] Nat. Tijd. N. I. 63 (1904) 96; Suppl. Cel. 2 (1922) t. 28; Suppl. 3 (1922) 14.—*Canarium articulatum* ENGL. *ex* KOORD. Nat. Tijd. N.I. 63 (1904) 97, *nomen*; Suppl. Cel. 2 (1922) t. 24; *ibid.* Suppl. 3 (1922) 13.—*Santiria samarensis* MERR. Philip. J. Sc. 10 (1915) Bot. 31; En. Philip. 2 (1923) 356.—*Canarium crassifolium* MERR. Philip. J. Sc. 10 (1915) Bot. 274.—*Canarium caudatifolium* MERR. Philip. J. Sc. 10 (1915) Bot. 315.—*Canarium cuspidatum* MERR. En. Born. (1921) 316.—*Hemisantiria rostrata* H. J. LAM in MERR. Pl. Elm. Born. (1929) 119.—*Canarium reticulatum* RIDL. Kew Bull. (1930) 83.—**Fig. 2d.**

Tree, 5–25(–35) m by 20–50(–120) cm, sometimes buttressed. *Branchlets* 4–10 mm thick, lenticellate, glabrous; pith with some to many dispersed vascular strands. *Leaves* 2–8(–10)-jugate, usually glabrous. *Petioles* terete or somewhat flattened at base, (3–)6–15(–26) cm, pith usually with many vascular strands. *Leaflets* ovate to oblong, 3½–20 by 1½–10 cm, rigid, chartaceous, glabrous or pubescent underneath; intervenium with pitted dots on lower surface (most distinct in *f. cuspidata* and *f. pallida*); base often very oblique, lower half cuneate, apical half rounded; apex usually abruptly acuminate, acumen up to 2(–4) cm by 1–2 mm, tip slightly broadened, blunt; midrib and nerves prominent beneath, nerves 5–20 pairs (angle 45–70°), strongly curved, geniculate close to the margin, apical ones sometimes arching. *Panicles* axillary, together usually pseudoterminal, long-peduncled, 5–35 cm long, densely and minutely tomentose, glabrescent, branches rarely exceeding 3 cm. *Flowers* tomentose, 2–4 mm long. *Calyx* in ♂ flowers 1–1½ mm high, in ♀ ones 1½–2 mm. *Petals* outside densely tomentose, inside slightly woolly except at the base. Episepalous *stamens* usually distinctly longer than the epipetalous ones, sometimes all adnate to the disk. *Disk* in ♂ flowers more or less cushion-shaped, in ♀ flowers cupular, rim 6-undulate. *Pistil* in ♂ flowers strongly to nearly entirely reduced. *Infructescences* stout, (nearly) glabrous, flower-remains long persistent. *Fruits* ovoid to oblong, slightly oblique, 1¾–3½(–4) by ¾–1¾(–2¼) cm, somewhat contracted at the apex, rounded at the base. *Cotyledons* contortuplicate, deeply palmatifid, with *c.* 7 segments.

Distr. Cochin-China and *Malaysia:* Sumatra, Banka, Billiton, Malay Peninsula, Borneo, Philippines (Palawan, Luzon, Samar, Leyte, Mindanao), N. Celebes.

Ecol. Primary, sometimes secondary forests, rarely swamps, up to *c.* 600 m. *Fl.* mainly March–Oct., *fr.* mainly March–Sept.

Uses. Timber used for planks and for paddy-pounders. Resin used for making torches. The fruits are edible.

Vern. *Asĕm begomdang, a. duku, babak, batang dantan, kasei, kĕmbajau (*or *kumbajau, kĕmbajan, kambajan), k. bĕkuwak, k. ĕnggang, k. tikus, simalang, sulai(i), tapus*, Sum., *anglip paja*, Simalur, *layo*, Nias, *rĕngas burung, r. putih*, Banka, *kĕmbajau (*or *kumbajau, kĕmbajan, kambajan, kĕmajau, lĕmajau)*, Banka, Billiton, *mĕngkĕlingan*, Billiton, *dumar bĕkam, epie, kĕdondong (krut), mansipot (*or *mansiput)*, Mal. Pen., *kĕbayan ajĕr, k. burong, kĕlamok maruk, kĕramu(h), ungit*, Sarawak & Brunei, *ampadu kalui, kalasu, kĕdondong (krut), kĕlamok maruk, kĕmbajau (*or *kumbajau, kĕmbajan, kambajan*), *k. lamak, k. tèta, k. utan, masam, mĕrading, njihah, tindjau*, S. & E. Born., *kumabang, pĕninasan, piramuh*, Br. N. Born., *salong banggi*, Labuan; Philippines: *lunai*, Lan., *palaspas*, Bik., *pili-hanai*, C.Bis.; *madesi, wuwuk*, Cel. Minahasa.

Note. Extremely polymorphous species, specially in its vegetative characters; some forms can be distinguished, but their boundaries are vague and intermediate specimens are not infrequent (*cf.* KALKMAN, *l.c.*).

10. Dacryodes crassipes KALKMAN, Blumea 7 (1954) 516, f. 5.

Tree ? *Branchlets c.* 1 cm thick, lenticellate, puberulous at the tip; pith with many vascular strands. *Leaves* 3–4-jugate. *Petioles* (4½–)7½–10 cm, strongly flattened at the base, densely pubescent, pith with many vascular strands. *Leaflets* ovate, 5–12½ by 3–6½ cm, coriaceous, glabrous; base rounded to subcordate; apex rather abruptly, shortly, and bluntly acuminate; nerves 10–13 pairs (angle 80–85°), straight, apical ones arching; intermediate veins distinctly developed. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, together pseudoterminal, stout, 7½–10 cm, hardly branched, pubescent. *Fruits:* only sterile ones known.

Distr. *Malaysia:* Sumatra (Indragiri), once collected at 50 m. *Fr.* Aug.

Note. Very incompletely known (only with galls and sterile fruits), but probably belonging to *Dacryodes*, and related to *D. rostrata* H. J. LAM.

11. Dacryodes macrocarpa (KING) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 203, t. 5 f. 8, t. 14 f. 106c and 111; Bull. Jard. Bot. Btzg III, 12 (1932) 342, t. 4 f. 10; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 15, *cum fig.*; KALKMAN, Blumea 7 (1954) 514.—*Santiria macrocarpa* KING, J. As. Soc. Beng. 62, ii (1894) 256; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 13, t. 17; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 258, f. 39[1]; RIDL. Fl. Mal. Pen. 1 (1922) 378.—*Santiria elliptifolia* MERR. Philip. J. Sc. 13 (1918) Bot. 305; En. Philip. 2 (1923) 355.—*D. kostermansii* KALKMAN, Blumea 7 (1954) 515, f. 4.—**Fig. 11.**

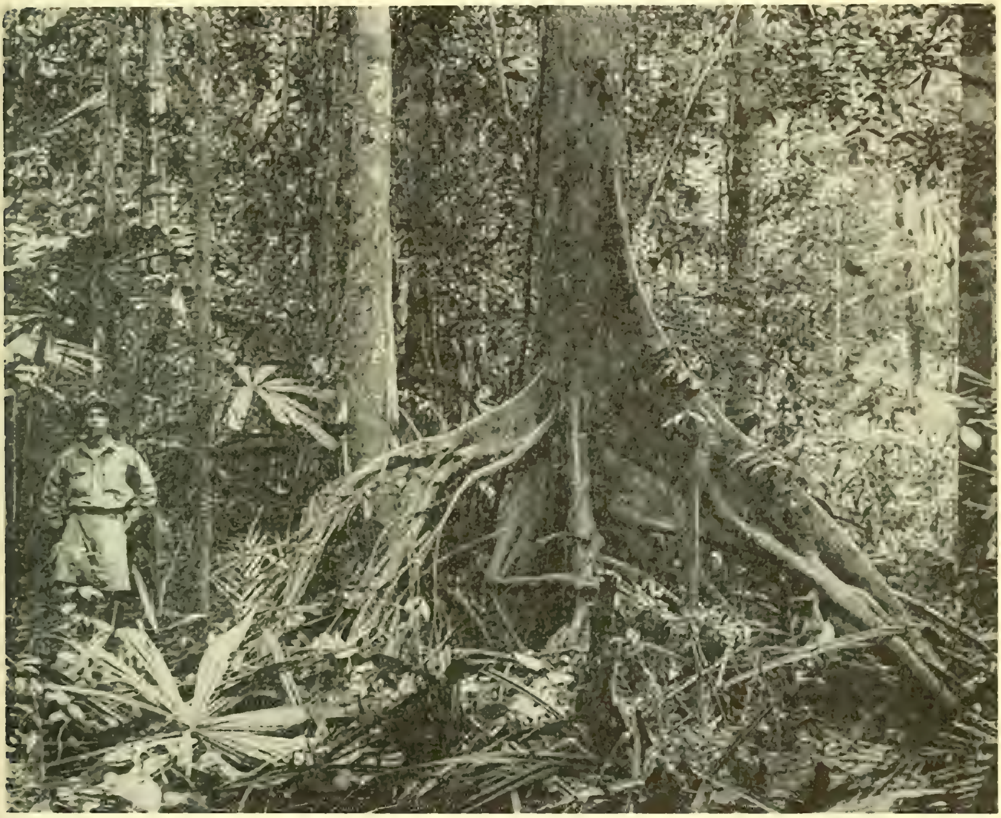

Fig. 11. Stilt-roots in *Dacryodes macrocarpa* (KING) H. J. LAM. Swampy forest, Mawai-Jemaluang Rd, 13½ mile, E. Johore (photogr. CORNER, Sept. 1935).

Tree, 10–25(–40) m by up to 65 cm, with stilt-roots or (stilted) buttresses (?always). *Branchlets* 4–8 mm thick, lenticellate, glabrous; pith without vascular strands. *Leaves* (0–)2–5-jugate, glabrous. *Petioles* flattened at base, 1½–7½ cm, pith with 1 or few vascular strands. *Leaflets* elliptic-obovate, ovate or elliptic-oblong, sometimes nearly orbicular, 4–16½ by 3–12 cm, thin-coriaceous; base often oblique, rounded to broadly cuneate, ultimate base cuneately or acuminately contracted; apex blunt and emarginate to shortly, broadly, and bluntly acuminate; nerves 6–14 pairs (angle 55–75°), curved, only the apical ones arching. *Inflorescences* axillary, together pseudo-terminal, broadly paniculate, 6–25 cm, glabrous, peduncle 0–4 cm, branches up to 12 cm. *Flowers* 4–6 mm, glabrous. *Filaments* confluent with the disk. *Disk* cupular, the rim undulate. *Pistil* in ♂ flowers rather strongly reduced. *Fruits* ovoid, faintly trigonous in cross-section, 2¼–3½ by 1¼–2 cm, stigmatic scar (nearly) apical. *Cotyledons* folded, 3-lobed.

Notes. This species is remarkable for its canaroid features: the thick and large petals with induplicate margins and inflexed apiculum and the large and faintly trigonous fruits. Three varieties can be distinguished.

KEY TO THE VARIETIES

1. Leaves up to 3-jugate.
   2. Leaf-rhachis and petiolules glabrous, blackish when dry. Midrib and nerves not sharply prominent on the lower surface. *var.* **macrocarpa**
   2. Leaf-rhachis and petiolules puberulous to glabrous, brown when dry. Midrib and nerves sharply prominent on the lower surface. *var.* **kostermansii**
1. Leaves 4–5-jugate . . . . *var.* **merrillii**

var. **macrocarpa.**—*Santiria macrocarpa* KING.—*D. macrocarpa var. genuina* H. J. LAM, Ann. *l.c.*; Bull. *l.c.* 343.

Leaves (0–)2(–3)-jugate. Petioles 1½–5(–7) cm. Nerves 6–10(–12) pairs (angle 55–65°). Pedicels 4–5 mm. Calyx 2½–3 mm.

Distr. *Malaysia:* Sumatra, Lingga, Malay Peninsula, and Borneo.

Ecol. Primary forests, up to 50(–400) m, apparently mostly in low, wet or swampy localities. *Fl.* Sept.–March, *fr.* Oct.–April.

Uses. The timber is sometimes used.

Vern. *Bantar burung, lĕntambung, sumbulajang,* Sum., *kabu-kabu hutan, mĕdang malai,* Lingga Arch., *kĕdondong,* Mal. Pen., *kambasina, karawas burong, madang lada, m. talsak, paoh-paoh,* Born.

var. **kostermansii** (KALKM.) KALKMAN, *nov. stat.*—*D. kostermansii* KALKM.

Leaves 2–3-jugate. Petioles 4½–7½ cm. Nerves (8–)10–14 pairs (angle from *c.* 75° at base to *c.* 60° near apex). Flowers unknown.

Distr. *Malaysia:* S. and E. Borneo.

Ecol. Primary forests up to 50 m. *Fr.* April.

Uses. Fruits edible.

Vern. *Asam, asĕm, rarawa pipit.*

var. **merrillii** H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 203; Bull. *l.c.* 344.—*Santiria elliptifolia* MERR.

Leaves 4–5-jugate. Nerves 8–13 pairs (angle 65–75°). Pedicels ½–3 mm long. Calyx in ♂ flowers (♀ flowers unknown) ½–1 mm. Fruits unknown.

Distr. *Malaysia:* Philippines (Luzon), once collected.

12. Dacryodes expansa (RIDL.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 204; Bull. Jard. Bot. Btzg III, 12 (1932) 366, t. 5 f. 21; KALKMAN, Blumea 7 (1954) 510, f. 2.—*Canarium expansum* RIDL. Kew Bull. (1930) 83.

Small, buttressed tree, 10–25 m. *Branchlets* ½–1½ cm thick, glabrous; pith without vascular strands. *Leaves* 2–4(or more?)-jugate, glabrous. *Petioles* 5–9½ cm, not or slightly flattened, pith with some vascular strands. *Leaflets* oblong to oblong-lanceolate, 8–30 by 3½–10 cm, coriaceous or chartaceous; base cuneate; apex shortly acuminate; nervation prominent below, nerves 10–17 pairs (angle 50–80°), curved, not arching. *Panicles* (♀ unknown) lax, axillary or on leafless axillary shoots with terminal buds, (5–)13–21 cm, glabrous, peduncle 0–5½ cm, branches up to 11 cm. *Flowers* (♀ unknown) ½ cm, glabrous. *Calyx* 2 mm. *Filaments* free. *Disk* cupular to annular, thick and radially furrowed or more or less undulate. *Pistil* moderately reduced. *Infructescences* axillary (?), 9–27 cm, glabrous, peduncle 6–7 cm. *Fruits* broad-ellipsoid, slightly triangular in cross-section, 3½–3¾ by 2–3 by 2½–3 cm, style-remains slightly to rather strongly excentric; pericarp coarsely wrinkled and pustular when dry; wall of the pyrene woody, 1–1½ mm thick.

Distr. *Malaysia:* Borneo (Sarawak and Brunei).

Ecol. Primary forests up to 100 m. *Fl.* Jan. *fr.* July–Aug.

Uses. The fruits are eaten.

Vern. *Sabal, sibut,* Brunei.

13. Dacryodes papuana HUSSON, Blumea 7 (1952) 167, f. 1; KALKMAN, Blumea 7 (1954) 513.

Tree, 30 m high. *Branchlets* 4–6 mm thick, glabrous; pith without vascular strands. *Leaves* 2-jugate, glabrous. *Petioles c.* 5 cm, slightly flattened at base, pith without vascular strands. *Leaflets* elliptic, 8½–11½ by 4–5 cm, subcoriaceous; base slightly oblique, broadly cuneate; apex shortly, broadly and bluntly acuminate; nerves 7–11 pairs (angle *c.* 50°), curved, not arching. *Inflorescences* and flowers unknown. *Infructescences* axillary, 11–12 cm, with few fruits. *Fruits* ellipsoid, 2¾–3 by 1½ cm, stigmatic scar apical, pericarp thick and fleshy. *Cotyledons* contortuplicate.

Distr. *Malaysia:* NW. New Guinea (Idenburg River), once collected.

Ecol. Primary forest at 650 m. *Fr.* April.

Note. Nearest related to *D. macrocarpa* H. J. LAM.

14. Dacryodes longifolia (KING) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 202; Bull. Jard. Bot. Btzg III, 12 (1932) 340, t. 4 f. 9; KALKMAN, Blumea 7 (1954) 509.—*Santiria longifolia* KING, J. As. Soc. Beng. 62, ii (1894) 258; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 14, t. 19; RIDL. Fl. Mal. Pen. 1 (1922) 379.—*Curtisina penangensis* RIDL. J. Str. Br. R. As. Soc. *no* 82 (1920) 180; Fl. Mal. Pen. 1 (1922) 491.

Tree. *Branchlets* ½–1 cm thick, lenticellate, glabrous; pith without vascular strands. *Leaves* 3–15-jugate, glabrous. *Petioles* 2½–18½ cm, strongly flattened above, pith with one or few vascular strands. *Leaflets* ovate to narrowly oblong, 6–30(–42) by 2½–8 cm, stiff, chartaceous; base broadly cuneate to rounded; apex tapering, bluntly acuminate; nerves 8–14 pairs (angle 60–65°), curved, apical ones arching. *Panicles* (♀ unknown) axillary, up to 12 cm long, glabrous, branched from the base, branches up to 4 cm long. *Flowers* (♀ unknown) 3½ mm, glabrous. *Calyx* 1½ mm. *Stamens* free or confluent to the disk. *Disk* cupular with subtruncate rim. *Pistil* moderately reduced. *Infructescences* axillary, pyramidal, 2–15(–23) cm, glabrous, peduncle 0–3½ cm, branches stout, up to 9½ cm. *Fruits* ovoid, slightly oblique, 1½–2¾ by 1¼–1½ cm, style-remains somewhat excentric; wall of the pyrene very thin.

Distr. *Malaysia:* Malay Peninsula (Perak, P. Penang).

Notes. For about 50 years this species has not been recollected; it is known from 5 old specimens only. LAM, *l.c.*, divides it in two varieties, adding that 'more material may reduce them into forms or even eliminate them'. The two varieties differ only in leaf-characters which have possibly no taxonomic value.

var. **longifolia.**—*Santiria longifolia* KING.—*D. longifolia var. typica* H. J. LAM, *l.c.*

Leaves 6–15-jugate; petiolules 1½–3 cm; leaflets 20–30(–42) by 3–8 cm.

Distr. *Malaysia:* Malay Peninsula: Perak.

Ecol. In open localities and jungle, up to 250 m. *Fr.* Nov.

var. **penangensis** (RIDL.) H. J. LAM, *l.c.*—*Curtisina penangensis* RIDL.

Leaves 3–5-jugate; petiolules ½–1½ cm; leaflets 6–18 by 2½–6½ cm.

Distr. *Malaysia:* Malay Peninsula: P. Penang.

Ecol. Hill forests, *c.* 600 m. *Fl.* May, *fr.* June.

15. Dacryodes breviracemosa KALKMAN, Blumea 7 (1954) 511, f. 3.

Tree, *c.* 18 m, slightly buttressed. *Branchlets c.* 4 mm thick, ferrugineous-tomentose at the extreme tips, pith without vascular strands. *Leaves* 2-jugate, glabrous. *Petioles* 3–4½ cm, flattened at the base, pith with some vascular strands. *Leaflets* ovate-oblong, 7½–11 by 3½–6 cm; base rounded, shortly contracted at the ultimate base; apex gradually narrowed into a rather broad acumen; nerves 10–12 pairs (angle from 75° at the base to 45° in the apex), curved, only the apical ones arching. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, together pseudoterminal, 3–6 cm, with 1–4 fruits; peduncle ½–1 cm. *Fruits* ellipsoid, 16–18 by 9–11 mm, stigmatic scar nearly apical, base rounded, apex broadly acute. *Cotyledons* contortuplicate (?), palmate.

Distr. *Malaysia:* Malay Peninsula (Trengganu), once collected, at 30 m. *Fr.* Oct. Possibly the sterile specimen bb. 24829 from Sumatra (Kuantan) belongs also to this species.

Vern. *Kĕdondong.*

Note. Nearest related to *D. longifolia* H. J. LAM.

5. SANTIRIA

BL. Mus. Bot. 1 (1850) 209; ENGL. in DC. Mon. Phan. 4 (1883) 152; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 367; KALKMAN, Blumea 7 (1954) 522.—*Trigonochlamys* HOOK. *f.* Trans. Linn. Soc. 23, 1 (1860) 170.—*Icicaster* RIDL. J. Str. Br. R. As. Soc. *no* 75 (1917) 15.—**Fig. 2e, 13–15.**

Dioecious trees. *Pith of the branchlets* usually without vascular strands. *Leaves* without stipules. *Petiole* either terete or the upper surface flat or channelled, pith usually with vascular strands. *Leaflets* entire. *Inflorescences* usually axillary, rarely truly terminal. *Flowers* 3-merous. *Sepals* free or connate. *Petals* with a usually slightly thickened and inflexed apex. *Stamens* 6 or 3, glabrous; anthers adnate or basi- to dorsifix. *Disk* intrastaminal, glabrous. *Pistil* 3-celled, glabrous, in ♂ flowers usually moderately reduced; stigma (sub)sessile. *Fruits* drupaceous, usually irregularly globose or ellipsoid, always more or less oblique, stigma excentric, sometimes near the pedicel; pericarp rather thin and solid, very slightly wrinkled when dry; pyrene containing one fertile and 2 sterile cells; endocarp crustaceous, thin; calyx usually persistent, not or slightly enlarged. *Seed* subglobular; cotyledons pinnate, folded or contortuplicate.

Distr. About 18 *spp.* in the Old World tropics. Two sections (*sect. Santiria* and *Icicopsis*) are exclusively Malaysian; the third one, *sect. Santiriopsis* (ENGL.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 204, comprising *c.* 6 *spp.*, is restricted to tropical West Africa. In Malaysia the genus is predominantly West Malaysian (*excl.* Java and the Lesser Sunda Islands), very few species occur in the Philippines, Celebes, the Moluccas, and New Guinea. Fig. 12.

Ecol. Trees of old, mainly primary, forests at low to medium altitudes, up to 1500 m; on dry to swampy ground.

Wood anat. DEN BERGER, Med. Proefst. Thee 97 (1926) 65, Med. Proefst. Boschw. 13 (1926) 65; DESCH, Mal. For. Rec. 15¹ (1941) 64 (hand lens); HEIMSCH, Lilloa 8 (1942) 122. See also under species.

Uses. Of some species the seeds are edible. The wood of several species is locally used for housebuilding, *etc.*; it is not of a very good quality.

KEY TO THE SPECIES

1. Lower surface of the adult leaflets densely pubescent on all nerves and mostly also on the veins.
  2. Veins distinctly transverse.
    3. Filaments free from the disk . . . . **8. S. nervosa**
    3. Filaments more or less adnate to the disk.
      4. Flowers 2–4 mm long, sepals up to 1½ mm long, petals 2–2½ mm. Upper surface of the petioles sharply flattened or channelled to terete.

5. Stigma on the fruit less than 90° excentric. Leaflets with a minute, conspicuous but not prominent reticulation on the upper surface; pubescence on lower surface consisting of simple hairs. **1. S. tomentosa**
5. Stigma on the fruit near the pedicel. Leaflets with a lax and very distinct reticulation on the upper surface; pubescence on the lower surface consisting of branched hairs . **7. S. conferta**
4. Flowers 4½ mm long (♂ unknown), calyx 2½–3 mm, petals 3–3½ mm. Petioles deeply channelled. **3. S. grandiflora**
2. Veins not distinctly transverse.
6. Petioles terete or hardly flattened. Terminal bud small, ¼–1 cm, narrow or broad.
7. Stigma on the fruit 90° or more excentric. Anthers basi- to dorsifix.
8. Sepals nearly free. Pith of the branchlets with many vascular strands . . . . **2. S. mollis**
8. Calyx nearly truncate. Pith of the branchlets without vascular strands. **9. S. apiculata** *var.* **pilosa**
7. Stigma on the fruit up to 90° excentric. Anthers adnate.
9. Flowers 2–3 mm long. Stamens 3. Stigma on the fruits slightly excentric. Leaflets villous underneath specially on the nerves and on the midrib above. . . . **12. S. rubiginosa** *var.* **nana**
9. Flowers 4–10 mm long. Stamens 6. Stigma on the fruits *c.* 90° excentric. Midrib of the leaflets pubescent to pilose underneath, otherwise leaflets glabrous. Branchlets and petioles minutely pubescent . . . . **11. S. griffithii**
6. Petioles sharply flattened or channelled. Terminal bud 2–3 cm long, narrow . **7. S. conferta**
1. Lower surface of the adult leaflets glabrous, or slightly pubescent on the midrib (and the lower nerves) only.
10. Upper surface of the petioles terete or hardly flattened at the base.
11. Veins distinctly transverse . . . . **8. S. nervosa**
11. Veins not distinctly transverse.
12. Flowers 4–10 mm, calyx 3–7 mm long . . . . **11. S. griffithii**
12. Flowers 2–4 mm, calyx ½–2½ mm long.
13. Stigma on the fruits less than 90° excentric.
14. Stamens 3, sometimes with rudiments of the 3 others; anthers adnate . **12. S. rubiginosa**
14. Stamens 6, anthers basi- to dorsifix.
15. Leaflets reddish-brown when dry, averagely ovate-oblong and *c.* 2–2½ times as long as broad; venation not prominent underneath. Flowers 2 mm long, calyx ½–¾ mm; filaments adnate to the disk. Fruits 9–15 by 7–12 mm . . . . . **4. S. laevigata** *f.* **glabrifolia**
15. Leaflets yellowish brown or greyish when dry, averagely more elliptic-oblong and *c.* 2½–3 times as long as broad; venation ± prominent underneath. Flowers 2½–4 mm long, calyx 1–2 mm; filaments free or slightly adnate to the disk. Fruits 13–22 by 10–20 mm. **5. S. oblongifolia**
13. Stigma on the fruits 90° or more excentric, often close to the pedicel.
16. Petiolules 3–3¾ cm long . . . . **6. S. ridleyi**
16. Petiolules ½–2 cm long.
17. Inflorescences branched from the base or with a short peduncle. Calyx subtruncate, 1–1½ mm. Pith of the branchlets without vascular strands . . . . **9. S. apiculata**
17. Inflorescences branched from halfway upwards. Sepals nearly free, 1½–2½ mm. Pith of the branchlets with many vascular strands . . . . **2. S. mollis**
10. Upper surface of the petioles distinctly flattened or channelled at the base.
18. Veins distinctly transverse.
19. Flowers 4½ mm long (♂ unknown); sepals 2½–3 mm; petals 3–3½ mm . . **3. S. grandiflora**
19. Flowers 2–4 mm long; calyx up to 1½ mm.
20. Calyx 1½ mm long. Stamens free from the disk . . . . **8. S. nervosa**
20. Calyx ½–¾ mm long. Stamens more or less adnate to the disk.
21. Stigma on the fruits near the pedicel. Peduncle 0–2 cm . . . . . . **7. S. conferta**
21. Stigma on the fruits less than 90° excentric. Peduncle 1½–12½ cm. **4. S. laevigata** *f.* **laevigata**
18. Veins not distinctly transverse.
22. Leaves usually very large, up to 135 cm long, leaflets up to 47 cm long, petioles 23–35 cm. Tips of the branchlets with undeveloped, 2–5 cm long, leaf-bases, similar to the bracts of the inflorescence. . . . . **10. S. megaphylla**
22. Leaves and leaflets smaller. Petioles rarely longer than 20 cm (unknown in *S. ridleyi*). Bract-like undeveloped leaf-bases at the tip of the branchlets absent.
23. Peduncle 1½–12½ cm long. Stigma on the fruit up to 90° excentric. **4. S. laevigata** *f.* **laevigata**
23. Peduncle 0–3 cm long. Stigma on the fruit more than 90° excentric.
24. Panicles slender, rhachis at the base up to 3 mm thick . . . . **9. S. apiculata**
24. Panicles stout, rhachis at the base more than 4 mm thick.
25. Reticulations distinct on either surface of the leaflets. Infructescences 4½–19 cm long. Petiolules 1–2½ cm long . . . . **7. S. conferta**
25. Reticulations inconspicuous, especially on the upper surface. Infructescences *c.* 25 cm long. Petiolules 3–4 cm long . . . . **6. S. ridleyi**

1. Section Santiria

Santiria sect. Eusantiria ENGL. in DC. Mon. Phan. 4 (1883) 157.

Veins usually ± transversely reticulate. Receptacle not concave. Calyx usually with short lobes, rarely sepals nearly free. Stamens 6, anthers basi- to dorsifix (fig. 13c–d).

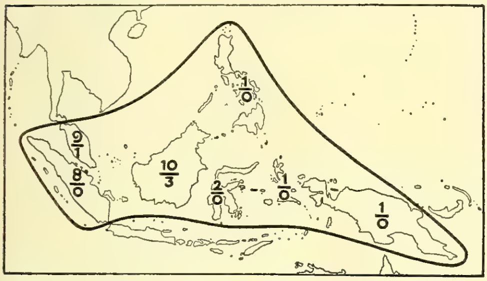

Fig. 12. Distribution of *Santiria* sections *Santiria* and *Icicopsis*. Above the hyphen the total number of species, below the hyphen the number of endemic species in each district or island.

1. Santiria tomentosa BL. Mus. Bot. 1 (1850) 211; ENGL. in DC. Mon. Phan. 4 (1883) 159; HEYNE, Nutt. Pl. (1927) 881; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 14 f. 107e; Bull. Jard. Bot. Btzg III, 12 (1932) 391, t. 7 f. 33; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 26, *cum fig.*; KALKMAN, Blumea 7 (1954) 529.—*Canarium korthalsii* MIQ. Fl. Ind. Bat. 1, 2 (1859) 645.—*S. multiflora* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 538; ENGL. in DC. Mon. Phan. 4 (1883) 159; KING, J. As. Soc. Beng. 62, ii (1894) 261; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 243, f. 139; ed. 2, 19a (1931) f. 216 D–F; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 258, f. 39^5; RIDL. Fl. Mal. Pen. 1 (1922) 380.—*Canarium micrantherum* STAPF *ex* RIDL. Kew Bull. (1930) 82.—*S. mollissima* RIDL. Kew Bull. (1930) 85; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 67; Bull. Jard. Bot. Btzg III, 12 (1932) 390, t. 7 f. 32; KALKMAN, Blumea 7 (1954) 532.

Tree, 15–35 m by 20–80 cm, rarely with buttresses, sometimes monoecious? *Branchlets* 2–15 mm thick, more or less angular, more or less densely woolly pubescent, as are the leaves (upper surface of the leaflets excepted), inflorescences and infructescences; terminal bud $^1/_4$–$1^3/_4$ cm long, subacute. *Leaves* 0–4(–5)-jugate. *Petioles* ($1^1/_2$–) 3–$24^1/_2$ cm, flattened at the base to terete. *Leaflets* ovate to oblong (terminal ones sometimes obovate), $5^1/_2$–28(–34) by $2^1/_2$–9(–$12^1/_2$) cm, upper surface glabrous except the midrib (and the bases of the nerves), lower surface woolly pubescent (very rarely to subglabrous); base rounded or one half broadly cuneate; apex gradually to abruptly acuminate; nervation prominent underneath, nerves (9–)11–26(–29) pairs (angle 60–80°, in the base up to 90°), usually not arching. *Panicles* axillary, lax, 2–38 cm, peduncle $^1/_4$–7 cm, branches up to $17^1/_2$ cm. *Flowers* 2–3 mm long. *Calyx* $^1/_2$–1 mm high, nearly truncate, outside sparsely pubescent. *Filaments* adnate to the disk, in ♂ flowers episepalous ones often distinctly longer than epipetalous ones. *Disk* cupular, fleshy, rim undulate. *Pistil* in ♂ flowers much reduced. *Infructescences* up to 22 cm long. *Fruits* irregularly globular to oblong, $1^1/_4$–2 by $^3/_4$–2 cm, stigma less than 90° excentric.

Distr. *Malaysia:* Sumatra, Banka, Billiton, Malay Peninsula, and Borneo.

Ecol. Primary forests on dry or swampy grounds, sometimes in periodically inundated localities, at low altitudes (rarely higher than 250 m). *Fl.* June–Nov., *fr.* July–May.

Uses. The timber, though not very durable, is used for indoor-construction. The fruits, after being boiled, are eaten; an edible oil is pressed out of the pericarp.

Vern. *Kabu, kaju langik, ('m)parak, pĕgah (*or *pĕgo), sĕrantai*, Sum., *asĕm-asĕm, kĕdondong, lĕmubuk, mĕngkabu*, Banka, *kĕrantai*, Billiton, *kĕdondong, kĕrantai, kumbul nyiur, panggong, surian, ta-tahu, tĕrantai*, Mal. Pen., *bantrang, djabai, garunggung, kadjang karang, kahingai, kaju djagung, kambaloh, kembajau, kurihang, mĕrangan mèrah, mohontowong, njatu kolan, tahengai*, Born.

Note. By reducing *S. mollissima* to *S. tomentosa* the variability of the latter is only slightly increased. Between 'typical' *S. mollissima* (small leaves and terete petioles) and 'typical' *S. tomentosa* (large leaves and strongly flattened petioles) all transitions exist.

2. Santiria mollis ENGL. in DC. Mon. Phan. 4 (1883) 156, t. 3 f. 37–38; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 206, t. 16 f. 128, *excl. var. sessilis*; Bull. Jard. Bot. Btzg III, 12 (1932) 388, t. 6 f. 30; KALKMAN, Blumea 7 (1954) 530, f. 9.—*Canarium hirtipetalum* RIDL. Kew Bull. (1930) 84.

Tree, 25–40 m by 40–70 cm, buttressed. *Branchlets* 7–9 mm thick, verrucose, young parts densely ferrugineously woolly-tomentose to glabrous, as are the petioles, and the lower surface of the leaflets; pith with rather many, small and dispersed or more or less peripherally arranged vascular strands; terminal bud *c.* $^1/_2$ cm long. *Leaves* 2–4(–5)-jugate. *Petioles* 5–8 cm, not or hardly flattened at the base. *Leaflets* ovate to oblong, $5^1/_2$–$14^1/_2$ by 3–$4^1/_2$ cm, (glabrous or) tomentose underneath; base rounded (to cuneate); apex gradually long-acuminate; nervation prominent underneath, nerves 9–15 pairs (angle *c.* 70°), curved, not distinctly arching. *Panicles* (♀ unknown) axillary, 5–23 cm, tomentose, long-stalked, branches up to 9 cm long. *Flowers* (♀ unknown) 3–4 mm long, tomentose. *Calyx* $1^1/_2$–$2^1/_2$ mm high, segments nearly free. *Petals* sericeous tomentose at both sides. *Filaments* adnate to the disk. *Disk* cupular with undulate rim. *Pistil* in ♂ flowers strongly reduced. *Infructescences* 9–19 cm long, lenticellate, shortly tomentose. *Fruits* subglobose, 15–18 by 12–14 mm, stigma 90° or more excentric.

Distr. *Malaysia:* Borneo.

Ecol. Primary forests up to 250 m. *Fl.* Febr.–April, *fr.* April.

Vern. *Kumbajau burung*, SE. Born.

3. Santiria grandiflora KALKMAN, Blumea 7 (1954) 525, f. 7.

Tree 25–30 m by 50 cm. *Branchlets c.* 1 cm thick, tips puberulent; terminal bud acute, 2–3 cm long. *Leaves* 4–5-jugate. *Petioles* 11½–16½ cm, deeply channelled at the base, rims of the groove incurved. *Leaflets* oblong or oblong-lanceolate, 11–27 × 4–7 cm, the lower surface pubescent on the nerves; base rounded; apex acuminate, acumen 6–15 mm long, rather narrow; nervation prominent underneath; nerves 15–24 pairs, hardly conspicuous on the upper surface, nearly straight, rather abruptly arching close to the margin; veins transverse. *Panicles* (♂ unknown) axillary, pseudoterminal, 10–16 cm long, densely pubescent. *Flowers* (♂ unknown) 4½ mm long, pubescent. *Calyx* 2½–3 mm high, segments nearly free. *Filaments* adnate to the disk. *Disk* annular. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* Borneo (Sarawak, Mt Dulit), once collected.

Ecol. In primary forest below 300 m. *Fl.* Aug.

Uses. The fruits are said to be edible.

Note. Related to *S. tomentosa* BL. and specially to *S. laevigata* BL.

4. Santiria laevigata BL. Mus. Bot. 1 (1850) 211, t. 40, *incl.* also *var. applanata*; BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 538; ENGL. in DC. Mon. Phan. 4 (1883) 165; KING, J. As. Soc. Beng. 62, ii (1894) 257; RIDL. Fl. Mal. Pen. 1 (1922) 378; HEYNE, Nutt. Pl. (1927) 881; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 382, t. 6 f. 28; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 24, *cum fig.*; KALKMAN, Blumea 7 (1954) 535.—*S. rufescens* BL. Mus. Bot. 1 (1850) 213.—*Canarium laevigatum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 648.—*Canarium rufescens* MIQ. Fl. Ind. Bat. 1, 2 (1859) 650.—*Canarium eupteron* MIQ. *var. puberulum* MIQ. Sum. (1860) 526.—*S. glabrifolia* ENGL. in DC. Mon. Phan. 4 (1883) 164.—*S. violacea* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 205, t. 14 f. 107d; Bull. Jard. Bot. Btzg III, 12 (1932) 379, t. 6 f. 26; KALKMAN, Blumea 7 (1954) 540.

Tree, 15–30(–45) m by 25–70(–more than 100) cm, often with buttresses. *Branchlets* ¼–1½ cm thick, glabrous; pith without or with up to 20 scattered vascular strands; terminal bud ½–2½ cm long. *Leaves* 1–5-jugate, glabrescent. *Petioles* 3–18(–22½) cm, channelled at the base to terete. *Leaflets* ovate to oblong, 5–26(–35) by 2–8(–11) cm, glabrous or sometimes tomentose on the midrib underneath; base rounded to cuneate; apex acutely short-acuminate; midrib and nerves (rather) prominent underneath, nerves 8–22 pairs (angle 70–90°), straight, curving and usually arching near the margin. *Panicles* axillary, pubescent when young, ♂ ones 4–37 cm, branches up to 18 cm, ♀ ones (2½–)5–27 cm, branches up to 12 cm. *Flowers* 2 mm long, subglabrous. *Calyx* ½–¾ mm high. *Filaments* adnate to the disk. *Disk* cupular. *Pistil* in ♂ flowers very small. *Fruits* obliquely globular (to oblong), (1–)1¼–2 by (¾–)1¼–2 cm, stigma up to 90° excentric.

Distr. *Malaysia:* Sumatra, Banka, Billiton, Malay Peninsula, Borneo, Central Celebes.

Ecol. Forests up to 1200–1500 m, sometimes in lowland peat forest (specially *f. glabrifolia*). *Fl.* mainly July–Dec., *fr.* mainly July–Febr.

Wood anat. DESCH, Mal. For. Rec. 15^1 (1941) 64, Pl. 13 fig. 1 (hand lens); HEIMSCH, Lilloa 8 (1942) Pl. 8 fig. 47.

Uses. The timber is used for posts and planks, and for chopping-knife handles. The fruits are edible.

Vern. Sumatra: *dalhi*, *hatapul miak*, Tapanuli, *bintanak*, *b. nasi*, *damar putih*, *gĕdundung*, *katuko lagau*, *lalan*, *madang kĕladi*, *m. lantjik*, *sumbulajang*, W. Coast, *damar taktahan*, *kaju kalas*, *logan*, *murak*, *rĕsung bunga*, E. Coast, *balam pauh*, *lalan*, *siampi*, *tĕrantai*, Bengkalis, *(bala)m parak*, *balam putih*, *mĕdang kĕladi*, *parah putih*, Bencoolen, *amparah*, *malapara*, *pĕgah kabu-kabu*, *tengeh*, *tètak tundjuk*, Palemb., *bangkiring uding bungo*, *b. u. pajo*, *marapujan uding*, *silaora*, *umawak putih*, Simalur; *bĕrĕmbang*, *gerunggang*, *kabu-kabu*, *mĕngkabu*, *ranggung*, Banka, *chenarah*, *gerunggun*, *kĕdondong*, *kĕrantai*, *kumbooi nyior*, *ledah kerah*, *panjong bruang*, *surian*, Mal. Pen., *bĕrambang*, *berinas*, *biumbang*, W. Born., *asĕm*, *gandis*, *kambajau burung*, *merambang*, *mĕrasam*, *pasan*, *pusan*, SE. Born., *bakata (pute)*, *longori*, *tapi-tapi (*or *topi-topi)*, Cel.

Notes. The following two forms can be distinguished:

f. **laevigata.**—All synonyms mentioned under the species except *S. glabrifolia.*

Branchlets ½–1½ cm thick; pith sometimes with vascular strands. Leaves 2–5-jugate. Petioles 4½–18(–22½) cm, sharply flattened at the base to channelled, rarely nearly terete. Leaflets oblong to elliptic, (5–)12½–26(–35½) by 2–8(–11) cm; on the lower surface midrib prominent and reticulations less conspicuous than the veins. Panicles 6½–37 cm. Fruits 12–20 by (10–)14–18 mm.

Distr. As the species.

f. **glabrifolia** (ENGL.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 205; Bull. Jard. Bot. Btzg III, 12 (1932) 384.—*S. glabrifolia* ENGL.

Branchlets 3–6 mm thick; pith without vascular strands. Leaves 1–3-jugate. Petioles 3–8½(–11) cm, terete or hardly flattened. Leaflets ovate to elliptic, (4½–)6–15½ by 2½–7 cm; on the lower surface midrib not prominent and reticulations as conspicuous as the veins. Panicles 4–27 cm. Fruits 9–15 by 7–12 mm.

Distr. *Malaysia:* Sumatra, Malay Peninsula, and Borneo.

5. Santiria oblongifolia BL. Mus. Bot. 1 (1850) 211; ENGL. in DC. Mon. Phan. 4 (1883) 162; KING, J. As. Soc. Beng. 62, ii (1894) 257; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 14, t. 18; RIDL. Fl. Mal. Pen. 1 (1922) 379; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 372, t. 5 f. 22; KALKMAN, Blumea 7 (1954) 537.—*Canarium oblongifolium* MIQ. Fl. Ind. Bat. 1, 2 (1859) 645.—*Canarium eupteron* MIQ. Fl. Ind. Bat. 1, 2 (1859) 648, *excl. var. puberula* MIQ. Sum. (1860) 526; ENGL. in DC. Mon. Phan. 4 (1883) 147.—*S. maingayi* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 538; ENGL. in DC. Mon. Phan. 4 (1883) 165.—*S. caesia* ENGL. in DC. Mon. Phan. 4 (1883) 166.—*S. latifolia* STAPF *ex* RIDL. Kew Bull. (1930) 86.

Tree, 20–30(–42) m by 40–90(–120) cm, sometimes with small buttresses. *Branchlets* 4–6 mm thick, minutely tomentose to glabrous; terminal bud 1–2 cm long. *Leaves* (2–)3–5-jugate, (sub)-glabrous. *Petioles* 4–12(–19) cm, terete or slightly flattened at the base. *Leaflets* oblong to ovate, (6–)8–17(–25) by (1½–)3–6(–10) cm, rather rigid, sometimes slightly pubescent on the midrib beneath; base cuneate to rounded; apex gradually to rather abruptly, short and bluntly acuminate; nervation prominent underneath; nerves 9–16 pairs (angle 60–70°), slightly curved, not arching. *Panicles* either axillary, together pseudoterminal, or terminal, broad, 15–40 cm long, peduncle 0–9 cm, branches up to 15 cm, densely pubescent to glabrate. *Flowers* sparsely pubescent to glabrous, ♂ 2½–3 mm long, ♀ 4 mm. *Calyx* deeply cleft, in ♂ flowers 1 mm high, in ♀ flowers 2 mm. *Filaments* free or slightly adnate to the disk. *Disk* cupular, thick, rim truncate to undulate. *Pistil* in ♂ flowers slightly reduced. *Infructescences* stout, verrucose. *Fruits* oblique, oblong-ellipsoid to globular, 1¼–2½ by 1–2 cm, stigma little (less than 90°) excentric, often one or two sides of the fruit more or less flattened.

Distr. *Malaysia:* Sumatra, Banka, Malay Peninsula, and Borneo.

Ecol. Primary, sometimes secondary, forests, usually on dry, rarely on temporarily inundated, grounds, up to 300 m altitude, but some records from 900–1950 m (Sumatra W. Coast, Mt Kinabalu). *Fl.* May–Aug., *fr.* mainly Aug.–Febr.

Vern. Sumatra: *damar djuruwing, d. tjulak,* Atjeh, *damar ariung, d. sirasih, gadondong, kaju kapur, k. putih, kĕdundung, lagan, paruh-paruh, tajan,* W. Coast, *babeko, kondoi, mĕdang batu, m. sabo, tenan,* Bengkalis, *lalan,* Djambi, *bajung sisip, kabu-kabu, kaju latjak, kĕdondong pĕrgam, mĕdang pĕlan, meleparak, mĕrasam putih, parak lumu, pĕgah katulu, tĕtak tundjuk,* Palemb.; *kĕdondong,* Mal. Pen., *asĕm garunggang,* SE. Born.

Note. Nearest allied to *S. laevigata* BL.

6. Santiria ridleyi H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 205; Bull. Jard. Bot. Btzg III, 12 (1932) 379, t. 6 f. 25; KALKMAN, Blumea 7 (1954) 538.

Small tree. *Branchlets* unknown. *Leaves* c. 4-jugate, glabrous. *Leaflets* oblong, 15–20 by 6–7½ cm, subcoriaceous; base rounded; apex more or less abruptly short-acuminate; midrib and nerves prominent underneath, nerves 10–13 pairs (angle 60–80°), curved, not or indistinctly arching. *Inflorescences* and *flowers* unknown. *Infructescences* (detached ones) broadly paniculate, –23 cm, branched from the base, glabrous, branches up to 17 cm; remains of filaments free or slightly adnate to the disk. *Fruits* angular-ovoid, 12–19 by 11–15 mm, stigma more than 90° excentric.

Distr. *Malaysia:* Malay Peninsula (Perak: G. Keledang), once collected.

Ecol. *Fr.* Sept.

Note. This very incompletely known species resembles in many respects *S. oblongifolia* BL.; it is mainly different from the latter species by the much more excentric stigma on the fruits.

7. Santiria conferta BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 537; ENGL. in DC. Mon. Phan. 4 (1883) 160; KING, J. As. Soc. Beng. 62, ii (1894) 261; RIDL. Fl. Mal. Pen. 1 (1922) 379; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 16 f. 131, *incl.* also *var. wrayi*; Bull. Jard. Bot. Btzg III, 12 (1932) 380, t. 6 f. 27; KALKMAN, Blumea 7 (1954) 528, f. 8.—*S. wrayi* KING, J. As. Soc. Beng. 62, ii (1894) 259; Ann. R. Bot. Gard. Calc. 9, 1 (1901) 15, t. 20; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 258, f. 39^6; RIDL. Fl. Mal. Pen. 1 (1922) 379.

Tree, 6–24 m, with small buttresses. *Branchlets* ½–1½ cm thick, pubescent or glabrous; terminal bud 2–3 cm long. *Leaves* 2–7-jugate. *Petioles* (4½–)7½–29 cm, strongly channelled at the base. *Leaflets* lanceolate to oblong, 6½–26 by 3–10 cm, upper surface glabrous, under surface densely pubescent when young, glabrescent; base rounded (or one half cuneate); apex tapering or short-acuminate; midrib and nerves strongly prominent underneath, on upper surface nerves and veins rather distinct; nerves (9–)11–19 pairs (angle 60–80°), curved near the margin, specially at base and apex arching. *Panicles* axillary, 3½–13 cm, contracted, pubescent to glabrous; peduncle 0–2 cm. *Flowers* 2–4 mm long, pubescent. *Calyx* ½–¾ mm high. *Filaments* more or less adnate to the disk. *Disk* cupular. *Pistil* in ♂ flowers strongly reduced. *Infructescences* 4½–19 cm, pubescent. *Fruits* 1–1¼ by ¾–1½ cm, stigma strongly excentric, near the pedicel.

Distr. *Malaysia:* S. Sumatra and Malay Peninsula.

Ecol. Forests, usually under 100 m alt. (once 240–300 m, once 1150 m). *Fl.* Jan.–Febr., and Aug.–Sept., *fr.* Febr.–March, June, Dec.

Vern. *Babi kurus, lalan, mĕrdondong,* Sum., *kĕdondong, k. bulau, kĕrantai mèrah,* Mal. Pen.

8. Santiria nervosa H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 206, t. 11 f. 65; Bull. Jard. Bot. Btzg III, 12 (1932) 387, t. 6 f. 29; KALKMAN, Blumea 7 (1954) 539.

Tree, 25–30 m by 20–100 cm, with up to 2½ m high buttresses, which are 1½ m spreading. *Branchlets* 4–8 mm thick, the tips ferrugineous-tomentose; terminal bud ½–1 cm long. *Leaves* 1–3-jugate. *Petioles* 4–9(–14) cm, slightly to strongly flattened at the base. *Leaflets* oblong to ovate (to suborbicular), 5½–17(–22) by 3–7½ (–10½) cm, lower surface pubescent to glabrous, indumentum partly or entirely consisting of stellate hairs; base broadly cuneate to rounded; apex subabruptly, short and bluntly acuminate; nervation rather prominent underneath; nerves 10–15(–18) pairs (angle 65–80°, near the base up to 90°), more or less curved, not distinctly arching except at base and apex; reticulations minute. *Panicles* axillary, often representing short, leafless shoots with terminal buds, narrow, 1½–5½ cm, ferrugineous-tomentose. *Flowers c.* 2 mm long, sessile, glabrous. *Calyx* 1½ mm. *Stamens* free from the disk. *Disk* thick-annular or (in ♀ flowers) cupular, radially furrowed and with undulate rim. *Pistil* in ♂ flowers moderately reduced. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* Sumatra, Banka, Malay Peninsula, and Borneo.

Ecol. Primary and secondary forests, up to 60 (–350) m. *Fl.* Febr.–March.

Vern. *Bantan burung*, *kĕdondong tundjuk*, *sisip banièng*, Sum., *asam-asam*, Banka, *kĕdudong*, Mal. Pen., *ĕngai*, *mĕndjĕlih*, Born.

9. Santiria apiculata BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 537; ENGL. in DC. Mon. Phan. 4 (1883) 163; KING, J. As. Soc. Beng. 62, ii (1894) 259; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 39^8, 40^2; RIDL. Fl. Mal. Pen. 1 (1922) 378; HEYNE, Nutt. Pl. (1927) 881; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 66, t. 14 f. 107f; Bull. Jard. Bot. Btzg III, 12 (1932) 375, t. 5 f. 23; KALKMAN, Blumea 7 (1954) 538.—*S. beccarii* ENGL. in DC. Mon. Phan. 4 (1883) 162.—*S. teysmannii* ENGL. in DC. Mon. Phan. 4 (1883) 162.—*S. pilosa* ENGL. in DC. Mon. Phan. 4 (1883) 159; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) t. 7 f. 31; KALKMAN, Blumea 7 (1954) 531.—*S. glabra* MERR. Philip. J. Sc. 10 (1915) Bot. 30; En. Philip. 2 (1923) 355.—*S. lagunensis* MERR. Philip. J. Sc. 10 (1915) Bot. 31; En. Philip. 2 (1923) 355.—*S. minutiflora* RIDL. J. Str. Br. R. As. Soc. *no* 82 (1920) 175; Fl. Mal. Pen. 1 (1922) 377.—*S. brachystachys* RIDL. Kew Bull. (1925) 79.—*Canarium parciflorum* RIDL. Kew Bull. (1930) 80.—*S. rubra* RIDL. Kew Bull. (1930) 86; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 378, t. 6 f. 24; KALKMAN, Blumea 7 (1954) 540. —**Fig. 13a–e.**

Tree, 6–20(–40) m by 30–60(–100) cm. *Branchlets* 3–5 mm, densely pubescent or glabrous except the minutely pulverulent tip; terminal bud ½–1 cm long. *Leaves* (0–)1–2(–4)-jugate, glabrous or lower surface pubescent on all nerves. *Petioles* 2–9½(–14) cm, usually hardly flattened at the base (distinctly flattened in *var. rubra*). *Leaflets* ovate (rarely lanceolate) to elliptical, 5½–16(–20) by 2–6(–9½) cm, chartaceous, usually rather thin; base obliquely rounded to narrowly attenuate; apex subabruptly acuminate; on lower surface midrib and nerves prominent, veins and reticulations not very distinct; nerves 6–14 pairs (angle 65–75°), sinuous, arching. *Panicles* axillary (very rarely together pseudoterminal), broad, 0–4 cm peduncled, glabrous or pubescent, ♂ ones 4½–17 (–27) cm, branches up to 10 cm; ♀ ones (2–)3½–14 (in fruit up to 18) cm, branches up to 5½ cm (in fruit up to 10 cm). *Flowers* (sub)glabrous, 2–2½ mm long. *Calyx* 1–1½ mm high, subtruncate. *Filaments* more or less adnate to the disk. *Disk* thick, cupular or infundibuliform, with 6 interstaminal lobes in ♂ flowers, more truncate in ♀ ones. *Pistil* in ♂ flowers moderately reduced. *Fruits* very oblique, globose or ellipsoid, (8–)10–18 by 6–13 mm, stigma very excentric, usually more than 90°, sometimes near the pedicel; sometimes more-seeded.

Distr. *Malaysia:* Sumatra (also Nias Isl.), Malay Peninsula, Borneo, Philippines (Luzon, Leyte, Mindanao), Central and S. Celebes, and the Moluccas (Morotai, Ceram, Ambon).

KEY TO THE VARIETIES

1. Leaves glabrous.
  2. Flowers yellowish. Petioles 2–9 cm, hardly flattened at the base; leaflets light-coloured when dry, greenish or brownish. *var.* **apiculata**
  2. Flowers red. Petioles 4½–14 cm, strongly flattened at the base; leaflets dark-coloured when dry, upper surface greyish or brown, lower surface dark brown . . *var.* **rubra**
1. Lower surface of the leaflets pubescent on all nerves . . . . *var.* **pilosa**

var. **apiculata.**—All synonyms mentioned under the species except *S. rubra* and *S. pilosa.*

Leaves glabrous. Petioles 2–9 cm, hardly flattened at the base. Leaflets light-coloured when dry. Flowers yellowish. Fruits 10–18 by 7–13 mm.

Distr. *Malaysia:* As the species.

Ecol. Primary forests, usually on dry, rarely on swampy grounds, preferably at low altitudes, rarely up to *c.* 1200 m. *Fl.* Febr.–May, Aug.–Nov., *fr.* May–June, Oct.–Jan.

Uses. The wood is rather hard and used for rifle-butts; in Sum. West Coast the timber should be used in the mines, in West Ceram for house construction.

Vern. *Babi kurus*, *bako tjitjĕrek*, *barih-batih*, *kalek duku*, *kĕdondong tundjuk*, Sum., *eu fusi*, Nias, *kĕdondong*, *k. bulau*, *k. kru(i)t*, *kĕlat jawa*, *kurantai batu*, *planking*, *sĕrapoh*, Mal. Pen., *pĕlajah bukit*, Born.

var. **rubra** (RIDL.) KALKMAN, *nov. stat.*—*S. rubra* RIDL.

Leaves glabrous. Petioles 4½–14 cm long, strongly flattened at the base. Upper surface of the leaflets dark when dry, greyish or brown, lower surface dark brown. Flowers red. Fruits 8–11(–13) by 6–8 mm.

Distr. *Malaysia:* Malay Peninsula and Borneo (Sarawak).

Ecol. *Fl.* Jan.–Febr., *fr.* Febr.–March.

Vern. *Damar chabok*, *kĕdondong*, *suryan batu*, Mal. Pen.

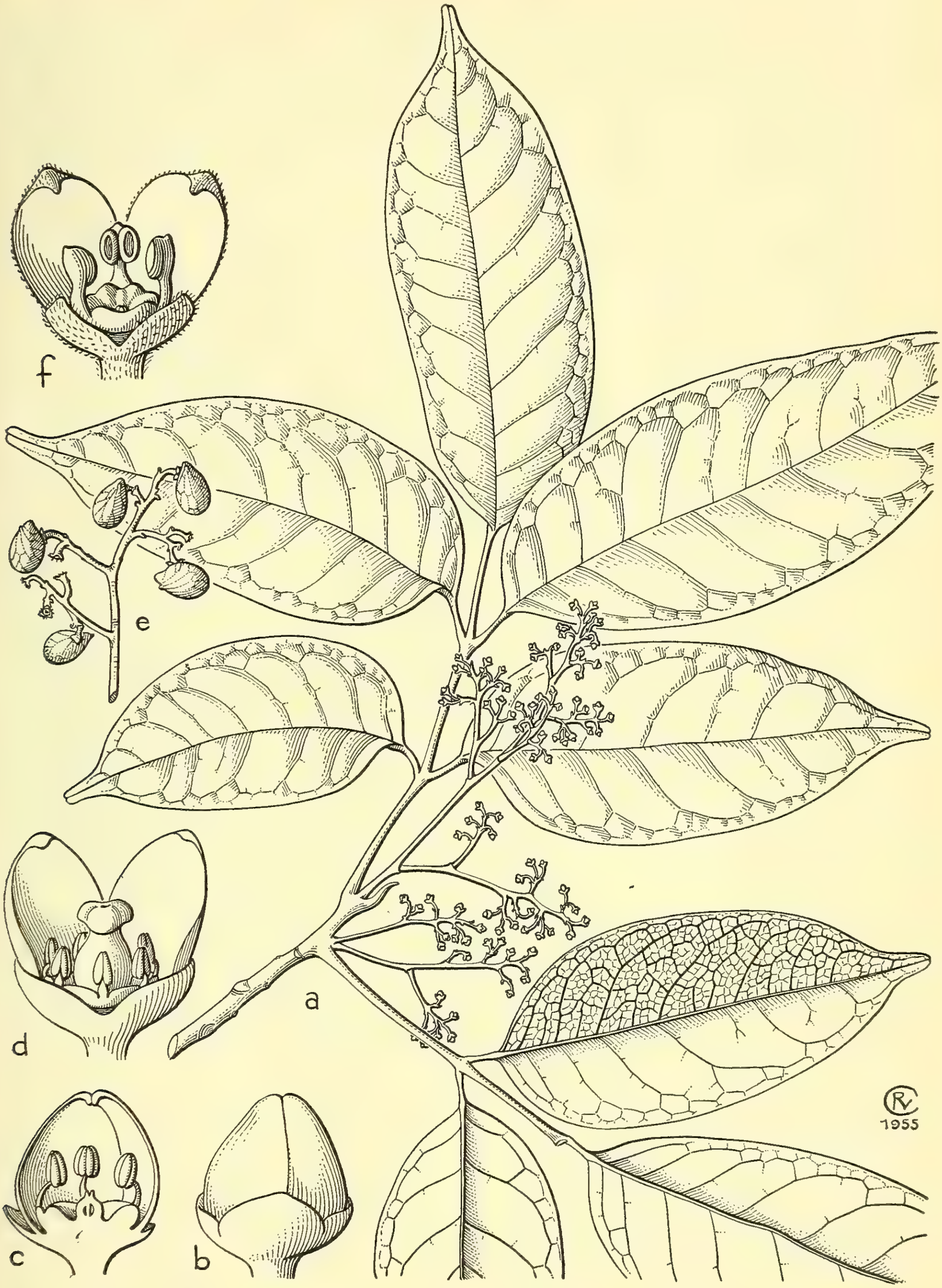

Fig. 13. *Santiria apiculata* BENN. *a*. Twig with ♀ flowers, *b*. ♀ bud, *c*. section of ♂ flower, *d*. ♀ flower, one petal removed, *e*. infructescence.—*Santiria rubiginosa* BL. *f*. ♂ flower, one petal removed (*a* and *e* × 2/3, *b–d* and *f* × 13).

var. **pilosa** (ENGL.) KALKMAN, *nov. stat.*—*S. pilosa* ENGL.

Petioles 2½–9½ cm, hardly flattened at the base. Upper surface of the leaflets pubescent on the midrib, lower surface pubescent on all nerves. Fruits 10–15 by 7–11 mm.

Distr. *Malaysia:* Borneo.

Ecol. Primary forests up to 1100 m. *Fl.* Oct., *fr.* May, Sept.

10. Santiria megaphylla KALKMAN, Blumea 7 (1954) 533, f. 10.

Tree, 23–25 m. *Branchlets* 2–3 cm thick, glabrous except the tips; terminal bud 1½–3 cm long; next to normal leaves, there are undeveloped leaf-bases, 2–5 by ½ cm, similar to those, which serve as bracts to the inflorescences. *Leaves* 3–5-jugate, glabrous, (60–)80–135 cm long. *Petioles* 23–35 cm, channelled at the base. *Leaflets* elliptic-ovate to elliptic-oblong (terminal one obovate-oblong), (15–)24–47 by (5½–)11–18 cm, coriaceous; base rounded to broadly cuneate; apex acuminate; midrib and nerves prominent on either surface, nerves 8–14 pairs (angle 60–70°), faintly curved, not arching except sometimes in basal and apical part; veins prominent underneath. *Panicles* (♂ unknown) axillary, crowded at the tips of the branchlets, 12–32 cm long, shortly pubescent, peduncle (1–)3–10 cm. *Flowers* (♂ unknown) *c.* 2 mm long, puberulous. *Calyx* 1 mm long. *Petals* suborbicular. *Filaments* adnate to the cupular disk. *Infructescences* 20–38 cm, shortly pubescent. *Fruits* ovoid, 1½–1¾ by 1–1¼ cm, stigma near the pedicel.

Distr. *Malaysia:* Borneo (Br .N. Borneo and Sarawak).

Ecol. *Fl.* May, *fr.* Jan., May.

2. Section Icicopsis

BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 536.—*Trigonochlamys* HOOK. *f.* Trans. Linn. Soc. 23 (1860) 170.—*Santiria sect. Trigonochlamys* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 206.

Veins ± longitudinally stretched. Receptacle sometimes slightly concave. Sepals nearly free. Stamens 6 or 3, in the latter case rudiments of the epipetalous ones sometimes present, anthers adnate (fig. 13f).

11. Santiria griffithii (HOOK. *f.*) ENGL. Bot. Jahrb. 1 (1881) 43; in DC. Mon. Phan. 4 (1883) 155, t. 3 f. 33–35; in E. &. P. Pfl. Fam. 3, 4 (1896) f. 139A–C; ed. 2, 19a (1931) f. 216A–C; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 38, 39⁴, and 40⁴; HEYNE, Nutt. Pl. (1927) 881; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 14 f. 107a; Bull. Jard. Bot. Btzg III, 12 (1932) 394, t. 7 f. 34; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 27, *cum fig.*; KALKMAN, Blumea 7 (1954) 545.—*Trigonochlamys griffithii* HOOK. *f.* Trans. Linn. Soc. 23 (1860) 170, t. 27; BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 539; KING, J. As. Soc. Beng. 62, ii (1894) 251; RIDL. Fl. Mal. Pen. 1 (1922) 381.—*S. bornensis* ENGL. Bot. Jahrb. 1 (1881) 43; in DC. Mon. Phan. 4 (1883) 156, t. 3 f. 36.

Tree, 12–35(–45) m by 50–80(–120) cm, with buttresses. *Branchlets* 4–6 mm thick, verrucose, the young parts minutely pubescent; pith with a peripheral layer of sclerenchymatic strands; terminal bud 3–6 mm long. *Leaves* (3–)5–10-jugate. *Petioles* 3–8(–10) cm, hardly flattened at the base, minutely pubescent as are the rhachis and petiolules. *Leaflets* elliptical-lanceolate to oblong-lanceolate, 3–10(–17½) by 1–3½(–4½) cm, chartaceous, usually pubescent to pilose on midrib (and nerves) underneath; base rounded or broadly cuneate; apex more or less gradually narrowed into a short to rather long and slender, blunt acumen; nerves 11–15(–20) pairs (angle *c.* 70°, at the base up to 90°), slender, straight, near the margin more or less distinctly arching. *Panicles* axillary, up to 20 cm long, branches up to 12 cm, densely and minutely pubescent. *Flowers* 4–10 mm long, tomentose. *Calyx* 3–7 mm, deeply cleft. *Petals* also partly pubescent inside. *Stamens* 6, filaments adnate to the disk. *Disk* cupular, the base thick, the rim abruptly thin and erect. *Pistil* in ♂ flowers strongly reduced. *Fruits* (sub)sessile, obliquely globose, 8–13 by 8–16 mm, stigma *c.* 90° excentric.

Distr. *Malaysia:* Sumatra, Banka, Malay Peninsula, and Borneo.

Ecol. Primary and secondary forests on dry, rarely on swampy soils, up to 300 m. *Fl.* mainly June–Sept., *fr.* Jan.–Dec., specially Sept.

Uses. The wood is rather hard and durable; it is used for constructions.

Vern. Sumatra: *kompas*, W. Coast, *andlahi tunggal*, E. Coast, *bebeka*, *kĕdundung*, *kĕmĕti*, *mĕrdjélajan*, *pakubajan*, *pĕtai belalang*, *piras*, *pungung kidjang*, *sĕmasan pujo*, Palemb.; *kĕlinggir bejan*, *mĕmbalu*, *mĕnjantung*, *mĕrdjatang*, *mĕsanit*, *rĕngas (mèrah)*, Banka, *bebras*, *kasai bukit*, *kĕdondong*, *k. kĕrat*, *k. pasir*, *kĕmpas roman*, Mal. Pen.; Borneo: *langguk*, *mĕramun*, *pegah*, W. Born., *(t)ampiras*, *bine*, *bumbun gunung*, *bunjau*, *buno*, *kapalan*, *kumbajau burung*, *tjĕlandjap laki gunung*, SE. Born., *pamutalun*, N. Born.

Notes. For the distinction of this species from *S. rubiginosa* BL. which it resembles closely in its vegetative parts, see there. As in that species, the nervation is very much alike that of *Koordersiodendron pinnatum* MERR. (*Anacardiaceae*), which has usually larger leaflets and more-jugate leaves, and which never possesses vascular strands in the pith of the petioles.

12. Santiria rubiginosa BL. Mus. Bot. 1 (1850) 213; ENGL. in DC. Mon. Phan. 4 (1883) 158; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 14 f. 107b, 112a, t. 16 f. 126c; Bull. Jard. Bot. Btzg III, 12 (1932) 399, t. 7 f. 37; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 28, *cum fig.*; KALKMAN, Blumea 7 (1954) 542.—*Canarium rubiginosum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 651.—*S. planchonii* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 536; ENGL. in DC. Mon. Phan. 4 (1883) 154, t. 3 f. 24–32; in E. & P. Pfl. Fam. 3, 4 (1896) f. 139 G–J; ed. 2, 19a (1931) f. 216 G–J; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 39^3, 40^3.—*S. parviflora* ENGL. in DC. Mon. Phan. 4 (1883) 155; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 39^7; RIDL. Kew Bull. (1930) 86.—*Canarium planchonii* KING, J. As. Soc. Beng. 62, ii (1894) 240.—*Icicaster planchonii* RIDL. J. Str. Br. R. As. Soc. *no* 75 (1917) 15; Fl. Mal. Pen. 1 (1922) 381.—*S. lamprocarpa* LAUT. Bot. Jahrb. 56 (1920) 337, f. 3; E. & P. Pfl. Fam. ed. 2, 19a (1931) f. 217; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 71; Bull. Jard. Bot. Btzg III, 12 (1932) 402, t. 7 f. 38.—*S. havilandii* RIDL. Kew Bull. (1930) 85.—*S. pedicellata* RIDL. Kew Bull. (1930) 86; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 73; Bull. Jard. Bot. Btzg III, 12 (1932) 398, t. 7 f. 36.—*S. minimiflora* RIDL. Kew Bull. (1930) 87; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 72; Bull. Jard. Bot. Btzg III, 12 (1932) 398, t. 7 f. 35.—*S. nana* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207; Bull. Jard. Bot. Btzg III, 12 (1932) 403, t. 7 f. 39; KALKMAN, Blumea 7 (1954) 541, f. 11.—**Fig. 2e, 13f, 14, & 15.**

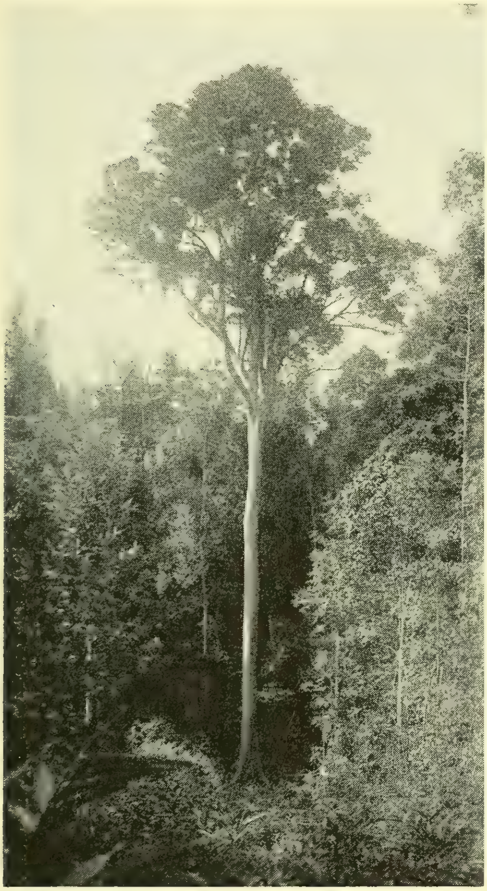

Fig. 14. *Santiria rubiginosa* BL. Tree *c.* 35 m high, Palembang (S. Sumatra) (photogr. THORENAAR, *a.* 1925).

Tree, up to 30(–45) m by 65 cm, buttressed. *Branchlets* up to ½ cm thick, glabrous except the tips; terminal bud 2–4 mm long. *Leaves* 1–5(–6)-jugate. *Petioles* 1½–7½ cm, not or hardly flattened at the base, glabrous or more or less pubescent. *Leaflets* elliptic or ovate to lanceolate-oblong, 3–11(–15) by 1–5½(–7) cm, glabrous except sometimes a slight pubescence on the midrib underneath; base more or less broadly cuneate; apex gradually or more or less abruptly, bluntly acuminate; nerves 9–15 pairs (angle 60–80°), very slender, nearly straight, forked near the margin and more or less distinctly arching. *Panicles* axillary, (1–)4–17 cm, without or (specially ♀ ones) with a short peduncle, branches up to 10 cm long, glabrous or minutely pulverulent. *Flowers* 2–3 mm long, slightly pubescent or glabrous. *Sepals* nearly free, 1–2½ mm. *Stamens* 3, filaments adnate to the disk; sometimes rudiments of 3 epipetalous ones present. *Disk* cupular with truncate rim. *Pistil* in ♂ flowers much reduced. *Fruits* oblique, irregularly globular or ellipsoid, 8–13 by 7–9 mm, stigma less than 90° excentric.

Distr. *Malaysia:* Sumatra, Banka, Billiton, Malay Peninsula, Borneo, and New Guinea (Biak, Sepik).

Notes. Sterile specimens can sometimes hardly be distinguished from *S. griffithii* ENGL. and the identification of such specimens is therefore not always certain. *S. rubiginosa* has usually fewer pairs of leaflets, which are, however, larger. Narrow-leaved specimens are closely resembling *Koordersiodendron pinnatum* MERR. (*Anac.*), which, however, can be distinguished by the absence of vascular strands in the pith of the petioles, and by the usually more-jugate leaves, and very short petiolules.

KEY TO THE VARIETIES

1. Leaflets glabrous, except sometimes a slight pubescence on the midrib underneath.
 2. Pedicels 1–3 mm, shorter than or as long as the flowers . . . . . . *var.* **rubiginosa**
 2. Pedicels 2–6 mm, longer than the flowers. *var.* **pedicellata**
1. Leaflets pilose on either surface, specially underneath and on the nerves . . . . *var.* **nana**

var. **rubiginosa.**—All synonyms except those of the other varieties.

Branchlets glabrous except the tips. Leaflets

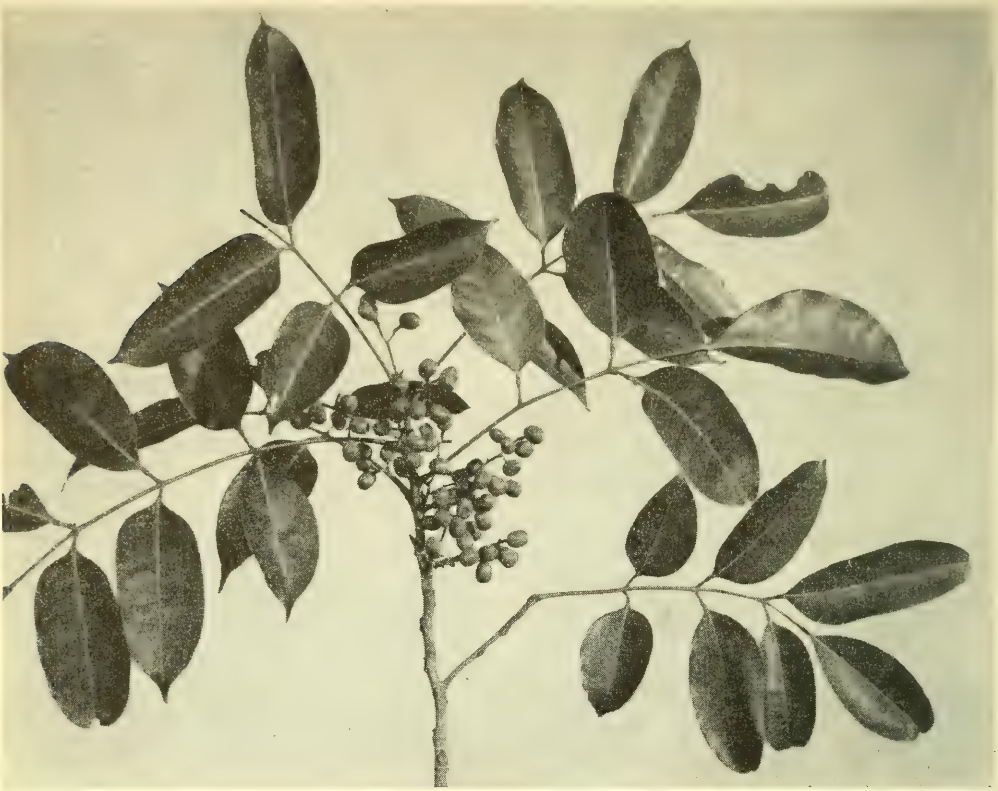

Fig. 15. *Santiria rubiginosa* Bl. Fruiting twig (Cult. Hort. Bog. III–B–49).

3–11(–15) by 1–$5^1/_2$(–7) cm, glabrous except sometimes the midrib underneath. Pedicels 1–3 mm, shorter than or as long as the flowers.

Distr. *Malaysia:* as the species.

Ecol. Primary forests, sometimes also in more open localities, sometimes on swampy or temporarily inundated grounds, up to 600 m, but once collected at 1200 m (Fraser Hill, Pahang). *Fl.* (Jan., March) July–Oct., *fr.* Oct.–June.

Vern. Sumatra: *kalek inai, kalok pinang masak,* W. Coast, *babi kurus, paha rusa, rĕsung,* E. Coast, *kĕdondong serik,* Djambi, *tadjam tumpul,* Bencoolen, *kĕdundung, kĕmĕti, marasam, mĕrdjĕlajan, pakubajan, piras, punggung kidjang (*or *hidjang),* Palemb., *mosiolo,* Nias; *mĕrtukul, mesànèn,* Banka, *malansatan,* Billiton, *maradjalai,* Riouw; Mal. Pen.: *babi kurus,* Perak, *kĕdondong matahari, kilat,* Selang., *kĕdondong bukit, sĕruyan batu,* Joh., *surian*; Borneo: *asam, salak gading, utah (putah),* Sarawak, *barempau, mĕlangsat, palai,* W. Born., *asĕm, batu, bunjau, buno putih, kauwtjuli, maniaran, pangahuli, pĕlang, tubulo,* S. & E. Born.

var. **pedicellata** (Ridl.) Kalkman, Blumea 7 (1954) 544.—*S. pedicellata* Ridl.—*S. minimiflora* Ridl.

As *var. rubiginosa,* but pedicels longer than the flowers, 2–6 mm long.

Distr. *Malaysia:* Borneo (Sarawak, W. Borneo).

var. **nana** (H. J. Lam) Kalkman, *nov. stat.—S. nana* H. J. Lam.

As *var. rubiginosa,* but branchlets densely pilose, as are the petioles, rhachis, petiolules and inflorescences. Leaflets pilose on either surface.

Distr. *Malaysia:* Sumatra (E. Coast) and the Malay Peninsula (Selangor).

Ecol. Swampy forests at low altitudes. *Fl.* Nov., *fr.* Jan.

Vern. *Babi kurus,* Sum.

6. HAPLOLOBUS

H. J. Lam, Ann. Jard. Bot. Btzg 42 (1931) 25, (1932) 207; Bull. Jard. Bot. Btzg III, 12 (1932) 404; Husson & H. J. Lam, Blumea 7 (1953) 413.—*Santiria sect. Anisandra* Laut. Bot. Jahrb. 56 (1920) 332, 340; Engl. in E. & P. Pfl. Fam. ed. 2, 19a (1931) 455.—**Fig. 2f, 16.**

Usually small, dioecious trees, not heavily buttressed. *Pith of the branchlets* without vascular strands. *Leaves* without stipules; medulla of the petioles with vascular strands; leaflets entire. *Inflorescences* mostly axillary, rarely also terminal on larger branchlets, or on smaller axillary shoots which may bear one or a few leaves, or show an obsolete vegetative bud, which is getting overtopped; usually branched from near the base. *Flowers* 3-merous, small. *Calyx* 3-dentate to subtruncate. *Petals* with slightly thickened and inflexed tip. *Stamens* 6, glabrous, free or adnate to the disk. *Disk* intrastaminal, 6-lobed, glabrous, undulate or truncate. *Pistil* glabrous, stigma (sub)sessile; in ♂ flowers slightly reduced. *Fruits* rarely larger than 2½ cm long, mostly ovoid or ellipsoid, more rarely globular or pointed at apex; pericarp thin and dry; pyrene papyraceous, 1-seeded, 2 cells fully compressed; calyx persistent, not enlarged. *Seed* shaped as the fruit; cotyledons planoconvex, thick, entire.

Distr. About 22 *spp.* from Borneo eastwards through Malaysia (the Philippines excepted) to ?Micronesia (Palau), and Melanesia (New Britain, New Ireland, the Solomons, New Hebrides, Fiji, and Samoa), definitely centering in East Malaysia; *H. aneityensis* HUSSON exclusively Melanesian.

Ecol. Primary forests, 0–1800 m alt. Some species, *e.g. H. clementium* in the Cyclops Range, and *H. acuminatus f. glabrior* near Hollandia, are reported to grow gregariously.

Notes. This is the only genus of the *Burseraceae*, in which glands and domatia in the nerve axils are known to occur and they are restricted to a few species only. Transitions between the glabrous glands and the hairy domatia are known in *H. monticola*; otherwise they do not occur together in one species.

Though by its fruit characters well-defined as a genus, delimitation of species proves to be difficult, both on account of a natural variability, it seems, and by the inadequacy of material. For this reason the status of several species is not as satisfactorily clear as compared with species in other genera of this family. Abundant future material will tend, possibly, to decrease the number of species.

KEY TO THE SPECIES

1. At least part of the leaflets with glabrous glandular pits in the axils of the nerves below, sometimes also on the blade between the nerves.
  2. Leaflets narrowly oblong, 3¾–7 by 1½–2½ cm, incl. a *c.* 1 cm long, narrow acumen; nerves 4–5 pairs; reticulations very minute; leaves 1–2-jugate . . . . **1. H. microphyllus**
  2. Leaflets 3–5½ cm broad, short- and broadly acuminate; nerves 6–12 pairs; reticulations not very minute; leaves 1–3-jugate.
    3. Leaves 1–2-jugate; leaflets ovate to elliptic, 5–10½ by 3–5½ cm; nerves 6–9 pairs. **2. H. glandulosus**
    3. Leaves 2–3-jugate; leaflets oblong to oblong-lanceolate, 10–16½ by 4½–5½ cm; nerves 10–12 pairs. **3. H. monticola**
1. No glandular pits or only domatia present.
  4. Leaflets 1½–6 by ½–2½ cm, distinctly acuminate, acumen ½–1½ cm long . **4. H. ledermannii**
  4. Leaflets larger, if distinctly acuminate the acumen much shorter than ⅓–¼ of the blade.
    5. Young parts and inflorescences woolly pubescent (in *H. acuminatus f. glabrior* glabrous); leaflets more or less sparsely pubescent underneath, particularly along the nerves.
      6. ♀ Inflorescences (and infructescences) 1–7 cm long, leaflets not very rigid.
        7. Branchlets not rough, 4–5 mm diam. Leaflets generally oblong, rather long, not abruptly acuminate. ♀ Inflorescences 1–7 cm long; ♂ ones 7–12 cm . . . . . . **5. H. acuminatus**
        Note. *f. glabrior* has the inflorescences entirely glabrous and the leaflets only slightly hairy.
        7. Branchlets rough, *c.* 1 cm diam. Leaflets broadly elliptic, short and abruptly acuminate. ♀ Inflorescences 1–2 cm long (♂ unknown) . . . . **6. H. mollis**
      6. ♀ Inflorescences (and infructescences) 10–13 cm long (♂ unknown). Leaflets rigid, abruptly acuminate. Branchlets 1 cm diam. . . . . **7. H. robustus**
    5. Young parts not woolly pubescent. Leaves entirely glabrous, or, if pubescent, than either: leaflets 21–36 by 7½–10 cm and petioles with 14–19 vascular strands in the pith, or: (♀) inflorescences axillary, glabrous, and leaflets smaller.
      8. Leaflets rather large, (12–)20–40 by 8–18 cm; pith of the petioles with 14–25(–40) vascular strands.
        9. Leaflets oblong-lanceolate, 21–36 by 7½–10 cm; base more or less acute; nerves 25–30 pairs, nerves and veins prominent and subpubescent underneath; leaves *c.* 6-jugate; petiole 13 mm thick at the base . . . . **8. H. beccarii**
        9. Leaflets broadly oblong, (12½–)24–38 by (6½–)10–17½ cm; base rounded to subcordate; nerves (9–)12–18 pairs, veins hardly prominent and glabrous underneath; leaves 3–5-jugate; petiole 8 mm thick at the base . . . . **9. H. moluccanus**

8. Leaflets usually smaller; pith of the petioles with up to 10–12 vascular strands.

10. Pith of the petioles with (1–)3–12 vascular strands; leaflets, at least in fertile branchlets, fairly large, 10–22 cm long.

11. Inflorescences axillary to terminal, ♀ ones and infructescences (without the fruits) 2½–13 cm long.

12. ♂ Inflorescences widely branched, slender, many-flowered, 10–22 cm long, ♀ ones more stiff, little branched, few-flowered, *c.* 10 cm long. Leaves 2–3(–4)-jugate; petioles 7–11 cm, pith with (1–)4–8(–9) vascular strands; leaflets ovate to oblong, 9–21 by 4–10 cm, rather thin, greenish when dry with dark brown midrib; base broadly rounded; reticulation above not dense and minute. Fruits 12–16 by 7–11 mm, dull . . . . **10. H. celebicus**

12. ♂ Inflorescences not many-flowered, not widely branched, rather stiff, 5–15 cm long, ♀ ones 2½–10 cm long. Leaves 0–2(–3)-jugate; petioles 3–9 cm, pith with 10–12 vascular strands; leaflets broad-ovate to obovate, 5–18(–21) by 5–9 cm, rather thin; base broad; reticulation above not dense and minute. Fruits 12–22 by 8½–14 mm, dull . . . **11. H. maluensis**

12. Inflorescences stiff, often (sub)terminal, ♂ ones 6–17 cm long, ♀ ones and infructescences (without the fruits) 2½–14 cm. Leaves (1–)2–4-jugate; petioles 4–9 cm, pith with 1–8(–11) vascular strands; leaflets oblong to ovate-elliptic, 7½–20 by 4–9 cm, rigid; base rounded to subcordate; reticulation often fairly minute and dense above. Fruits 15–19 by 9–15 mm, shining . . . . **12. H. floribundus** (see also *13. H. versteeghii*)

11. Inflorescences axillary, ♀ ones and infructescences (without the fruits) 2½–5½ cm long.

13. Nervation strongly prominent beneath. Infructescences thick and strong, *c.* 7 cm long. Branchlets 8–9 mm thick, heavily pustulate . . . . **13. H. versteeghii**

13. Nervation not strongly prominent beneath. Infructescences slender, 2½–5 cm long. Branchlets 4–5 mm thick, not heavily verrucose.

14. Leaflets oblong, usually 14–22 by 7–9 cm; nerves 9–17 pairs. Fruits 12–16 by 10–12 mm. **14. H. hussonii**

14. Leaflets ovate, usually 10–13 by 5–7 cm; nerves 7–8 pairs. Fruits 23–26 by 13–18 mm. **15. H. megacarpus**

10. Pith of the petioles with 1–3(–5) vascular strands; leaflets, at least in fertile branchlets, smaller, 3–12(–18) cm long.

15. Leaves 0–2-jugate; leaflets more or less rigid, acute or gradually acuminate. Inflorescences (♂ unknown in *H. clementium*) and infructescences 1–6 cm long.

16. Pith of the petioles with 2–5 vascular strands; nerves 11–14 pairs . . **18. H. clementium**

16. Pith of the petioles with 1 vascular strand; nerves 6–9 pairs.

17. Leaves 0(–1)-jugate; leaflets 6–12½ by 2½–5¾ cm, rigid, often with distinct hair tufts (domatia) in the nerve axils beneath; reticulation very minute; petiolules long and slender. ♂ Inflorescences very slender . . . . **16. H. monophyllus**

17. Leaves 0–2-jugate; leaflets 3½–8¼ by 1¼–5 cm, very stiff, sometimes with tiny glandular pits, but without domatia; reticulation minute; petiolules short and stout. ♂ Inflorescences fairly rigid . . . . **17. H. nubigenus**

15. Leaves 1–4-jugate; leaflets either thin or, if rigid, small (up to 14 by 6 cm) and then ♂ inflorescences up to 18 cm long and widely branched.

18. Base of the leaflets rounded to subcordate. ♂ Inflorescences 6–21, ♀ ones 3–14 cm long, widely branched . . . . **12. H. floribundus**

18. Base of the leaflets narrowly (to broadly) acute. ♂ Inflorescences rather variable.

19. Leaflets rather rigid, up to 13 by 5¼ cm. ♀ Inflorescences 3–6 cm long. **19. H. borneensis**

19. Leaflets either rather thin, or larger.

20. Leaflets rather rigid, often broad at the base . . . . **12. H. floribundus**

20. Leaflets thin, 2½–3 times as long as broad. ♂ Inflorescences 1½–8 cm long, very slender, not widely branched, few-flowered . . . . **20. H. anisander**

20. Leaflets thin but stiff, *c.* 2 times as long as broad. ♂ Inflorescences 4–8 cm long, widely branched, rather many-flowered . . . . **21. H. leeifolius**

1. Haplolobus microphyllus HUSSON, Blumea 7 (1953) 423, f. 2.

Tree *c.* 20 m high. *Branchlets* 1½–3(–5) mm thick, lenticellate, terminal bud slightly tomentose to glabrous. *Leaves* 1–2-jugate, glabrous. *Petioles* flattened to slightly canaliculate above; pith with 1(–3) vascular strands. *Leaflets* lanceolate to oblong-lanceolate, 3¾–7 by 1½–2½ cm, chartaceous; base obliquely rounded to acute; apex abruptly acuminate, acumen 9–12 mm long, slender, tip blunt, emarginate; nerves 4–5 pairs (angle 40–50°), curved, gradually arching, with glandular pits in the axils below. *Inflorescences* (♂ unknown) axillary, racemose, *c.* 5 cm long, glabrous, few-flowered, without bracts and bracteoles (?). *Flowers* (♂ unknown) glabrous. *Calyx* 2½ mm high. *Petals* unknown. *Stamens* free, glabrous. *Disk* 6-undulate, fleshy, glabrous. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* West New Guinea (Bernhard Camp, on the Idenburg River), once collected in primary forest at 1780 m. *Fl.* Jan.

Note. Closely related to *H. ledermannii* in which the leaves are glandless.

2. Haplolobus glandulosus HUSSON, Blumea 7 (1953) 423, f. 3.

Large tree. *Branchlets* 3–5 mm thick, glabrous. *Leaves* 1–2-jugate, glabrous. *Pith of the petioles* with 1–3 vascular strands. *Leaflets* ovate to elliptic, 5–10½ by 3–5½ cm, coriaceous; base rounded to broadly acute; apex shortly and bluntly acuminate; nerves 6–9 pairs (angle 50–80°), curved, distinctly arching near the margin; glandular pits 1–2 mm long, bullate above, margin often pilose. *Inflorescences* (only young, ♀ ? ones known) axillary, 1½–2½ cm long, branched from the base, few-flowered and with some intermingled vegetative buds, glabrescent. *Flowers*, *infructescences*, and *fruits* unknown.

Distr. *Malaysia:* E. New Guinea (Morobe Distr.).

Ecol. Alt. *c.* 1750 m; *fl.* (juv.) Jan.

Notes. Obviously allied to the equally mountainous *H. microphyllus*, from which it differs by the much larger leaflets with much shorter acumen. Most akin, however, is *H. monticola*, which has still larger leaflets with smaller and hardly bullate glandular pits and a much wider reticulation, 2–3-jugate leaves, and larger inflorescences without vegetative bud. Furthermore it is related to *H. floribundus*, a lowland species, which lacks the glandular pits; to *H. nubigenus*, distinguished by its 0–1-jugate leaves and smaller and more rigid leaflets, occasionally with tiny glandular pits; and to *H. monophyllus*, which has usually unifoliolate, long-petioled leaves and domatia instead of glandular pits.

3. Haplolobus monticola HUSSON, Blumea 7 (1953) 425, f. 4.

Tree, 24–27 m by 60 cm. *Branchlets* 3–6 mm thick, lenticellate, glabrous. *Leaves* 2–3-jugate. *Pith of the petioles* with 1–3 large vascular strands. *Leaflets* oblong to oblong-lanceolate, 10–16½ by 4½–5½ cm, chartaceous, glabrous; base slightly oblique, rounded to acute; apex shortly and bluntly acuminate; nerves 10–12 pairs (angle 60–75°), curved, not arching except near the apex; glandular pits ½–1 mm long, margin often pilose, the larger and more hairy ones sometimes on the blade between the nerves. *Inflorescences* (♂ unknown) axillary, broadly paniculate, up to 7½ cm long, branched from the base, branches up to 1½ cm long, many-flowered, glabrous. *Flowers* (♂ unknown) 2 mm, glabrous. *Calyx* 1 mm. *Stamens* adnate to the disk. *Disk* 6-undulate, thick. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* New Guinea.

Ecol. Primary forests at *c.* 1000 m. *Fl.* March.

Note. This species is undoubtedly related to *H. nubigenus*, which differs by its 0–2-jugate leaves, its smaller leaflets, and its much more minute reticulation.

4. Haplolobus ledermannii (LAUT.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207; Bull. Jard. Bot. Btzg III, 12 (1932) 408, t. 8 f. 41; HUSSON & H. J. LAM, Blumea 7 (1953) 427.—*Santiria ledermannii* LAUT. Bot. Jahrb. 56 (1920) 334.—*Santiria caudata* LAUT. Bot. Jahrb. 56 (1920) 336.

Tree, (1½–)15–20 m high. *Branchlets* 1–5 mm diam., glabrous. *Leaves* (1–)2–4-jugate, (sub)-glabrous. *Pith of the petioles* with 1(–2) vascular strands. *Leaflets* obovate to oblanceolate or lanceolate, (1–)2–6 by (½–)1–2½ cm, rigid, glabrous except sometimes a few hairs on the lower side of the midrib; base rounded to broadly cuneate; apex gradually narrowed into a rather long, blunt acumen; nerves very slender, 6–10 pairs (angle 60–70°), straight, curved near the margin, not arching; reticulations very minute and dense. *Inflorescences* axillary, rarely together pseudoterminal, paniculate or subracemose, branched from the base, glabrous, ♂ ones 1–2 cm, ♀ ones up to 5 cm. *Flowers* glabrous, *c.* 2½ mm. *Calyx* 1 mm. *Stamens* free. *Disk* in ♂ flowers more or less undulate, in ♀ ones truncate. *Fruits* ovoid to ellipsoid, 7–9 by 5–6 mm.

Distr. *Malaysia:* NE. New Guinea (Sepik area).

Ecol. Mountain forests at 850–1400 m. *Fl.* Aug., Nov., March, *fr.* Oct.

Note. The nearest ally is *H. microphyllus*, which is distinguished by 1–2-jugate leaves provided with glandular pits.

5. Haplolobus acuminatus (K.SCH.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207, t. 7 f. 46; Bull. Jard. Bot. Btzg III, 12 (1932) 410, t. 8 f. 43; HUSSON & H. J. LAM, Blumea 7 (1953) 427, f. 5; H. J. LAM, Blumea 8 (1955) 175.—*Santiria acuminata* K.SCH. in K. SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 64; K. SCH. & LAUT. Fl. Schutzgeb. (1901) 378; RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 25; LAUT. Bot. Jahrb. 56 (1920) 337.—*Canarium pachypodum* LAUT. Bot. Jahrb. 56 (1920) 324.—*H. pachypodus* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207; Bull. Jard. Bot. Btzg III, 12 (1932) 411, t. 8 f. 44.—**Fig. 16a–d.**

Tree, (4–)*c.* 25 m high. *Branchlets* 4–10 mm, often verrucose, young parts densely pilose. *Leaves* 1–4-jugate. *Pith of the petioles* with 1–17 vascular strands. *Leaflets* ovate (to lanceolate), 4–22 by 2–12 cm, chartaceous, sometimes more or less bullate, above glabrous or pilose on the nerves only, beneath densely woolly pubescent on the nerves to subglabrous; base cuneate to subcordate; apex more or less abruptly, shortly and bluntly acuminate; nervation prominent beneath, nerves 7–20 pairs (angle 60–80°), curved, not arching except in the apex; intermediate veins sometimes distinctly developed. *Inflorescences* axillary, paniculate, with a short peduncle, sometimes with a vegetative terminal bud, densely woolly pubescent, glabrescent or glabrous, ♂ ones 7–12 cm long, rather dense and many-flowered, ♀ ones 1–7 cm, more lax, branches always very short. *Flowers* usually glabrous, 1½–2½ mm. *Calyx* ¾ mm high. *Stamens* free or slightly adnate to the disk. *Disk* cupular, truncate or irregularly undulate. *Infructescences* sparsely pubescent. *Fruits* 13–19 by 8–12 mm, ovoid, slightly pointed at the apex.

Distr. *Malaysia:* New Guinea.

Ecol. Primary forests up to 700 m. *Fl.* March, July, Oct.–Nov., *fr.* Oct.–March.

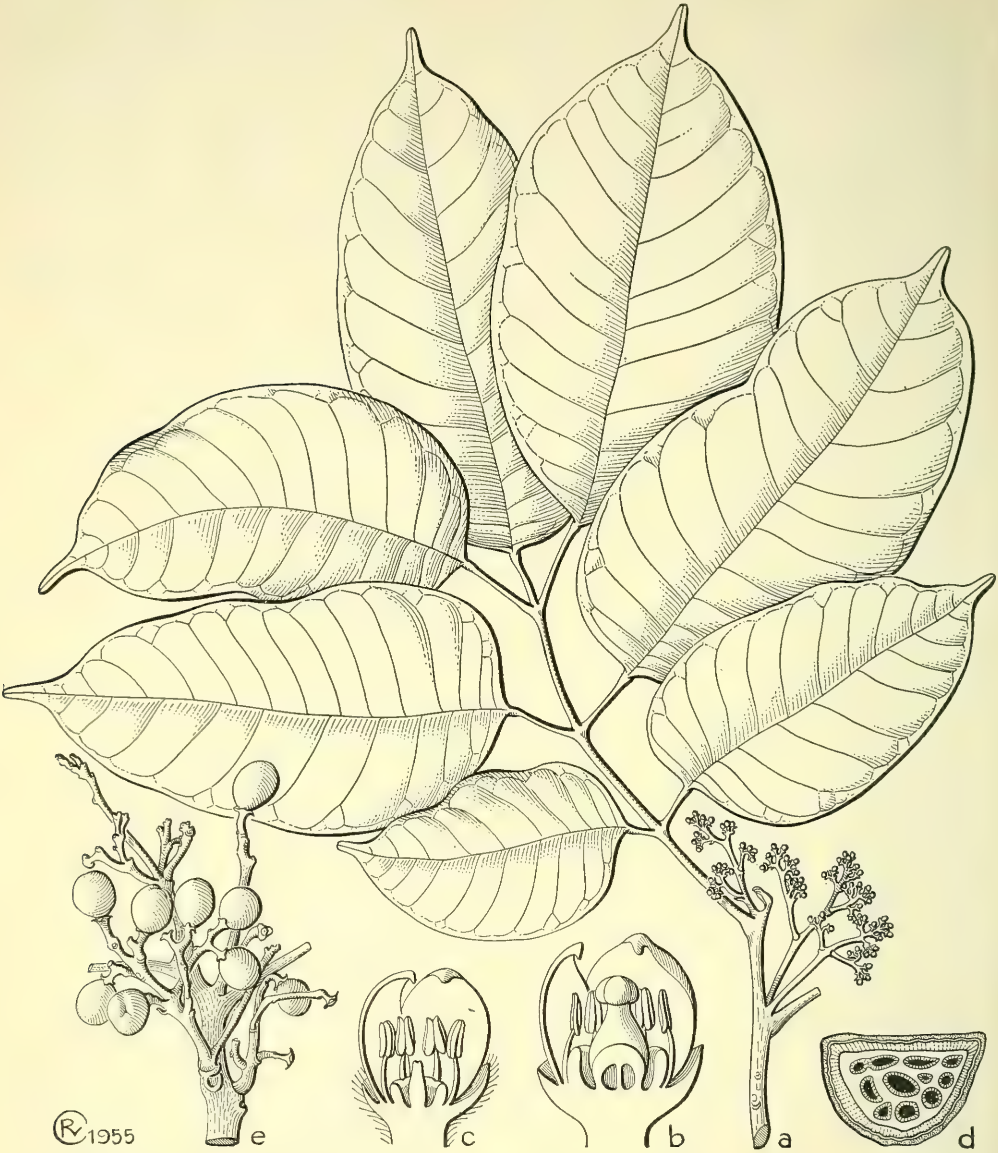

Fig. 16. *Haplolobus acuminatus* (K.SCH.) H. J. LAM *f. glabrior* H. J. LAM, *a*. Twig with ♀ flowers, *b*. ♀ flower in section, *c*. section of ♂ flower, *d*. cross-section of petiole.—*Haplolobus floribundus* (K.SCH.) H. J. LAM. *e*. infructescence (*a* and *e* × $^{2}/_{3}$, *b* and *c* × 17, *d* × 7).

Vern. *Kao*, Hollandia.

Notes. Two forms can be distinguished:

f. **acuminatus.** Inflorescences and nervation on the underside of the leaflets densely woolly pubescent.

f. **glabrior** H. J. LAM, Blumea 8 (1955) 175. Inflorescences glabrous, leaves subglabrous.

This species is related to *H. robustus*, which differs by rigid leaflets with abrupt and short acumen, and longer and much broader (♀) inflorescences; probably also related to *H. maluensis*, which differs by longer and more lax inflorescences.

6. Haplolobus mollis H. J. LAM, Blumea 8 (1955) 177, f. 1.

Tree *c.* 20 m high. *Branchlets c.* 1 cm diam., verrucose. *Leaves* 1–3-jugate. *Pith of the petioles* with 8–10 vascular strands. *Leaflets* elliptic to obovate, 7–19 by 5–11½ cm, glabrous above, softly pubescent underneath; base rounded to subcordate, often oblique; apex abruptly and short acuminate; nervation prominent beneath; nerves 8–15 pairs (angle 70–80°), much curved, near the margin more or less arching. *Inflorescences* (♂ unknown) small, pilose, 1½–2 cm long, on stout, short, axillary shoots. *Flowers* (♂ unknown) 3 mm long, glabrous. *Calyx* spreading, 2 mm wide. *Stamens* free. *Disk* undulate. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* Moluccas (Halmaheira: G. Sembilan), once collected.

Ecol. Primary rain-forest, 600 m. *Fl.* Sept.

Note. The branchlets and leaves remind of *H. moluccanus*, from which the present species differs, however, by fewer vascular strands in the petiolar pith, smaller, broader, and pubescent leaflets, and much smaller ♀ inflorescences.

7. Haplolobus robustus H. J. LAM, Blumea 7 (1953) 429, f. 6.

Tree, *c.* 20 m by 40 cm. *Branchlets c.* 1 cm diam., tips densely pubescent, as are the leaves and inflorescences. *Leaves* 2–3-jugate. *Pith of the petioles* with *c.* 15 vascular strands. *Leaflets* oblong, 14–21 by 6–9 cm, rigid, densely woolly pubescent beneath and on the midrib above; base rounded to subcordate; apex abruptly, shortly and bluntly acuminate; nervation prominent beneath, nerves 12–16 pairs (angle *c.* 70°), curved, not distinctly arching except the apical ones. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, 10–13 cm long, rigid, densely woolly pubescent, shortly stalked, branches up to 8½ cm long. *Fruits* subglobular, 10–13 by 7–10 mm.

Distr. *Malaysia:* West New Guinea (incl. also Numfoor Isl.).

Ecol. Primary rain-forest up to 850 m. *Fr.* March.

Vern. *Wom*, Numfoor.

Note. A characteristic species, apparently close to *H. acuminatus*, but distinguished by rigid, oblong leaflets, robust branchlets and infructescences, and long and broad panicles.

8. Haplolobus beccarii HUSSON, Blumea 7 (1953) 431, f. 7.

Tree. *Branchlets* 1¾–2¼ cm diam., lenticellate. *Leaves* 6-jugate. *Pith of the petioles* with 15–20 vascular strands. *Leaflets* lanceolate-oblong, 21–36 by 7½–10 cm, chartaceous, pubescent on the nerves beneath; base slightly oblique, cuneate; apex rather abruptly, long, and acutely acuminate; nervation prominent beneath, nerves 25–30 pairs (angle 70–80°), curved, arching near the margin. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, 4–7 cm long, densely minutely pubescent, branched from (near) the base. *Fruits* oblong to subglobose, 13–15 by 12 mm.

Distr. *Malaysia:* Borneo (Sarawak), once collected, *fr.* June.

Note. This species stands quite apart in the genus; its only possible relation is not with the second Bornean species, *H. borneensis*, but rather with *H. acuminatus* from New Guinea.

9. Haplolobus moluccanus H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207, t. 7 f. 45, t. 11 f. 60; Bull. Jard. Bot. Btzg III, 12 (1932) 407, t. 8 f. 40; HUSSON & H. J. LAM, Blumea 7 (1953) 433.

Tree, 16–28 m by 30–55 cm. *Branchlets* 1–1½ cm diam., lenticellate, glabrous except the tips. *Leaves* 3–5-jugate, glabrous. *Pith of the petioles* with 10–40 vascular strands. *Leaflets* ovate to oblong, 12–38 by 7–18 cm; base slightly oblique, broadly cuneate to subcordate; apex shortly and bluntly acuminate; nervation strongly prominent beneath, nerves (9–)12–18 pairs (angle 60–80°), faintly curved, distinctly arching. *Inflorescences* (♀ unknown) axillary, broadly paniculate, 23–32 cm long, densely pulverulent, glabrescent, lower branches slightly shorter than the inflorescences, many-flowered. *Flowers* (♀ unknown) minute, glabrous. *Calyx* very short. *Stamens* free or the epipetalous ones slightly adnate to the petals. *Disk* cupular, thick, with truncate rim. *Infructescences* broadly paniculate, 7–19 cm long, (sub)-glabrous, shortly stalked, branches up to 14 cm long. *Fruits* oblong to ellipsoid, 17–22 by 8½–12 mm.

Distr. *Malaysia:* Moluccas (Morotai, Halmaheira, Batjan).

Ecol. Primary forests up to *c.* 100 (once 500) m. *Fl.* Oct., April, *fr.* Dec.

Vern. *Lian(a)*, Morotai, *damar tai babi*, *liana*, *liha*, *ode mayoko*, Halmaheira, *dian*, Batjan, *daun lebar*.

Notes. This species, together with *H. celebicus*, *anisander*, *floribundus* and *maluensis*, forms a large and wide-spread complex, in which specific delimitations are very hard to draw. Any subdivision seems more or less arbitrary. This group ranges from Celebes to East New Guinea and perhaps New Britain. Generally speaking, the size of the leaflets, their width, and the dimensions of the inflorescences seem to decrease from W. to E., and the same is true for the number of vascular strands in the petiole. There are, however, some irregularities and in cases of sterile specimens it is often impossible to state their proper taxonomic position.

10. Haplolobus celebicus H. J. LAM, Blumea 3 (1938) 111, *cum fig.*; HUSSON & H. J. LAM, Blumea 7 (1953) 435; H. J. LAM, Blumea 8 (1955) 177.

Tree, 20–30 m by 30–70 cm. *Branchlets* 4–7 mm thick, lenticellate, glabrous except the terminal bud. *Leaves* 1–4-jugate, glabrous. *Pith of the petioles* with (1–)4–9 vascular strands. *Leaflets* ovate to oblong-lanceolate, 9–21 by 4–10 cm, chartaceous; base slightly oblique, rounded to cuneate; apex rather abruptly, bluntly acuminate; nerves (6–)8–11 pairs (angle 50–80°), faintly curved, vaguely arching. *Inflorescences* (♀ unknown) axillary, broadly paniculate, 10–22 cm long, glabrous, branched from the base, many-flowered, intermingled with vegetative buds. *Flowers* (♀ unknown) minute, glabrous. *Calyx* 1 mm high. *Stamens* free. *Disk* thick, 6-undulate. *Infructescences c.* 10 cm long, glabrous, branched from the base. *Fruits* ovoid or slightly oblique, 12–16 by 7–11 mm.

Distr. *Malaysia:* Central Celebes; dubious (sterile) specimens also from the Moluccas (Morotai, Batjan, Sula Islands), and Palau (even genus not quite certain).

Ecol. Primary forests up to 250 m. *Fl.* Oct.–Nov., *fr.* March.

Vern. *Bakata putih, tapitapi, tumoni putih.*

Notes. The nearest relative is *H. moluccanus*, which differs from *H. celebicus* by its generally broader leaflets with much more numerous vascular strands in the pith of the petioles. On the other hand, *H. celebicus* is clearly allied with *H. floribundus* and *H. anisander*, which have both leaflets of the same type as the narrower *celebicus* specimens. *H. floribundus*, however, has stiffer leaflets and fairly large and spreading, often subterminal inflorescences, and seems restricted to New Guinea. *H. anisander*, on the other hand, occurs from the Moluccas to East New Guinea or even New Britain. It is particularly difficult to name sterile specimens. The inflorescences of *H. anisander* are much smaller than in *H. celebicus* and the number of vascular strands is mostly small (1–5).

11. Haplolobus maluensis (LAUT.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 208, t. 12 f. 97; Bull. Jard. Bot. Btzg III, 12 (1932) 416, t. 8 f. 49; HUSSON & H. J. LAM, Blumea 7 (1953) 436, f. 8; H. J. LAM, Blumea 8 (1955) 177.—*Santiria maluensis* LAUT. Bot. Jahrb. 56 (1920) 334.

Tree, 10–30 m high. *Branchlets* 4–7 mm thick, verrucose, glabrous except the pulverulent terminal bud. *Leaves* 0–2(–3)-jugate, glabrous. *Pith of the petioles* with 10–12 vascular strands. *Leaflets* broad-ovate to oblong, 5–21 by 2–9 cm, coriaceous; base rounded to subacute; apex gradually to subabruptly, shortly and bluntly acuminate; nerves 10–14 pairs (angle 60–70°), slender, straight, not arching but in the apex. *Inflorescences* axillary, paniculate, glabrous, ♂ ones 5–13 cm, branched from the base, ♀ ones 2½–10 cm, short-stalked. *Flowers* 1½–2 mm, glabrous. *Calyx* ½–¾ mm. *Stamens* in ♂ flowers free, in ♀ ones slightly adnate to the disk. *Disk* cupular, thick, the rim truncate. *Fruits* globose to somewhat ellipsoid, 12–19 by 8–13 mm.

Distr. *Malaysia:* East New Guinea (dubious specimens also from the Geelvink Bay).

Ecol. Primary forests up to 200 m. *Fl.* July–Nov., *fr.* Jan.–March, Aug.

Vern. *Ongo*, Papua.

Notes. Belongs to the group of *H. moluccanus*; moreover possibly related to *H. acuminatus*, though the leaflets show no trace of pubescence. As all the original material of this species apparently is lost, it is difficult to establish its exact taxonomic position.

12. Haplolobus floribundus (K.SCH.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207; Bull. Jard. Bot. Btzg III, 12 (1932) 412, t. 8 f. 45; HUSSON & H. J. LAM, Blumea 7 (1953) 436; H. J. LAM, Blumea 8 (1955) 177.—*Santiria floribunda* K.SCH. in K. SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 63; K. SCH. & LAUT. Fl. Schutzgeb. (1901) 378.—*Canarium furfuraceum* LAUT. Bot. Jahrb. 56 (1920) 325.—*Santiria sepikensis* LAUT. Bot. Jahrb. 56 (1920) 333.—*H. furfuraceus* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207, t. 11 f. 63; Bull. Jard. Bot. Btzg III, 12 (1932) 409, t. 8 f. 42.—*H. sepikensis* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 208, t. 11 f. 62; Bull. Jard. Bot. Btzg III, 12 (1932) 416, t. 8 f. 48.—**Fig. 2f, 16e.**

Tree, 10–30(–36) m by 20–75 cm, buttresses, if present, up to 2 m high. *Branchlets* 5–9 mm thick, lenticellate, younger parts pubescent. *Leaves* 1–4-jugate. *Pith of the petioles* with 1–4(–11) vascular strands. *Leaflets* oblong, 7–20 by 3–9 cm, rigid; base more or less broadly cuneate; apex long acuminate; nerves 7–13 pairs (angle 60–70°), curved, not arching but in the apex; reticulations very dense. *Inflorescences* axillary and sometimes terminal, broadly paniculate, rigid, minutely pubescent, glabrescent, without or with a short peduncle, the ♂ ones 8–23(–28) cm, ♀ ones 4–14 cm. *Flowers* 2½–3½ mm long, glabrous. *Calyx* 1½ mm, subtruncate. *Stamens* free or slightly adnate to the disk. *Disk* cupular, the rim 6-undulate to truncate, in ♂ flowers very thick, in ♀ ones thinner. *Fruits* ovoid, somewhat acute at the apex, 16–18 by 9–11 mm.

Distr. *Malaysia:* New Guinea.

Ecol. Primary forests up to 900 m. *Fl.* May–July, Nov., *fr.* Jan., May.

Vern. *Bowi*, *djaato*, *jakko*, Manokwari, *ongo*, *jondopu*, Papua, *ratitunga*, Milne Bay.

Notes. In the above delimitation, *H. floribundus* is a relatively common, widely spread and extremely variable species; it is closely related to and possibly conspecific with *H. celebicus* and *anisander*. A striking characteristic of the present species is the occasional occurrence of terminal inflorescences.

13. Haplolobus versteeghii H. J. LAM, Blumea 7 (1953) 440, f. 9.

Tree, 23–26 m by 55 cm. *Branchlets* 8–9 mm thick, verrucose-lenticellate, as are the petioles and inflorescences. *Leaves* 4-jugate, glabrous. *Pith of the petioles* with 3–7 vascular strands. *Leaflets* ovate to oblong, 9½–19 by 4½–7½ cm, rigid; base slightly oblique, rounded to broadly acute; apex shortly and bluntly acuminate; nervation strongly prominent beneath, nerves 10–15 pairs (angle 60–70°), faintly curved, arching at some distance from the margin. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, 7 cm long, branched from the base, branches thick, lenticellate. Immature *fruits* ovoid, 12 mm long.

Distr. *Malaysia:* West New Guinea (Idenburg River).

Ecol. Primary forests at *c.* 1150 m. *Fr.* (juv.) Febr.

Note. This species seems to be related to *H. floribundus*, but it is distinctly different by the coarsely prominent venation and the thick branchlets and strong petioles.

14. Haplolobus hussonii H. J. LAM, Blumea 7 (1953) 443, f. 10.

Tree (?), entirely glabrous. *Branchlets* 4–5 mm thick. *Leaves* 2(–3)-jugate. *Pith of the petioles* with 1–10 vascular strands. *Leaflets* (lanceolate-)oblong, 10–22 by 4½–8½ cm, thinly coriaceous; base subrotundate to cuneate; apex gradually, obtusely long-acuminate; nervation rather prominent beneath, nerves 10–14 pairs (angle 60–90°), faintly curved, arching. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, branched from the base, 2½–5½ cm long. *Fruits* olive-shaped, 12–16 by 10–12 mm.

Distr. *Malaysia:* West New Guinea.

Ecol. Up to 400 m alt. *Fr.* April.

15. Haplolobus megacarpus H. J. LAM, Blumea 7 (1953) 443, f. 11; Blumea 8 (1955) 178, f. 2.

Tree, entirely glabrous. *Branchlets c.* 4 mm thick. *Leaves* (1–)2–3-jugate. *Pith of the petioles* with 5–12 vascular strands. *Leaflets* ovate to lanceolate, 8½–16½ by 5–7 cm; base broadly cuneate, abruptly contracted; apex abruptly, shortly and bluntly acuminate; nervation prominent beneath, nerves 7–8 pairs (angle 50–60°), curved, not distinctly arching. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, branched from the base, 2½–5 cm, rather rigid, with few fruits. *Fruits* olive-shaped, 23–28 by 13–18 mm.

Distr. *Malaysia:* West New Guinea (Japen & Numfoor Isl.). *Fr.* April.

Note. Perhaps related to *H. leeifolius*, which differs by the much smaller fruits and the less numerous vascular strands in the pith of the petioles.

16. Haplolobus monophyllus H. J. LAM, Blumea 7 (1953) 445, f. 12.

Tree, 10 m by 20 cm, fully glabrous. *Branchlets* 2–4 mm thick. *Leaves* 0–1-jugate. *Pith of the petioles* with 1 vascular strand. *Leaflets* ovate, 6–12½ by 2½–5¾ cm, coriaceous, rather rigid; base broadly cuneate, decurrent; apex gradually to subabruptly, shortly and bluntly acuminate; nerves 6–9 pairs (angle 65–80°), faintly curved, rather abruptly arching close to the margin; reticulations dense; domatia present in most of the nerve-axils beneath. *Inflorescences* (♀ unknown) axillary, paniculate ¾–5 cm long, slender, without or with a short peduncle, branches up to 2 cm long. *Flowers* (♀ unknown) *c.* 1 mm long. *Calyx c.* ½ mm high, sparsely pilose, glabrescent. *Stamens* adnate to the disk. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* Moluccas (Morotai).

Ecol. Alt. 1000 m. *Fl.* May.

Notes. On account of the very few leaflets, the dense reticulation, the single vascular strand in the pith of the petiole and the short, few-flowered inflorescences, the present species is undoubtedly most closely allied to *H. nubigenus* from New Guinea. The very striking domatia link it both with the gland-bearing mountain species *H. glandulosa*, *monticola*, and *microphyllus*, and again with *H. nubigenus*, which is sometimes provided with tiny glands.

17. Haplolobus nubigenus (LAUT.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 208, t. 11 f. 61; Bull. Jard. Bot. Btzg III, 12 (1932) 415, t. 8 f. 47; HUSSON & H. J. LAM, Blumea 7 (1953) 447.—*Santiria nubigena* LAUT. Bot. Jahrb. 56 (1920) 335.—*Santiria triphylla* LAUT. Bot. Jahrb. 56 (1920) 336.

Tree, 5–20 m high. *Branchlets* 3–6 mm thick, glabrous except the pubescent tips. *Leaves* 0–3-jugate, glabrous. *Pith of the petioles* with 1–few vascular strands. *Leaflets* elliptic to elliptic-lanceolate, 4–11½ by 1½–6 cm, rigidly coriaceous; base subrotundate to cuneate; apex obtuse or more or less broadly and bluntly acuminate; nervation rather prominent beneath, nerves 6–9 pairs (angle 50–60°), curved, not arching but in the apex; reticulation dense, sometimes with some minute glandular pits in the nerve-axils. *Inflorescences* axillary, paniculate, 1–3½ cm, without or with a short peduncle, glabrous or slightly pulverulent, branches up to 8 mm long. *Flowers* 1½ mm, glabrous. *Calyx* ¾ mm high. *Stamens* free. *Disk* shallowly cupular to annular, truncate. *Fruits* unknown.

Distr. *Malaysia:* East New Guinea.

Ecol. Primary forests at 200–1500 m. *Fl.* Oct.–Dec.

Note. Apparently related to the group of *H. glandulosus.*

18. Haplolobus clementium HUSSON, Blumea 7 (1953) 449, f. 13; H. J. LAM, Blumea 8 (1955) 179.

Tree, 15–25 m by 20–60 cm, sometimes with small buttresses; glabrous except the youngest parts. *Branchlets* 3–5 mm thick. *Leaves* 0–2-jugate. *Pith of the petioles* with 2–5 vascular strands. *Leaflets* oblong-lanceolate, 3–17 by 2–6½ cm, chartaceous; base oblique, broadly cuneate; apex subabruptly, bluntly acuminate; nerves 6–16 pairs (angle 70–80°), curved, arching. *Inflorescences* (♂ unknown) axillary, ½–4 cm, usually branched from the base, when young densely minutely pubescent. *Flowers* (♂ unknown) 1–1½ mm. *Calyx* 1 mm high. *Stamens* free. *Disk* annular. *Fruits* oblong, occasionally somewhat obliquely pointed with 3 small ribs at the apex, 10–15 by 7–10 mm.

Distr. *Malaysia:* New Guinea.

Ecol. Forests at 600–1000 m. *Fl.* Febr., *fr.* Oct., Febr. In the Cycloop Range near Hollandia reported to grow gregariously.

Notes. A mountain species characterized by its longish pointed leaflets and more or less crowded short ♀ inflorescences.

19. Haplolobus borneensis H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 418, t. 14 f. 93; HUSSON & H. J. LAM, Blumea 7 (1953) 452; H. J. LAM, Blumea 8 (1955) 179, f. 3.

Tree, 12–27 m by 18–120 cm. *Branchlets* 2–4 mm thick, glabrous. *Leaves* 2–3-jugate, glabrous. *Pith of the petioles* with 1–5 vascular strands.

Leaflets ovate to lanceolate, 3½–13 by 1¼–5½ cm, chartaceous; base cuneate; apex more or less abruptly, bluntly acuminate; nerves 7–10 pairs (angle 45–70°), slender, straight to faintly curved, vaguely arching; intermediate veins often well developed. *Inflorescences* axillary, glabrous, ♂ ones broadly paniculate, 6–18 cm, without or with a short peduncle, the branches up to 11 cm long; ♀ inflorescences 3–6 cm long, branched from the base. *Flowers* glabrous, ♂ ones 2–2½ mm, ♀ 3–3½ mm long. *Calyx* 1 mm. *Stamens* in ♂ flowers free or the epipetalous ones slightly confluent with the petals, in ♀ flowers all adnate with the disk halfway up. *Disk* small, annular. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* North Borneo (Mt Kinabalu).

Ecol. Primary forests at 1500 m. *Fl.* Nov.–Dec., April.

Notes. This species seems to be related with Papuan species, rather than with the second Bornean species (*H. beccarii*), but it is difficult to state which Papuan species is nearest. The ♂ inflorescences resemble those of *H. floribundus*, the ♀ ones those of *H. acuminatus f. glabrior*, but the leaves are glabrous and quite differently shaped, and the reticulation is more lax.

20. Haplolobus anisander (LAUT.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 207; Bull. Jard. Bot. Btzg III, 12 (1932) 414, t. 8 f. 46; HUSSON & H. J. LAM, Blumea 7 (1953) 452.—*Santiria anisandra* LAUT. Bot. Jahrb. 56 (1920) 339, f. 4; E. & P. Pfl. Fam. ed. 2, 19a (1931) f. 218.

Tree, (5–)20–30 m by *c.* 35–40 cm. *Branchlets* 2–6 mm thick, young parts dark furfuraceous-pubescent, soon glabrate. *Leaves* 0–3-jugate, glabrous. *Pith of the petioles* with 1–4(–5) vascular strands. *Leaflets* ovate-lanceolate, 6–11½(–20) by 2–5(–8) cm, thin; base cuneate; apex gradually to subabruptly, short-acuminate; nerves 7–12 pairs (angle 60–70°), curved, not arching but in the apex; reticulations little conspicuous, rather lax; sometimes with some small domatia in the nerve-axils. *Inflorescences* axillary, paniculate, 1½–8 cm, mostly branched from the base, very slender, specially ♂ ones. *Flowers c.* 2 mm, glabrous. *Calyx c.* 1 mm. *Stamens* free or slightly confluent with the disk. *Disk* annular, in ♂ flowers thick and nearly cushion-shaped, the rim somewhat undulate. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* Moluccas (Morotai, Halmaheira, Batjan, Banggai Islands, Buru, Ceram), New Guinea; a dubious specimen from New Britain.

Ecol. Primary forests up to 400(–1000) m. *Fl.* April–May (July, Oct.).

Vern. *Lawai*, Ceram.

Notes. Unfortunately the specific epithet refers to an incorrect observation. In fact, the androecium, like in all other species of the genus, is isodynamous, at least in adult flowers, and all stamens are inserted outside the fleshy disk.

The demarcation between the present species and *H. moluccanus*, *floribundus*, and *celebicus*, is very vague, and therefore the naming of sterile specimens often remains doubtful.

21. Haplolobus leeifolius H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 208; Bull. Jard. Bot. Btzg III, 12 (1932) 417, t. 8 f. 50; HUSSON & H. J. LAM, Blumea 7 (1953) 454, f. 15.—*Santiria leeaefolia* LAUT. Bot. Jahrb. 56 (1920) 335.

Tree, 12–15 m high. *Branchlets* 2–4 mm thick, glabrous. *Leaves* (1–)2–3-jugate, glabrous. *Pith of the petioles* with 1–5 vascular strands. *Leaflets* ovate, 7–15½ by 3½–7 cm, chartaceous, rather thin; base cuneate; apex long, narrowly, and bluntly acuminate; nerves 8–12 pairs (angle 60–70°), slender, faintly curved, not distinctly arching but in the apex; veins and reticulations little conspicuous. *Inflorescences* (♀ unknown) axillary, paniculate, 4–8 cm, often branched from the base and sometimes with an obsolete vegetative bud. *Flowers* (♀ unknown) 1½–2 mm long, glabrous. *Calyx* ½ mm. *Stamens* free. *Disk* cupular with undulate rim. *Infructescences* slender, 2–4 cm. *Fruits* globular, 11–13 mm diam., pericarp with 6 faint grooves from the base, 3 of which may reach the apex; pyrene with 3 shallow and short ribs near base and apex.

Distr. *Malaysia:* New Guinea.

Ecol. At 200–400 m. *Fl.*, *fr.* Oct.

Note. Perhaps related to *H. megacarpus* (see there).

7. SCUTINANTHE

THWAITES in Hook. J. Bot. Kew Misc. 8 (1856) 266; LEENH. Blumea 7 (1952) 160.—*Canarium sect. Scutinanthe* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 531.—**Fig. 2g & 18.**

Dioecious trees. *Pith of the branchlets* without vascular strands. *Leaves* without stipules; pith of the petiole without vascular strands. *Leaflets* entire. *Inflorescences* axillary, paniculate. *Flowers* 5-merous; receptacle cupular. *Sepals* free. *Petals* free, with slightly thickened apex. *Stamens* 10, confluent at the base, episepalous ones slightly longer, in ♀ flowers all sterile, though only slightly reduced in size. *Disk* nearly entirely adnate to the receptacle, intrastaminal. *Pistil* with a 3-celled, pilose ovary; in ♂ flowers only slightly reduced. *Fruits* drupaceous, stigmatic scar (nearly) apical; pericarp fleshy; mesocarp consisting of long, radially arranged, pallisadoid cells; pyrene hard and bony, usually 2 cells strongly reduced; calyx persistent, not enlarged. *Seed* 1; cotyledons contortuplicate, entire, leafy.

Distr. Two *spp.* in Ceylon, S. Burma, W. *Malaysia* & Celebes. Fig. 17.

Ecol. Primary forests up to 900 m.

KEY TO THE SPECIES

1. Sepals 1½–2 mm, at least half as long, in most cases (nearly) as long as the petals. Young parts and inflorescences densely pubescent. Nerves 8–15 pairs, prominent beneath, usually arching. **1. S. brunnea**
1. Sepals ½–1(–2) mm, often much shorter than the petals. Young parts and inflorescences much less pubescent. Nerves 4–8(–10) pairs, less prominent and less distinctly arching . . **2. S. brevisepala**

1. Scutinanthe brunnea THWAITES in Hook. J. Bot. Kew Misc. 8 (1856) 267, t. 8B; JADIN, Contr. Téréb. (1894) 90; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) f. 141; ed. 2, 19a (1931) f. 220; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 261, f. 42; HEYNE, Nutt. Pl. (1927) 882; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 95, t. 13 f. 103, t. 14 f. 112b; Bull. Jard. Bot. Btzg III, 12 (1932) 420; LEENH. Blumea 7 (1952) 162; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 30, *cum fig.*—*Garuga brunnea* MARCH. Adansonia 8 (1867) 34, 66.—*Canarium brunneum* BEDDOME, Fl. Sylv. 1 (1868) t. 127; ENGL. in DC. Mon. Phan. 4 (1883) 105, t. 3 f. 6–14; TRIM., Fl. Ceyl. 1 (1893) 238, t. 23.—**Fig. 2g & 18.**

Tree up to 30(–40) m by 80 cm, rarely with up to 1 m high buttresses. *Branchlets* 4–10 mm thick; young parts, inflorescences, rhachis, petiolules and underside of the midrib densely and minutely ferrugineously pubescent. *Leaves* (2–)4–7-jugate. *Leaflets* ovate to oblong, 3–20 by 1½–7 cm, rather rigidly chartaceous, glabrous except the midrib underneath; base rounded to broadly cuneate; apex rather abruptly, slender and acutely acuminate; nerves 8–15 pairs (angle 55–70°), slightly curved, often arching. *Inflorescences:* ♂ broadly paniculate, 13–30 cm long, main branches up to 19 cm; ♀ narrowly paniculate, 4½–25 cm long, branches up to 7 cm. *Flowers* 4–6 mm long, densely pubescent; cupular receptacle 2–2½ mm high. *Sepals* 1½–2 mm. *Ovary* in ♀ flowers densely pubescent, in ♂ ones slightly pubescent to glabrous. *Fruits* slightly oblique, ellipsoid, 4½–6¼ by 2¼–3 by 1¾–2½ cm, densely ferrugineously tomentose. *Seed* 1(–2); cotyledons on the seedling leafy, 8 by 6 cm, with cordate base and acutely acuminate apex.

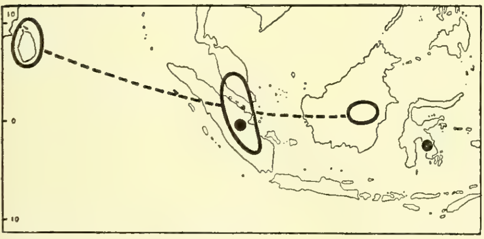

Fig. 17. Distribution of *Scutinanthe*. *S. brunnea* THW. (o), *S. brevisepala* LEENH. (●).

Distr. Ceylon and *Malaysia:* Sumatra, Malay Peninsula, and Borneo. Fig. 17.

Ecol. Non-inundated primary forests, in *Malaysia* only at low altitudes, in Ceylon up to 900 m. *Fl.* mainly Aug.–Jan.; *fr.* Sept. (Mal. Pen.), Jan.–Febr. (Sum.).

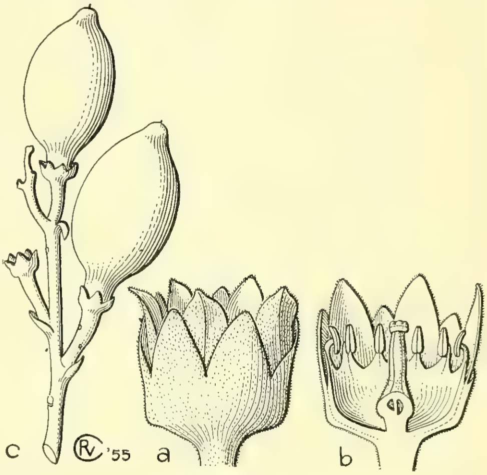

Fig. 18. *Scutinanthe brunnea* THW. Flower and infructescence (*a* and *b* × 3, *c* × ½).

Wood anat. DESCH, Mal. For. Rec. 15^{1} (1941) 64, pl. 13 fig. 2 (hand lens).

Uses. The fruits are sometimes eaten. Timber only for local use.

Vern. *Luwing*, Palemb., *kajam pĕngali, kĕdondong, kĕranlai, sĕngkuang, suryan, tajam bĕlat*, Mal. Pen., *nytoh*, Brunei.

Note. Not unlike *Dracontomelum mangiferum* BL. (*Anacardiaceae*) in its vegetative parts; different by its small or absent buttresses, its creamy-white to colourless, sticky exudate, and the absence of resiniferous ducts in the medulla of the petioles.

2. Scutinanthe brevisepala LEENH. Blumea 7 (1952) 162, f. 1.

Tree *c.* 25 m. *Branchlets* 3–6 mm thick, lenticellate, tips scabrous to slightly hairy. *Leaves* 1–5-jugate, glabrous. *Leaflets* lanceolate to oblong, 5–6½(–16) by 1¾–2¾(–6) cm, coriaceous; base subrotundate; apex more or less abruptly, slender, obtusely acuminate; nerves 4–8(–10) pairs (angle *c.* 60°), curved, not distinctly arching. *Inflorescences*

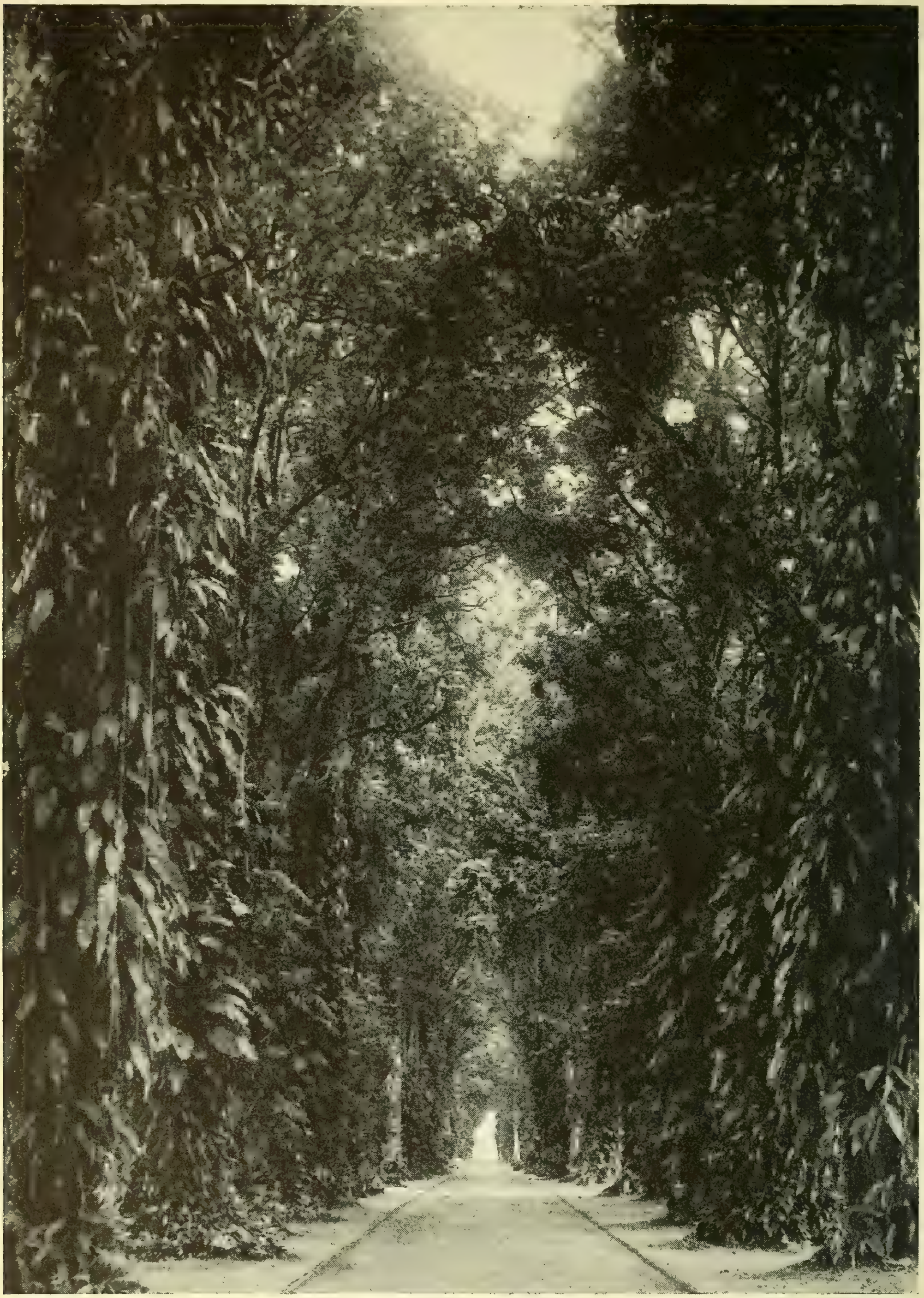

Fig. 19. The new Kenari avenue of *Canarium vulgare* LEENH. in Kebun Raya Indonesia, about 70 years old, trees *c.* 30 m tall, stems clothed with *Araceae*, *Freycinetia*, and other climbers.

(♀ unknown) pseudoterminal, narrowly paniculate, 8–13 cm long. *Flowers* (♀ unknown) 4 mm long, scabrous, the cupular receptacle 2 mm high. *Sepals* $^1/_2$–1(–2) mm high. *Ovary* in ♂ flowers sometimes densely tomentose. *Fruits* unknown.

Distr. S. Burma (King Isl.) and *Malaysia:* Sumatra (Indragiri, once collected), SE. Celebes (two collections). Fig. 17.

Ecol. Primary forests up to 350 m. *Fl.* Apr. (Sum.), Nov. (Cel.).

Vern. *Mardjĕlai,* Sum., *kobili,* Cel.

Excluded

Scutinanthe boerlagei Hochr. Pl. Bog. Exs. (1904) 64, based on a tree cultivated in the Botanic Gardens, Bogor, *sub no* III.J.27 is according to H. J. Lam (Bull. Jard. Bot. Btzg III, 12, 1932, 422) = *Walsura robusta* Roxb. (*Meliaceae*).

Scutinanthe engleri Elm. (Leafl. Philip. Bot. 1, 1908, 298) is according to Merr. (En. Philip. 2, 1923, 380) = *Walsura sumatrana* Miq. = *Heynea sumatrana* Roxb. (*Meliaceae*).

8. CANARIUM

Stickm. Herb. Amb. (1754) 10 (erroneously *Cenarium*); Linné, Amoen. Ac. 4 (1759) 121; Engl. in DC. Mon. Phan. 4 (1883) 101; H. J. Lam, Ann. Jard. Bot. Btzg 42 (1931–32) 23, 97; Bull. Jard. Bot. Btzg III, 12 (1932) 422.—*Nanari* Adans. Fam. Pl. 2 (1763) 342.—*Pimela* Lour. Fl. Cochinch. (1790) 407.—*Canariopsis* Bl. *ex* Miq. Fl. Ind. Bat. 1, 2 (1859) 651.—*Sonzaya* March. Adansonia 8 (1868) 64.—**Fig. 1, 2h, 19–48.**

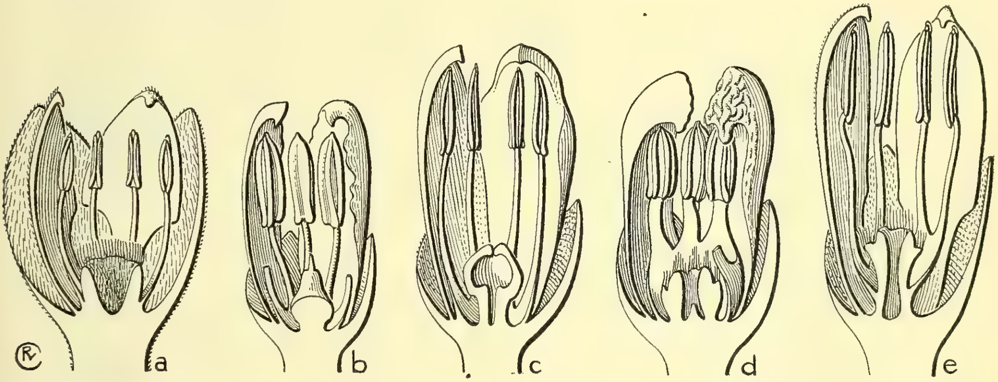

Fig. 20. Longitudinal sections of ♂ *Canarium* flowers. *a. C. grandifolium* (Ridl.) H. J. Lam with unguiculate petals, *b. C. oleosum* Engl., showing an ovariodisk with rudimentary style, *c. C. gracile* Engl., *d. C. polyphyllum* K.Sch., provided with strongly thickened petals with rugose sides, *e. C. schlechteri* Laut. (*a* × 3, *b–e* × 6).

Trees, occasionally shrubs (or ?climbers, see p. 211); pith of the branchlets nearly always with vascular strands. *Leaves* spirally arranged, very rarely in pseudowhorls; pinnate, very rarely unifoliolate; usually with a pair of stipules near or on the petiole; base of the petiole and ends of the petiolules often swollen. *Panicles* axillary or terminal, bracteate, sometimes, especially ♀ ones, reduced to racemes or spikes. *Flowers* 3-merous. *Receptacle* in ♀ flowers sometimes slightly concave (then disk adnate to it, and pistil shortly stalked). *Sepals* usually about halfway connate; outside hairy or glabrous, inside nearly always densely sericeous. *Petals* free, usually imbricate, in the central part thickened and induplicate-valvate near the apex, tip inflexed; outside usually more or less hairy except the base and margins, inside very rarely hairy. *Stamens* 6, epipetalous ones sometimes more or less to totally reduced; free to entirely connate, sometimes adnate to the disk; in ♀ flowers sterile and often less well developed. *Disk* intrastaminal, in ♀ flowers often for the greater part adnate to the receptacle; usually 6-lobed, in ♂

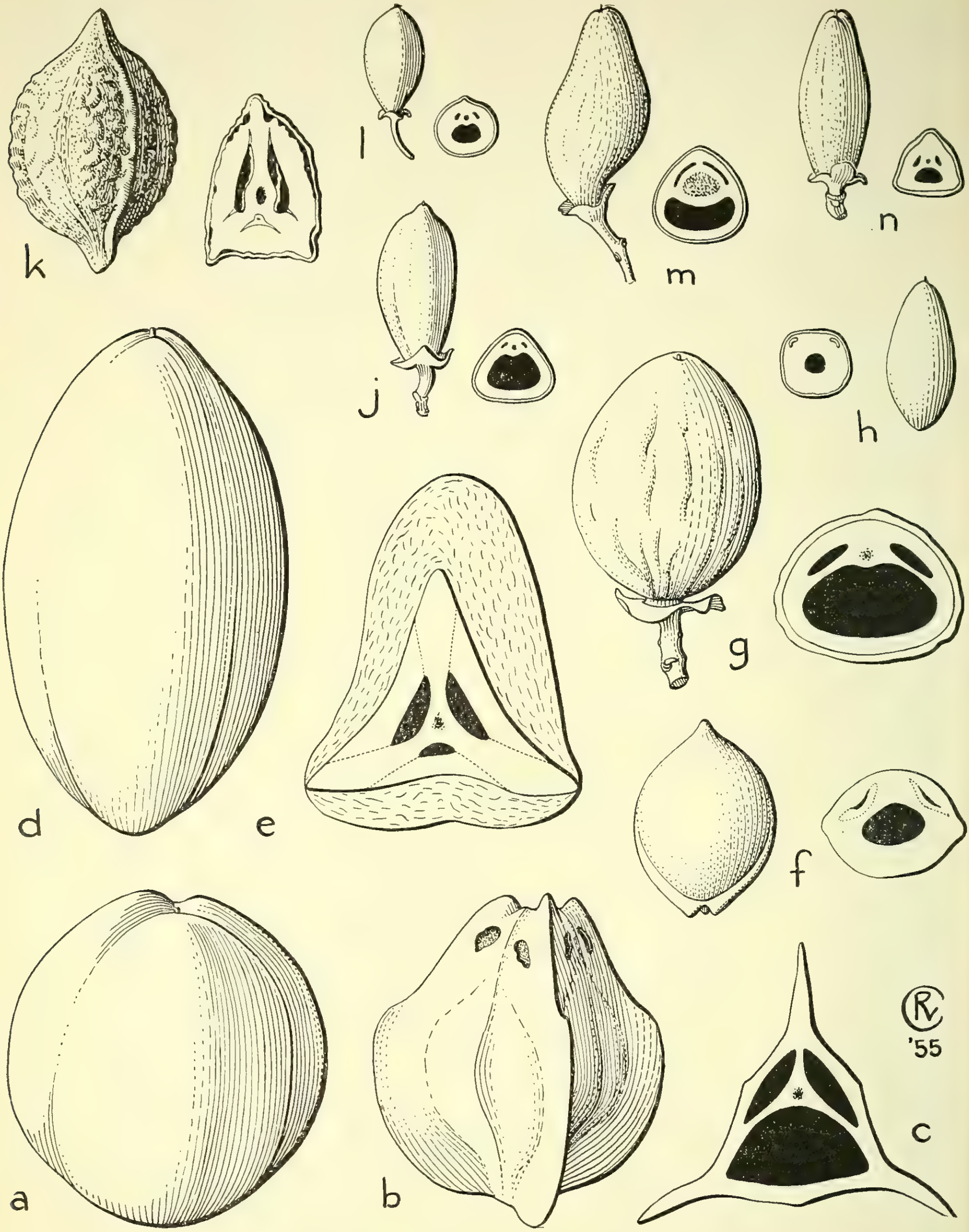

Fig. 21. Different kinds of fruits in *Canarium*. *a–c*. *C. kaniense* LAUT. *var. globigerum* LEENH., *d–e*. *C. megacarpum* LEENH., *f*. *C. salomonense* B. L. BURTT *ssp. papuanum* LEENH., *g*. *C. indicum* L., *h*. *C. maluense* LAUT. *ssp. maluense*, specimen with entirely marginal sterile cells, *j*. *C. denticulatum* BL., *k*. *C. cestracion* LEENH., *l*. *C. oleosum* (LAMK) ENGL., *m*. *C. gracile* ENGL., *n*. *C. pilosum* BENN. *ssp. pilosum* (of each taxon a fruit—in *b*, *f*, and *k* a pyrene—in habit and in cross-section; cells black, axial cavity dotted; all × 4/5).

flowers often strongly developed. *Pistil in ♂ flowers* usually very reduced to absent, sometimes united with the disk in an 'ovariodisk', which even can bear a 'style'; pistil sometimes fully replaced by the strongly developed disk. *Pistil in ♀ flowers* 3-celled (in Mal. *spp.*), sometimes seemingly stalked (the stalk representing the fertile part of the ovary). *Fruits* usually plum-shaped, drupe-like, nearly always blue-black when ripe (white in *C. album* from SE. Asia, red in *C. euryphyllum var. euryphyllum*), hairy, especially near base and apex, or glabrous; pericarp fleshy, rarely fibrous; pyrene stony, 3-celled, 1 or 2 cells often slightly to nearly entirely reduced (in the latter case endocarp very rarely absent). *Cotyledons* palmatifid to 3-foliolate, contortuplicate or folded.

Distr. About 100 *spp.* in the tropics of the Old World, centering in *Malaysia*, *subg. Canarium* extending to SE. Asia, Ceylon, the Mascarenes, Madagascar, and Africa, and to North Australia, Micronesia (Palau), and Melanesia to Fiji, Tonga and Samoa Islands; *subg. Canariellum nov. stat.* (*Canariellum* ENGL. in E. & P. Pfl. Fam. 3, 4, 1896, 242) is restricted to E. Queensland and New Caledonia & adjacent islands. Fig. 23.

Ecol. Mainly large trees of primary and secondary rain-forests at low altitudes; sometimes in monsoon- or more open forests, parklands and (in Australia) on coastal dunes, rarely ascending up to *c.* 1800 m; some *spp.* are apparently abundant in secondary forests. None of the species is consistently a typical dominant in the rain-forest, though *C. vulgare* may locally occur gregariously as the main constituent of the upper canopy in rather dry rain-forests (Kangean Isl., S. Port. Timor). *Fl.* mainly in the dry season, *fr.* mainly in the wet season, though many species apparently are flowering and fruiting all the year round.

Wood anat. DEN BERGER, Med. Proefst. Thee 97 (1926) 65 & Atlas pl. 11 fig. 44, Med. Proefst. Boschw. 13 (1926) 65 & Atlas item; DESCH, Mal. For. Rec. 15^1 (1941) 62 (hand lens); HEIMSCH, Lilloa 8 (1942) 122. See also under species.

Uses. The timbers are soft to moderately hard and probably not very durable in exposed positions, therefore not of great commercial value and only locally used. (The wood of the African *C. schweinfurthii*, of *C. euphyllum* from the Andamans, and of some Indian species seems to be of some importance in the world trade.) The resin is locally used; only that of *C. luzonicum* ('*Manila-elemi*') is of more than local importance. The fruits and especially the oily seeds of many species are in some way used as food; the only ones reaching the world market are those of Philippine *C. ovatum* ('*Pili-nuts*') and the Chinese *C. album* and *pimela* ('*Chinese olives*'). Some *Canariums* are planted as shade trees, along roads, and in nutmeg-plantations (preferably *C. vulgare* and the Ceylonese *C. zeylanicum*).

Vern. The only two wide-spread names in Malaysia are *kanari* (*kĕnari*), principally a Moluccan name, now in use in the greater part of the Archipelago, and *kĕdondong* in the Malay Peninsula, the latter a name freely used also for other *Burseraceae*, specially *Dacryodes*, but also for some *Meliaceae*, and *Anacardiaceae* (specially *Spondias*).

KEY TO THE SPECIES

1. Stipules (at least in the terminal bud) or their (sometimes inconspicuous!) scars present.
  2. True stipules absent, but a basal pair of dwarf leaflets inserted at the base of the petiole (fig. 22a), caducous, leaving a small (*c.* 1 mm) *c.* circular scar; main nerves tortuous, dissolving into a lax marginal reticulation. Terminal bud 4–5 cm long . . . . **27. C. decumanum**
  2. True stipules present; basal pair of leaflets not inserted at the base of the petiole, not dwarfed; main nerves nearly always different, if tortuous and dissolving towards the margin, than terminal bud less than 1 cm.
    3. Stipules subulate, rarely narrowly lanceolate; scars circular, minute (fig. 22b–c).
      4. Terminal bud *c.* 3 cm long, slender, curved, ferrugineous-tomentose . . . **42. C. sumatranum**
      4. Terminal bud up to 1 cm long.
        5. Leaflets distinctly densely papillose underneath, rough on the touch, sometimes pilose. **34. C. merrillii**
        5. Leaflets not papillose underneath.
          6. Stipules 1½–3½ cm long, filiform, inserted mostly at the base of the petiole, sometimes up to 5 mm on the petiole, exceeding the terminal bud (fig. 22c). Branchlets hollow. Inflorescences and infructescences large, laxly paniculate. Stamens 3. Fruits acute-ovate, up to 1½ by 1 cm. **50. C. acutifolium** *var.* **acutifolium**
          6. Stipules up to 1½ cm long, not distinctly exceeding the terminal bud. Branchlets solid. Stamens 6.
            7. Branchlets 1½–3 cm diam., pith thick and soft. Petioles stout, up to 2 cm thick, acute-angled. Stipules inserted on the petiole, up to 5 cm from its base. Fruits prickly-hairy. **43. C. hirsutum**
            7. Branchlets up to 1½(–2) cm diam., pith different. Petioles more slender, not acute-angled. Stipules inserted on the twig or on the petiole up to 2 cm from its base. Fruits not prickly-hairy.

8. Apex of the leaflets rounded to obtuse, rarely shortly blunt-acuminate; nerves 15–24 pairs, rather dense (distance along midrib *c.* $1/2$ cm), angle 75–80°, usually slightly tortuous, fading towards the margin; base usually rounded to subcordate, in the upper pair of leaflets the lower half mostly decurrent to the base of the petiolule (fig. 44) . . . **38. C. australianum**

8. Apex of the leaflets acuminate (sometimes not very distinct), nerves rarely more than 20 pairs, usually less dense and angle more acute, not tortuous, never fading towards the margin; base never as oblique as above.

9. Panicles (also in fruit) 35–40 cm long, pyramidal-paniculate, axillary. Fruits acute-ovoid, up to $1^1/_2$ by 1 cm . . . . **50. C. acutifolium**

9. Inflorescences either terminal, or: smaller, racemose to rather narrowly paniculate. Fruits usually otherwise.

10. Nerves 20–25 pairs, faintly curved, abruptly arching close to the margin. Leaves 6–7-jugate. Leaflets 10–12 by 3–$3^1/_2$ cm. Pistil and fruit glabrous . . **32. C. kostermansii**

10. Nerves mostly less than 20 pairs. Leaves mostly up to 5-jugate. Leaflets usually larger and specially wider. Pistil (and fruit sometimes, specially near the apex) pilose.

11. Inflorescences and infructescences terminal (lower branches sometimes in the upper leaf-axils).

12. Inflorescences narrowly paniculate to racemose, up to 25 cm long; infructescences subracemose. Stipules subulate, inserted on the petiole, usually at some distance (–2 cm) from its base. Flowers slender, corolla 3–4 times as long as the calyx. **33. C. pilosum** *ssp.* **pilosum**

12. Inflorescences and infructescences pyramidal, laxly dichotomously branched, up to 40 cm long. Stipules inserted either at the base of the petiole, or on the petiole up to 5 mm from its base, usually distinctly flattened, *c.* 2 mm wide at the base, sometimes inserted on a rim (fig. 22b). Flowers less slender; corolla *c.* 2 times as long as the calyx.

13. Leaves 1–2(–3)-jugate, thinly and shortly pubescent as are the branchlets. **37. C. fusco-calycinum**

13. Leaves 3- or more-jugate, subglabrous as are the branchlets . . **36. C. dichotomum**

11. Inflorescences and infructescences all axillary.

14. Inflorescences (specially ♀ ones) and infructescences nearly always spicate to narrowly racemose, rarely compoundly spicate or narrowly paniculate (♂ flowers usually in sessile to very shortly stalked glomerules). Flowers 3–7 mm long, the buds minutely globose (in the sometimes rather similar *C. vrieseanum* the buds are rather large and spindle-shaped), corolla *c.* 2 times as long as the calyx; stamens mostly free. Fruits usually acute-ovoid, sometimes subglobular to ellipsoid, up to $1^1/_2$ by $1^1/_4$ cm, mostly glabrous . . . . **51. C. asperum**

14. Inflorescences racemose (♀) to paniculate (♂). Flowers larger; corolla mostly more exserted; stamens in ♂ flowers usually confluent at base and sometimes adnate to the disk. Fruits 2 cm long (in that case more or less velvety tomentose) or more, greatest width central.

15. Stipules inserted on the branchlet, next to the base of the petiole, linear, glabrous. Branchlets with peripheral and central vascular strands in the pith; soon glabrescent. Leaves glabrous; leaflets usually shortly and bluntly acuminate.

16. Leaflets 5–11 by 2–$4^1/_2$ cm. Pyrene of the fruits more or less prominently 3-keeled. **45. C. chinare**

16. Leaflets 11–20 by $4^1/_2$–8 cm. Pyrene either smooth, or: deeply furrowed and distinctly 6-ribbed.

17. Leaflets oblong, 11–20 by $4^1/_2$–7 cm; nerves 10–12 pairs. Fruits peculiar-shaped (fig. 21k) . . . . **48. C. cestracion**

17. Leaflets oblique-ovate, 12–15 by 6–8 cm; nerves 14–16 pairs. Fruits ellipsoid. **44. C. macadamii**

15. Stipules usually inserted on the petiole (sometimes up to 2 cm from its base), subulate, pilose. Pith of the branchlets mostly with only peripheral vascular strands. Branchlets and leaves long remaining somewhat pilose. Leaflets usually with long and slender acumen.

18. Branchlets, leaves, inflorescences, and infructescences usually remaining fulvous- to ferrugineous-tomentose for a long time (if glabrous, branchlets 1–$1^1/_2$ cm thick, gnarly). Leaflets mostly elliptical-oblong. Inflorescences usually cylindrical-paniculate, laxly branched; flower-buds slender, spindle-shaped, closed. Stamens in ♂ flowers confluent to various degree. Fruit calyx deeply 3-lobed. Fruits ellipsoid, usually velvety pubescent . . . . **49. C. vrieseanum**

18. Branchlets, leaves, and inflorescences either ferrugineously hairy, or soon glabrescent. Leaflets ovate to lanceolate. Stamens either distinctly connate, or adnate to the disk. Fruit calyx not deeply 3-lobed. Fruits early glabrescent.

19. Tips of the branchlets puberulous, glabrescent; central vascular strands in the pith forming a second cylinder. Nerves usually slightly sunken at the upper side of the leaflets. At least some of the filaments in ♂ flowers less than halfway connate, all adnate to the disk; disk cylindrical, 3 mm high (fig. 20e). Fruits spindle-shaped, 4 by 2 cm . . . . **52. C. schlechteri**

19. Tips of the branchlets, leaves and inflorescences shaggy ferrugineous-pilose, glabrescent. Pith of the branchlets usually without central vascular strands. Nervation prominulous. Filaments connate halfway up or more, not adnate to the disk. Disk in ♂ flowers cupular, 1 mm high. Fruits usually prismatic, slightly blunt 3-angular, truncate, with 3 distinct shoulders, up to 3¼ by 1½ cm (fig. 21n). **33. C. pilosum** *ssp.* **pilosum**

3. Stipules not subulate; scars mostly linear, or, if on the petiole, drop-shaped (fig. 22d–k).

20. Stipules distinctly (usually more than halfway) incised, rather persistent, parallel-veined (fig. 22i–k).

21. Flowers 11–15 mm long. Fruit calyx 2–2½ cm diam.; fruits 5 by 3½ cm or more. Stipules deeply pectinate, few-lobed, lobes broad (fig. 22j). Leaflets glabrous to slightly scabrous beneath, entire.

22. Stipules inserted at or near the base of the petiole, slightly incised, persistent, glabrous. Leaves glabrescent. Pistil glabrous . . . . **21. C. karoense**

22. Stipules inserted on the petiole, distinctly pectinate, semi-persistent, fulvous-tomentose (fig. 22j). Leaflets usually slightly scabrous below. Pistil pilose . . . . **22. C. megalanthum**

21. Flowers 3–9 mm long. Fruit calyx *c.* 1½ cm diam.; fruits 3½ by 2 cm or less. Stipules usually with many, linear to subulate, often branched, lobes (fig. 22i & k). Leaflets often distinctly tomentose beneath, margin usually more or less dentate.

23. Coarse. Stipules inserted at, rarely on, the base of the petiole, usually large (2–9 by 1½–3½ cm), incised all round, lobes often branched, those near the base longest and most densely branched (fig. 22i). Leaflets rather densely tomentose beneath, nerves very prominent. **19. C. odontophyllum**

23. Slender. Stipules usually inserted on the petiole, smaller (up to 4 by 1½ cm), deeply pectinate (fig. 22k). Leaflets usually glabrous to sparsely pilose, rarely tomentose and with prominent nerves beneath . . . . **20. C. denticulatum**

20. Stipules entire or the margins crenate to fimbriate (though in the latter case the lobes are subulate and rebranched, and up to *c.* 1½ cm long, the incisions never reach the base of the stipule; moreover, the venation is coarsely reticulate), persistent or caducous (fig. 22d–h).

24. Stipules auricle-shaped, small and shrivelled, inserted on the petiole, usually subpersistent; scars drop-shaped (fig. 22e, 25).

25. Leaflets not entire. Inflorescences axillary.

26. Stipules persistent. Twigs, leaves, and inflorescences pubescent. Stamens adnate to the disk. **20. C. denticulatum** *ssp.* **kostermansii**

26. Stipules very caducous. Twigs and leaves glabrous, inflorescences minutely pubescent. Stamens in ♂ flowers halfway connate . . . . **3. C. perlisanum**

25. Leaflets entire. Inflorescences terminal.

27. Leaflets abruptly acuminate; acumen 3–15 mm long, up to 3 times as long as wide, blunt to emarginate. Nerves rather dense (distance along the midrib up to *c.* 1 cm), nearly transverse to the midrib, straight, rather abruptly arching near the margin.

28. Leaflets broadly elliptic, up to 10 by 5 cm; nerves up to 14 pairs . . **13. C. salomonense**

28. Leaflets narrowly elliptic (at least 12 by 4 cm) or broadly ovate (at least 14 by 7 cm); nerves 15–20 pairs . . . . **8. C. maluense**

27. Leaflets gradually acuminate; acumen 6–25 mm long, 3 or more times as long as wide, blunt or acute. Nerves rather lax (distance along the midrib 1–2 cm), oblique to the midrib, curved, gradually arching near the margin.

29. Leaflets 5–15 by 2½–7 cm, *c.* 1¾–2½ times as long as wide; caudate-acuminate, acumen 1–2 cm long, *c.* ⅕ the length of the blade. ♂ Flowers with 3 stamens; ovariodisk with 'style' (*cf.* fig. 20b). Fruits 4¾–7½ by 1¼–2 cm; pyrene acute-3-angular. **5. C. caudatum** *f.* **auriculiferum**

29. Leaflets 8–21 by 3½–10 cm, *c.* 2½ times as long as wide; shortly, broadly, and bluntly, to caudate-acuminate, acumen 1–1½ cm long, *c.* 1/10 the length of the blade. ♂ Flowers with 6–3 stamens; ovariodisk without 'style'. Fruits 3–5½ by 1½–2¾ cm; pyrene blunt-3-angular.

30. Young parts, inflorescences, and leaves (the upper side of the leaflets excepted) rather densely pilose. ♂ Flowers 8 mm long . . . . **12. C. piloso-sylvestre**

30. Glabrous. ♂ Flowers 4 mm long . . . . **11. C. sylvestre**

24. Stipules not auricle-shaped, flattish, mostly inserted near or at the base of the petiole (sometimes partly on the twig), caducous to persistent; scars elliptic to linear (fig. 22d & f–h).

31. Leaflets glaucous-waxy beneath, entirely dentate . . . . **1. C. littorale** *f.* **pruinosum**

31. Leaflets not glaucous-waxy beneath.

32. Nervation very regular, nerves dense, nearly straight and parallel (angle 75–85°), abruptly and distinctly arching. Leaflets regular, elliptic to elliptic-ovate; the base equilateral, rather broad; apex abruptly, shortly, broadly, and bluntly acuminate. Stipules inserted on the base of the petiole or partly on the twig, small, reniformous, very caducous (*cf.* fig. 22d). **8. C. maluense**

32. Nervation less regular; leaflets and/or stipules different.

33. Leaflets pubescent beneath, nearly always dentate.

34. Stipules circular, 1–2 by 1–1$^3/_4$ cm, crenulate, usually inserted on the base of the petiole, semi-persistent. Leaflets subglabrous, nervation not very prominent. **2. C. latistipulatum**

34. Either stipules reniformous, smaller, entire, usually inserted on the branchlet near the base of the petiole, caducous (fig. 22d); or: leaflets densely pubescent beneath, nervation strongly prominent.

35. Fruits spindle-shaped, rarely more than 6 by 3 cm; pericarp fleshy; pyrene rounded 3-angular in cross-section. In the pith of the branchlets nearly always all vascular strands peripherally arranged . . . . **1. C. littorale**

35. Fruits ovate, 3-angular in cross-section, *c.* 8 by 5 cm; pericarp fibrous; pyrene 3-winged (fig. 21d–e). Pith of the branchlets with many scattered vascular strands, no distinct peripheral cylinder . . . . **9. C. megacarpum**

33. Leaflets glabrous (except some occasional hairs on the midrib and the nerves beneath); margin entire to partly, rarely wholly, crenate or dentate.

36. Leaflets not totally entire.

37. Leaflets and stipules coriaceous . . . . **7. C. kinabaluense**

37. Leaflets and stipules chartaceous to herbaceous.

38. Inflorescences axillary. Filaments in ♂ flowers halfway connate . . . **3. C. perlisanum**

38. Inflorescences terminal. Filaments in ♂ flowers slightly connate.

39. Stipules subpersistent, inserted on the base of the petiole. Leaflets wholly distinctly serrate. ♂ Flowers 1$^1/_4$ cm long; disk without 'style' . . . **2. C. latistipulatum**

39. Stipules very caducous, partly inserted on the twig. Leaflets slightly dentate to serrate in the apical part only. ♂ Flowers *c.* 8 mm long; disk with 'style' (fig. 20b). **1. C. littorale**

36. Leaflets entire.

40. Stipules dentate to fimbriate (fig. 22h), usually persistent.

41. Inflorescences all axillary . . . . **21. C. karoense**

41. Inflorescences terminal, lower branches sometimes in the upper leaf-axils.

42. Pyrene 3–4 cm diam., acutely deltoid in cross-section, sometimes winged (fig. 21a–c), sides usually concave. Stipules repeatedly deeply dentate to fimbriate (fig. 22h). **16. C. kaniense**

42. Pyrene 2–3 cm diam., rounded triangular in cross-section, the sides usually convex (fig. 21g). Stipules dentate . . . . **15. C. indicum** *var.* **indicum**

40. Stipules entire (sometimes slightly undulate), often caducous (fig. 22d & f–g).

43. Very coarse: stipules persistent, 4–12 by 4–14 cm, subcoriaceous, margin undulating and more or less slit up; leaflets thick-coriaceous, 25–35 by 13–16 cm. **15. C. indicum** *var.* **platycerioideum**

43. Much more slender; stipules up to 5 by 2 cm, entire; leaflets smaller.

44. Stipules persistent, inserted on the petiole at some distance from its base.

45. Stipules inserted at *c.* $^1/_2$ cm from the base of the petiole, deltoid to lingulate, very stiff (fig. 22f). Inflorescences axillary. . . . . **18. C. ovatum**

45. Stipules inserted at $^1/_2$–1$^1/_2$ cm from the base of the petiole, oblique-obovate, less stiff. Inflorescences terminal . . . . **10. C. lamii**

44. Stipules rather to—mostly—very caducous, usually inserted at the base of the petiole.

46. Stipules oblong, 1–5 by $^1/_2$–1$^3/_4$ cm, rather caducous, inserted on the very base of the petiole or partly on the twig; scar linear, *c.* $^1/_2$ cm long (fig. 22g) . **14. C. vulgare**

46. Stipules reniformous, much smaller, very caducous, usually inserted at the conjunction of petiole and branchlet, sometimes on the petiole at *c.* $^1/_2$ cm from its base; scar elliptic (or, in the latter case, drop-shaped), 1–2 mm long (fig. 22d).

47. Inflorescences axillary. Stipules inserted on the petiole at some distance from its base. **17. C. luzonicum**

47. Inflorescences terminal. Stipules inserted at the conjunction of petiole and branchlet.

48. Leaflets cuneate at the base, long-acuminate to caudate at the apex. Stamens in ♂ flowers 3 . . . . **5. C. caudatum** *f.* **caudatum**

48. Leaflets broadly cuneate to rounded at the base, apex not caudate. Stamens in ♂ flowers 6.

49. ♂ Inflorescences very lax, branches long and transverse. ♂ Flowers 13 mm long. **6. C. divergens**

49. ♂ Inflorescences not very lax. ♂ Flowers *c.* 8 mm long.
50. Veins and reticulations nearly invisible in dried specimens; nerves 5–10–15 pairs, mutual distance along the midrib 1–1½ cm . . . . **4. C. patentinervium**
50. Veins and reticulations more or less prominulous and distinctly visible on the under-surface of the leaflet; nerves 11–15 pairs, mutual distance along the midrib usually up to 1 cm . . . . **1. C. littorale**
1. Stipules and their scars absent.
51. Terminal bud 3–5 cm long.
52. Practically glabrous. Leaves 7–11-jugate; leaflets often distinctly stalked, 2½–4 times as long as wide. Inflorescences broadly paniculate. Apical part of the petals strongly thickened, with rugose lateral surface (fig. 20d). Stamens connate. Fruits 1½ by 1 cm . . . . **42. C. sumatranum**
52. More or less densely pubescent to tomentose. Leaves 3–6-jugate; leaflets subsessile, 2(–3) times as long as wide. Inflorescences narrowly paniculate. Petals only slightly thickened in the apical part. Stamens free. Fruits 7 by 4½ cm or more . . . . **26. C. pseudodecumanum**
51. Terminal bud up to 1½ cm long.
53. Inflorescences terminal. Petals distinctly unguiculate (fig. 20a).
54. Leaves 1–2(–4)-jugate, usually glabrous; leaflets entire; apex shortly blunt-acuminate; leaflets greenish when dry . . . . **23. C. pseudopatentinervium**
54. Leaves (2–)3–7-jugate, very rarely glabrous; leaflets usually minutely fimbriate-serrate; apex blunt or acutely acuminate; leaflets usually brownish when dry.
55. Leaflets elliptic, base cuneate; leaves 2–3-jugate . . . . **24. C. grandifolium**
55. Leaflets more or less irregularly shaped, either greatest width near the base or margins parallel; base rounded or truncate to subcordate; leaves (2–)3–7-jugate . . . . . **25. C. apertum**
53. Inflorescences axillary (with some very rare exceptions). Petals not unguiculate.
56. Leafy part of the branchlets (often much) more than 1 cm diam. (up to 3 cm).
57. Leaflets narrowly lanceolate, 13–20 by 3½–5 cm. Flowers 7 mm long, slender. Fruits 5 by 2½ cm. **41. C. pseudosumatranum**
57. Leaflets usually broader, usually more than 5 cm wide. Flowers 1–1¼ cm long; corolla conical, densely pilose. Fruits up to 3 by 2½ cm . . . . **43. C. hirsutum**
56. Leafy part of the branchlets at most 1 cm diam., mostly much less; if more, than nerves up to 15 pairs and reticulations very dense, tessellate-like and prominulous in dried specimens.
58. Reticulations very dense, tessellate-like, prominent on both surfaces; leaflets mostly large and relatively broad (9–24 by 2–9¼ cm); nerves 8–15 pairs, obliquely patent, curving towards the margin, not distinctly arching . . . . **29. C. balsamiferum**
58. Either reticulations not very dense, not tessellate-like on both surfaces, *or*: leaflets narrow (6¼–15 by 1¼–4 cm) and nerves 15–20 pairs, nearly transverse, distinctly arching at 1–2 mm from the margin.
59. Leaves, inflorescences, and infructescences manifestly lax (lateral petiolules 1–1½ cm, terminal ones 3–4 cm, petioles 10–14 cm, interjugal parts 4–8 cm). Disk in ♂ flowers pistilloid, globular, stalked, hollow (fig. 20c). Fruits oblique, bulging on one side; central canal much widened (fig. 21m) . . . . **35. C. gracile**
59. Leaves, inflorescences, and infructescences not very lax. ♂ Flowers and fruits different.
60. Leaflets narrow (6¼–15 by 1¼–4 cm); nerves nearly transverse, faintly curved, distinctly arching. Leaves 6–12-jugate . . . . **46. C. rigidum**
60. Leaflets nearly always broader; nerves otherwise. Leaves up to 8-jugate.
61. Leaflets pubescent.
62. Acumen of the leaflets long and slender; base usually cuneate. Flowers (1–)1½ cm long; petals not strongly thickened in the apical part; filaments slightly confluent or free. Fruits up to 3 by 1¾ cm, broadly triangular in cross-section . . . . . **31. C. euryphyllum**
62. Acumen of the leaflets short; base rounded to subcordate. Flowers 6 mm long; petals towards the apex strongly thickened and with rugose lateral surfaces (fig. 20d); filaments halfway connate. Fruits at least 4 by 2 cm, deltoid in cross-section . **47. C. polyphyllum**
61. Leaflets glabrous.
63. Filaments at least halfway connate.
64. Nerves 14–17 pairs; leaflets 7–16 by 2½–6 cm. Filaments halfway connate; stamens in ♀ flowers as long as the pistil. Fruit calyx ½ cm diam. . . . . **39. C. intermedium**
64. Nerves 10–12 pairs; leaflets 4–12 by 2–3½ cm. Filaments nearly wholly connate, sometimes with interstaminal teeth; stamens in ♀ flowers about half as long as the pistil. Fruit calyx *c.* 1 cm diam. . . . . **40. C. kipella**
63. Filaments free or confluent at the base only.
65. Stamens pilose. Fruits shortly ovoid, 3½ by 2½ cm, cells equally well developed. **30. C. trigonum**
65. Stamens glabrous. Fruits either relatively longer, or much smaller, always 1 or 2 cells strongly reduced.

66. Fruits less than 2 by $1^{1}/_{2}$ cm, ovoid to obovoid (fig. 21l). Inflorescences usually 30–45 cm long. Disk in ♂ flowers pistilloid, tapering into a short 'style' (fig. 20b). **28. C. oleosum**
66. Fruits at least $2^{1}/_{2}$ by $1^{1}/_{4}$ cm, shaped otherwise. Inflorescences rarely longer than 20 cm. Disk in ♂ flowers not solid and without a 'style'.
  67. Fruits broadly elliptic, broadly triangular in cross-section, up to 3 by $1^{1}/_{2}$ cm. Branchlets soon glabrescent . . . . **31. C. euryphyllum** *var.* **euryphyllum**
  67. Fruits spindle-shaped, rounded deltoid in cross-section, $3^{3}/_{4}$–$4^{1}/_{2}$ by $1^{1}/_{2}$ cm. Branchlets subpersistently pilose . . . . **33. C. pilosum** *ssp.* **borneense**

1. Section Canarium

Sect. Canaria DC. Prod. 2 (1825) 79.—*Sect. Progressiva* and *sect. Regressiva subsect. Auriculata* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 214 and 209.

Stipules either foliaceous (fig. 22d & f–i) or pectinate (fig. 22j–k), enveloping the terminal bud, or small and shrivelled, auricle-shaped (fig. 22e & 25), rarely absent; scars mostly linear or, if on the petiole, drop-shaped. *Bracts* usually consisting of the persistent connate stipules, concave, enveloping the flower buds (fig. 1a–h), rarely lanceolate to subulate. *Leaflets* brownish when dry; margin entire to dentate; indument, if present, shortly tomentose. *Inflorescences* usually terminal, rarely all axillary. *Stamens* usually free or adnate to the disk, very rarely up to halfway connate. ♀ *Flowers* nearly always with a concave receptacle; in that case disk adnate to the receptacle and pistil stalked; *disk* and *pistil* usually glabrous. *Calyx* in fruit rarely less than 1 cm diam., usually flat with undulate margin, or more or less funnel-shaped, often densely tomentose. *Fruits* rather large, usually 5–7 cm long; pyrene smooth, sometimes with angle- and median ribs.

Distr. Africa, Madagascar, Mascarenes, Ceylon, Andamans and Nicobars, Indo-China, *Malaysia*, Solomon Isl., New Hebrides, Fiji, Samoa, and Tonga. The absence of the section in continental Asia outside the Malay Peninsula (except some specimens of *C. littorale* in Indo-China) is remarkable.

1. Canarium littorale BL. Bijdr. (1826) 1164; R. & S. Syst. 7 (1830) 1625; BL. Mus. Bot. 1 (1850) 218; MIQ. Fl. Ind. Bat. 1, 2 (1859) 645; ENGL. in DC. Mon. Phan. 4 (1883) 126; K. & V. Bijdr. 4 (1896) 36; BACK. Schoolfl. (1911) 198; KOORD. Exk. Fl. Java 2 (1912) 433; HEYNE, Nutt. Pl. (1927) 877; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104g, t. 15 f. 119b; Bull. Jard. Bot. Btzg III, 12 (1932) 498, t. 13 f. 82; CORNER, Ways. Trees (1940) t. 39, *sub C. sp.*; H. J. LAM, in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 5; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 11, *cum fig.*; *non* RIDL. Fl. Mal. Pen. 1 (1922) 375 (= *C. patentinervium* MIQ.).—*C. glaucum* BL. Mus. Bot. 1 (1850) 219; MIQ. Fl. Ind. Bat. 1, 2 (1859) 645; ENGL. in DC. Mon. Phan. 4 (1883) 140; KING, J. As. Soc. Beng. 62, ii (1894) 249; MERR. En. Born. (1921) 317; *non* HOCHR. Bull. Inst. Bot. Btzg *no* 22 (1905) 69 (= *Protium serratum* ENGL.).—*C. tomentosum* BL. Mus. Bot. 1 (1850) 219; MIQ. Fl. Ind. Bat. 1, 2 (1859) 644; ENGL. in DC. Mon. Phan. 4 (1883) 120; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 214, t. 12 f. 93, t. 15 f. 119d, e, *incl. var. typicum et var. flavum*; Bull. Jard. Bot. Btzg III, 12 (1932) 496, t. 12 f. 81; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 10, *cum fig.*—*C. serricuspe* MIQ. Fl. Ind. Bat. 1, 2 (1859) 649; ENGL. in DC. Mon. Phan. 4 (1883) 148; HEYNE, Nutt. Pl. (1927) 878.—*C. serrulatum* MIQ. Fl. Ind. Bat. 1, 2 (1859) 646; Ann. Mus. Bot. Lugd. Bat. 4 (1869) 116.—*C. purpurascens* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 532; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 115; KING. J. As. Soc. Beng. 62, ii (1894) 245; RIDL. J. Str. Br. R. As. Soc. *no* 33 (1900) 58; Fl. Mal. Pen. 1 (1922) 370; BURK. Dict. (1935) 432; *non* HENDERS. J. Mal. Br. R. As. Soc. *no* 17 (1939) 39 (= *perlisanum* LEENH.).—*C. rufum* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 533; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 107; KING, J. As. Soc. Beng. 62, ii (1894) 244; RIDL. J. Str. Br. R. As. Soc. *no* 33 (1900) 58; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 17, 22^{14}, 23^{4}; RIDL. Fl. Mal. Pen. 1 (1922) 372; BUCKLEY, Mal. For. Rec. 11 (1932) 34; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 79, t. 13 f. 104 1; Bull. Jard. Bot. Btzg III, 12 (1932) 494, t. 12 f. 80; BURK. Dict. (1935) 432; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 9, *cum fig.*—*C. secundum* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 532; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 116; KING, J. As. Soc. Beng. 62, ii (1894) 250; RIDL. J. Str. Br. R. As. Soc. *no* 33 (1900) 58; HOCHR. Pl. Bog. Exs. (1904) 62; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 9; RIDL. Fl. Mal. Pen. 1 (1922) 375; BURK. Dict. (1935) 432.—*C. acutum* ENGL. in DC. Mon. Phan. 4 (1883) 113.—*C. bennettii* ENGL. in DC. Mon. Phan. 4 (1883) 119.—*C. giganteum* ENGL. in DC. Mon. Phan. 4 (1883) 106.

—*C. pruinosum* ENGL. in DC. Mon. Phan. 4 (1883) 106; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 69; Bull. Jard. Bot. Btzg III, 12 (1932) 492, t. 12 f. 79.—*C. pseudocommune* HOCHR. Pl. Bogor. Exs. (1904) 60, *incl.* also *var. subelongatum*; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 22^2; HOCHR. Ann. Jard. Bot. Btzg Suppl. 3 (1910) 842, *incl.* also *var. genuinum*.—*C. subtruncatum* (*non* ENGL.) BAKER in RENDLE, J. Bot. 72 (1924) Suppl. 16.—*C. flavum* RIDL. Kew Bull. (1930) 81.

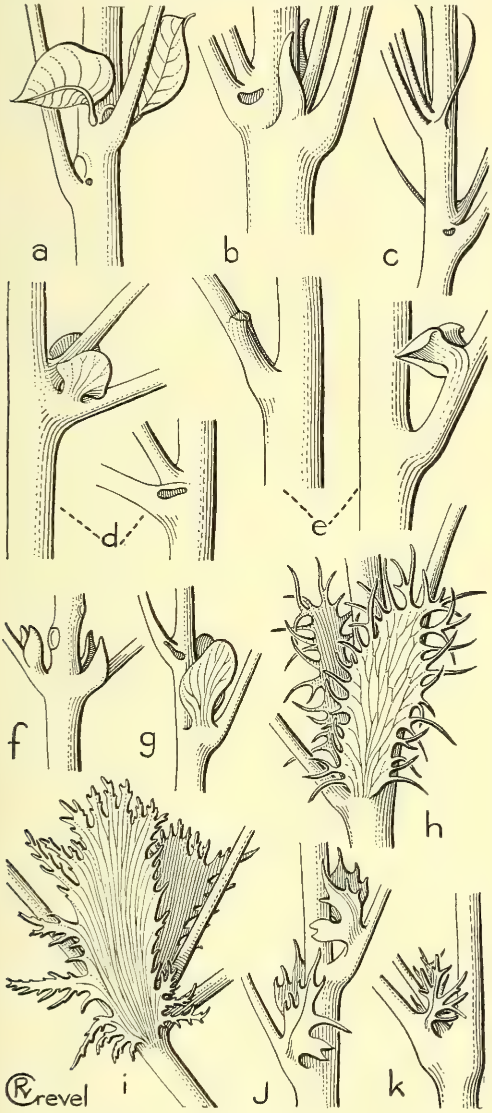

Fig. 22. Different kinds of stipules (and their scars) in *Canarium*. *a.* Pseudostipules in *C. decumanum* GAERTN.—*b–c.* Lanceolate to subulate stipules in *sect. Pimela: b. C. dichotomum* (BL.) MIQ., *c. C. acutifolium* (DC.) MERR. *var. acutifolium*.—*d–k.* Foliar stipules in *sect. Canarium: d. C. caudatum* KING *f. caudatum*, *e. C. sylvestre* GAERTN. with auricle-shaped stipules, *f. C. ovatum* ENGL., *g. C. vulgare* LEENH., *h. C. kaniense* LAUT., *i. C. odontophyllum* MIQ., *j. C. megalanthum* MERR., *k. C. denticulatum* BL. (*d* and *e* × 2, the others × $^2/_3$; scars of stipules shaded).

Tree (3–)10–30(–44) m by 20–70(–100) cm, sometimes buttressed. *Branchlets* $^1/_4$–1 cm thick, glabrescent; pith with some large to many small vascular strands, all or part of them peripherally arranged. *Stipules* caducous, inserted on the branchlet near the base of the petiole, reniformous, 5 by 4 mm, with various intergrades to: subpersistent and inserted on the base of the petiole, semi-rotundate, 17 by 12 mm, margin repandous; nearly always tomentose. *Leaves* (0–)2–6-jugate, 17–60 cm long, glabrous to tomentose. *Leaflets* ovate to oblong-lanceolate, 3–27 by 1–9 cm, chartaceous to coriaceous, smooth to bullate, glabrous—sometimes waxy white beneath—to densely tomentose beneath and on the midrib above; base cuneate to faintly cordate, slightly inequilateral; margin entire to dentate or serrulate; apex (gradually to) rather abruptly shortly acute-acuminate, acumen mostly dentate or serrate; nerves 9–22 pairs (angle 60–90°, gradually decreasing from base to apex), slightly curved, often partly arching near the margin. *Inflorescences* terminal, sometimes with additional ones in the upper leaf-axils, paniculate (♂) to subracemose (♀), 5–40 cm long, often densely reddish-brown tomentose, sometimes glabrous. *Bracts* concave. *Flowers* 8–13 mm long, outside densely ferrugineously pubescent. *Calyx* 4–9 mm high. *Stamens* 6, filaments glabrous, in ♂ flowers often slightly connate, adnate to the disk, in ♀ flowers inserted on the rim of the disk. *Disk* in ♂ flowers from globular, solid, tapering into a style-like appendix, to: cupular, thick-fleshy, without any rudiment of the pistil; 1–3 mm high, nearly always glabrous; in ♀ flowers minute, faintly 6-undulate, glabrous to tomentose. *Pistil* glabrous or pilose. *Infructescenses* 5–25 cm long, densely tomentose, with 1–6 fruits; calyx funnel-shaped, triangular, *c.* 8 mm diam., to: flat, orbicular, $1^1/_2$ cm diam., with undulate margin. *Fruits* ellipsoid (to obovoid), rounded triangular in cross-section, $4^1/_2$–7 by $1^1/_2$–3 cm, sparsely pilose to glabrous; pyrene smooth, acutely triangular in cross-section; lids 2–4 mm thick. *Seeds* 1–2, sterile cells moderately reduced.

Distr. Indo-China and *Malaysia:* Sumatra, Malay Peninsula, W.–E. Java, Borneo. Fig. 24.

HOCHREUTINER described his *C. pseudocommune var. subelongatum* after a specimen in the Bogor botanical garden, which according to him originated from Buru, Moluccas; possibly this should be Buru near Sumatra, in the Riouw Archipelago. The Celebes-specimens, mentioned by H. J. LAM, Bull., *l.c.*, belong in my opinion to *C. maluense* LAUT.

Ecol. Rain-forests on dry or swampy soils, under everwet or (in E. Java) subseasonal conditions, mostly at low altitudes, rarely up to 2000 m. *Fl.* mainly Nov.–Apr.; *fr.* mainly May–Sept.

Wood anat. BEEKMAN, Med. Proefst. Boschw. 5 (1920) 56, DESCH, Mal. For. Rec. 15^1 (1941) 66 (hand lens); MOLL & JANSSONIUS, Mikr. Holzes 2 (1908) 107; WEBBER, Lilloa 6 (1941) 450.

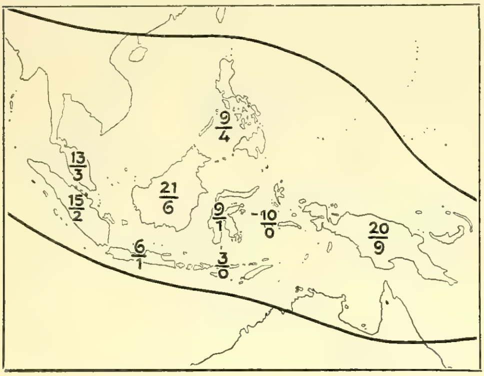

Fig. 23. Distribution of the genus *Canarium* within Malaysia. The number above the hyphen refers to the total number of species, that below the hyphen to the number of endemic species in each island or district.

Uses. The wood is used for house-building, though it is rather soft. The resin is used as a *damar*; in Indo-China it is said to be very sought after by the Chinese as a medicine against itch.

Vern. Sumatra: *madang tjingi*, Atjeh, *andalhe, basang, lalen*, Tapanuli, *damar hija-hija, d. kitimbalun, kalèk djambu, matanbango*, W.C., *kĕdondong (tjĕlana)*, E.C., *damar asam, d. pau*, Bencoolen, *kadundung asĕm, kaju tĕngiling, mardundung, tètak tundjuk*, Palemb., *kaju ariong;* Mal. Pen.: *buak kawa, chabok, damar kijai, gĕrinu, kasumba, kĕdondong bulan, k. gĕgaji, k. kana, k. kĕjai, k. mata hari, k. pasir, kĕrat tĕlampok, k. tĕlunjok, kĕrjijoh, mĕdang bĕladuk, m. bulanati, mĕlang, sangol (sungol) hutam;* Java: *ki kanari, ki tuwak, tanglar*, Sund., *dahu, dĕluwak, gijubug, sadjĕng*, Jav., *bulu*, Mad.; Born.: *mekos*, Brunei, *damar kahingai, djĕl(ĕ)mu (nanking), kawangan, kurihang*, S.E., *bĕkatan, rupai.*

Notes. Very variable, both in vegetative parts and, to a lesser degree, in the flowers. A number of extreme forms in the Malay Peninsula and Borneo surround a variable central form in Sumatra with which they are connected by a large number of transitional specimens. The only form which can sharply be defined is *f.* **pruinosum** (ENGL.) LEENH. *nov. stat.* (*C. pruinosum* ENGL.), confined to Sarawak and characterized by close-dentate leaflets waxy-white beneath.

2. Canarium latistipulatum RIDL. Kew Bull. (1930) 81; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 5 f. 15, t. 15 f. 119a; Bull. Jard. Bot. Btzg III, 12 (1932) 508, t. 13 f. 86.—*C. littorale* (*non* BL.) H. J. LAM, in Merr. Pl. Elm. Born. (1929) 116.

Tree 5–7 m by 10–15 cm. *Branchlets c.* $^1/_2$ cm thick, glabrescent; pith with a peripheral cylinder of vascular strands appressed to the wood. *Stipules* subpersistent, inserted on the base of the petiole (up to $2^1/_2$ mm high), rounded-ovate, 1–2 by 1–$1^3/_4$ cm, margin minutely crenulate. *Leaves* 3–5-jugate. *Leaflets* oblong-lanceolate, 7–17 by 4–7 cm, chartaceous, subglabrous; base broadly cuneate; margin serrate or dentate; apex abruptly rather long and slender acute-acuminate; nerves 9–13 pairs (angle 60–70°), slightly curved, distinctly arching close to the margin. *Inflorescences* (♀ unknown) terminal, laxly paniculate, 15–30 cm long, glabrescent. *Flowers* (♂) $1^1/_4$ cm, outside pulverulent. *Calyx* 3–5 mm high. *Stamens* glabrous, slightly connate at the base, sometimes adnate to the disk. *Disk* cupular, thick and fleshy, 1–2 mm high, glabrous, without pistil. *Infructescences* terminal, paniculate, $5^1/_2$ cm, densely tomentose, with 3 fruits; calyx funnel-shaped, triangular, 7 by 11 mm. *Fruits* unknown.

Distr. *Malaysia:* Borneo (Sarawak and Br. N. Borneo). Fig. 24.

Ecol. Lowland forest up to 150 m, apparently rare. *Fl.* Febr., *fr.* July.

Vern. *Dayaw*, Kedayan, Br. N. B., *moitos hutan*, Sarawak.

3. Canarium perlisanum LEENH. Blumea 8 (1955) 186.—*C. ? purpurascens* HENDERS. J. Mal. Br. R. As. Soc. 17 (1939) 39.

Tree *c.* 10 m. *Branchlets* $^1/_2$ cm thick, glabrous; pith with a peripheral cylinder of small vascular strands. *Stipules* caducous, inserted on the petiole $^1/_2$–1 cm from its base, scars 3 mm long. *Leaves* 2-jugate, glabrous. *Leaflets* subsessile, broadly-elliptic, 11–16 by 5–7 cm, chartaceous; base rounded; margin crenulate, specially near the apex; apex gradually, long and broadly, blunt-acuminate; nerves 14–18 pairs (angle *c.* 50°), straight, gradually arching close to the margin. *Inflorescences* (♀ unknown) axillary, narrowly paniculate, up to *c.* 13 cm long, most of the flower-clusters nearly sessile, glabrescent. *Bracts* concave. *Flowers* (♂) 8 mm, outside thinly tomentose. *Calyx* 4 mm high. *Stamens* glabrous, filaments halfway connate. *Disk* cylindrical, 6-lobed, 1 mm high, thinly pilose on the conical upper surface, with a central canal; no pistil. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* Malay Peninsula (Perlis), once collected. Fig. 24.

Ecol. Limestone hill, 70 m, *fl.* April.

Note. Taxonomically a rather remarkable species. Apparently related to *C. littorale* BL., though the axillary inflorescences and the connate stamens are quite unusual in this section, as is the combination of rather many nerves and stipules which are inserted on the petiole.

4. Canarium patentinervium MIQ. Sum. (1861) 526; KURZ, J. As. Soc. Beng. 44, ii (1875) 142, *sphalm. patentissimum*; ENGL. in DC. Mon. Phan. 4 (1883) 148; HOCHR. Pl. Bog. Exs. (1904) 59, *incl. var. genuinum* and *var. meizocarpum*; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. $22^{3,7}$; HEYNE, Nutt. Pl. (1927) 878; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931) t. 5 f. 11, t. 6 f. 29c; Bull. Jard. Bot. Btzg III, 12 (1932) 506; CRETZOIU, in Fedde, Rep. 36 (1934) 267, *incl.* also *var. nitidum*.—*C. subrepandum* MIQ. Sum. (1861) 525.—*C. nitidum* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 533; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 108; KING, J. As. Soc. Beng. 62, ii (1894) 251; RIDL. J. Str. Br. R. As. Soc. *no* 33 (1900) 58; Fl. Mal. Pen. 1 (1922) 373; BURK. Dict. (1935) 431.—*C. parvifolium* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 536; Pharm. J. Trans. III, 6 (1875) 104; ENGL. in DC. Mon. Phan. 4 (1883) 140; KING, J. As. Soc. Beng. 62, ii (1894) 241.—*C. ? littorale* (*non* BL.) RIDL. Fl. Mal. Pen. 1 (1922) 375.

Tree 12–40 m by 20–50(–180?) cm. *Branchlets* ½ cm thick, glabrescent; pith with a peripheral cylinder of rather large vascular strands and mostly some scattered small ones in the central part. *Stipules* caducous, inserted at the conjunction of branchlet and petiole, about reniformous, 3–5(–12) mm. *Leaves* (2–)3–4(–5)-jugate, 15–37 cm long, glabrous. *Leaflets* ovate to oblong-lanceolate, 4¼–6½–18 by 1½–3½–7¼ cm, coriaceous, shining beneath; base subequilateral, broadly cuneate (to subcordate); margin entire; apex gradually to subabruptly, shortly and bluntly acuminate; nerves 5–15 pairs (angle 60–70°), widely spaced, slightly curved, distinctly arching at some distance from the margin, not very conspicuous above; reticulations nearly inconspicuous. *Inflorescences* terminal, some main branches sometimes in the upper leaf-axils, ♂ ones laxly paniculate, (7–)15–20(–30) cm long, thinly tomentose, many-flowered; ♀ ones more dense, 2–10 cm long, more densely tomentose and few-flowered. *Flowers* ¾–1 cm, pubescent outside. *Calyx* nearly truncate, in ♂ flowers 2½–4 mm high, in ♀ ones 6 mm. *Stamens* 6, glabrous, in ♂ flowers slightly connate at the base and sometimes adnate to the disk, in ♀ flowers rather strongly reduced, inserted on the disk. *Disk* in ♂ flowers pistilloid, globular, sometimes stalked, tapering into a long style-like appendix, in total 2 mm high; in ♀ flowers adnate to the receptacle, if this is concave; always glabrous. *Pistil* glabrous. *Infructescences* 6–8 cm long, densely and shortly, ferrugineously woolly-tomentose, with 1–2(–4) fruits; calyx flat, 3-lobed, 11–14 mm diam. *Fruits* ellipsoid to obovoid, round to rounded-triangular in cross-section, glabrous, 3–6 by 1¾–3 cm; pyrene smooth; lids 3–5 mm thick. *Seeds* 1–3; sterile cells more or less reduced.

Distr. *Malaysia:* Sumatra, Malay Peninsula, Banka, Anambas Islands, Borneo. Fig. 24.

Ecol. Primary forests, up to 450 m (rarely up to 1150 m), *fl.* mainly Nov.–May; *fr.* mainly Sept.–April.

Vern. Sumatra: *kaju pandan, madang merpalam*, W.C., *kaju kana, palam palam*, E.C., *kĕdondong tulang, tĕta tundju*, Palemb.; Mal. Pen.: *kaju kĕdapak, kana hutan, kĕdondong, k. batu, k. bulan, k. kĕrot, k. krut;* Borneo: *bĕlasah, keramoh.*

Notes. Nearest related to *C. littorale* BL.; some intermediate specimens are known from Sumatra and Banka. However, the two species are nearly always quite distinguishable, specially in their leaf-characters.

Some specimens from the Mahakam river, E. Borneo, are intermediate between this species and *C. maluense* LAUT.

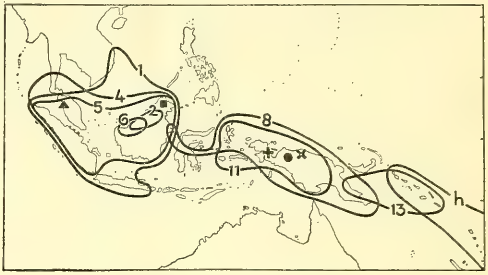

Fig. 24. Distribution of *C. littorale* BL. and its allies. 1. *C. littorale* BL., 2. *C. latistipulatum* RIDL., 3. *C. perlisanum* LEENH. (▲), 4. *C. patentinervium* MIQ., 5. *C. caudatum* KING, 6. *C. divergens* ENGL., 7. *C. kinabaluense* LEENH. (■), 8. *C. maluense* LAUT., 9. *C. megacarpum* LEENH. (●), 10. *C. lamii* LEENH. (**x**), 11. *C. sylvestre* GAERTN., 12. *C. piloso-sylvestre* LEENH. (+), 13. *C. salomonense* B. L. BURTT, h. *C. harveyi* SEEM.

In its vegetative parts very similar to the Malay Peninsular specimens of *C. caudatum* KING, a species with only 3 stamens in the ♂ flowers.

In my opinion the majority of the species of *sect. Canarium* have been derived from *C. patentinervium* and in a lesser degree from *C. littorale* BL.

5. Canarium caudatum KING, J. As. Soc. Beng. 62, ii (1894) 240; RIDL. Fl. Mal. Pen. 1 (1922) 370; Kew Bull. (1930) 81; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931–32) t. 5 f. 12, t. 11 f. 57, t. 13 f. 104m; Bull. Jard. Bot. Btzg III, 12 (1932) 443, t. 9 f. 54.—*C. pauciflorum* RIDL. Kew Bull. (1930) 80; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 55, t. 15 f. 119c; Bull. Jard. Bot. Btzg III, 12 (1932) 502, t. 13 f. 83.—**Fig. 22d.**

Tree up to 18 m by 40 cm. *Branchlets c.* 3 mm thick, glabrescent; pith with a peripheral cylinder of large and small vascular strands. *Stipules* from: very caducous, inserted at the conjunction of branchlet and petiole, reniformous, *c.* 2 mm long, to: subpersistent, inserted on the petiole up to ¾ cm from its base, auricle-shaped, 3–5 mm long. *Leaves* 0–3(–4)-jugate, glabrous. *Leaflets* elliptic-ovate to elliptic-lanceolate, tapering at base and apex, 5½–12(–17) by 2½–5(–7¼) cm, subcoriaceous; base cuneate; margin entire; apex caudate-acuminate; nerves 7–11 pairs (angle 60–80°), curved, distinctly arching at some distance from the margin, not very conspicuous. *Inflorescences* terminal, laxly paniculate, thinly tomentose to glabrous, ♂ ones 10–30 cm long, ♀ ones 7–15 cm. *Flowers* subglabrous, ♂ ones 3–6 mm, ♀ ones 7–10 mm. *Calyx* subtruncate, in ♂ flowers 1–2 mm high, in ♀ ones 4 mm. *Stamens* glabrous, in ♂ flowers 3, adnate to the disk, in ♀ flowers 6, slightly confluent at the base, inserted on the disk. *Disk* in ♂ flowers consisting of 3 tomentose alternistaminal lobes, which are adnate to the rudimentary pistil, the latter being glabrous, flat, tapering into a filiformous, rudimentary style; in ♀ flowers glabrous, adnate to the receptacle and to the stamens. *Pistil* glabrous. *Infructescences* up to 15 cm long with few fruits; calyx funnel-shaped, faintly 3-lobed, 7–9 mm diam. *Fruits* spindle-shaped, triangular in cross-section, 4³/₄–7¹/₂ by 1¹/₄–2¹/₄ cm, glabrous; pyrene acutely triangular; lids *c.* ¹/₄ cm thick. *Seeds* 1–2; sterile cells rather strongly reduced.

Distr. *Malaysia:* Sumatra, Malay Peninsula, Borneo. Fig. 24.

Ecol. Primary forests, sometimes bamboo-forests, up to *c.* 250 m, *fl.* mainly April–July, *fr.* mainly Oct.

Vern. Sumatra: *kaju damar arijong*; Mal. Pen.: *buah kayak, kĕdondong kuning*; *damar bĕdundung.*

Notes. The following two forms can be distinguished:

f. **caudatum.** Stipules small, reniformous, inserted partly on the branchlet (fig. 22d). Leaves and flowers large. Occupies the area of the species.

f. **auriculiferum** LEENH. Blumea 8 (1955) 181. Stipules auricle-shaped, inserted on the petiole. Leaves and flowers small. Sumatra and Borneo.

The major part of the specimens can be definitely referred to one of these forms, although a few are transitional. *Forma caudatum* is, specially in the Malay Peninsula, closely resembling *C. patentinervium* MIQ., from which it differs essentially only in its 3-staminate ♂ flowers.

6. Canarium divergens ENGL. in DC. Mon. Phan. 4 (1883) 143; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 89; Bull. Jard. Bot. Btzg III, 12 (1932) 503, t. 13 f. 84.

Tree. *Branchlets c.* ¹/₄ cm thick, glabrous; pith with a peripheral cylinder of vascular strands and some central scattered ones. *Stipules* caducous, inserted on the base of the petiole, probably small. *Leaves* (1–)2–3-jugate. *Leaflets* oblong-lanceolate to elliptic-oblong, 5¹/₂–10¹/₂ by 2¹/₂–4¹/₂ cm, subcoriaceous, glabrous; base broadly cuneate to rounded; margin entire; apex subabruptly, broadly blunt-acuminate; nerves 8–11 pairs (angle 50–60°), straight to faintly curved, abruptly arching close to the margin. *Inflorescences* (♀ unknown) terminal and in the upper leaf-axils, broadly and very laxly paniculate, 10–15 cm long, with *c.* 12–15 flowers, subglabrous. *Flowers* (♂) 1¹/₄ cm long, outside pubescent. *Calyx* 9 mm long. *Stamens* glabrous, often connate at base and adnate to the disk. *Disk* semiglobular to conical, 1 mm high, bearing on its top the tiny rudimentary pistil, glabrous. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* Borneo (Sarawak: Mattang), twice collected. Fig. 24.

Note. Apparently related to *C. patentinervium* MIQ.

7. Canarium kinabaluense LEENH. Blumea 8 (1955) 182, f. 1.

Tree 20 m by 25 cm. *Branchlets* ¹/₂–³/₄ cm thick, often lenticellate, glabrescent; pith with a peripheral cylinder of small vascular strands. *Stipules* subpersistent, inserted on the base of the petiole, suborbicular to elliptic, ³/₄–2¹/₂ by ³/₄–2 cm, subcoriaceous, densely sericeous-pubescent to glabrous, entire to denticulate, nerves anastomosing, conspicuous. *Leaves* 2–4-jugate. *Leaflets* broadly lanceolate to ovate or elliptic, 8–15–20 by (3¹/₂–) 5¹/₂–10 cm, coriaceous, glabrous; base rounded to broadly cuneate; margin crenulate to the apex; apex rather abruptly broadly acute-acuminate; nerves (8–)11–12(–19) pairs (angle variable), straight to curved, gradually arching at some distance from the margin. *Inflorescences* unknown. *Infructescences* terminal, laxly paniculate, 15–20 cm long, glabrescent, with *c.* 12 fruits; calyx widely funnel-shaped, 1¹/₄ cm diam., with remnants of an annular, fimbriate disk and free stamens. *Fruits* narrowly spindle-shaped, triangular in cross-section, acute at base and apex, 6–6¹/₂ by 2–3 cm, glabrous; pyrene rounded triangular, smooth except the 3 acute angle ribs near the apex; lids 3 mm thick. *Seed* 1; sterile cells more or less strongly reduced and more or less shifted to the surface.

Distr. *Malaysia:* N. Borneo. Fig. 24.

Ecol. Altitude mostly 1000–1500 m, *fl. fr.* Dec.–Jan.

Notes. Related to *C. patentinervium* MIQ. and to *C. divergens* ENGL. Referred by MERRILL (J. Str. Br. R. As. Soc. *no* 86, 1922, 318) to *C. pseudocommune* HOCHR., by H. J. LAM (Bull. Jard. Bot. Btzg III, 12, 1932, 498) to *C. littorale* BL.

8. Canarium maluense LAUT. Bot. Jahrb. 56 (1920) 323, f. 1; LANE-POOLE, For. Res. Pap. (1925) 99; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 90; Bull. Jard. Bot. Btzg III, 12 (1932) 504, t. 13 f. 85; LEENH. Blumea 8 (1955) 184, f. 5b.—*C. lian* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 209, t. 12 f. 92, t. 15 f. 116b; Bull. Jard. Bot. Btzg III, 12 (1932) 440, t. 9 f. 52.—*C. quadrangulare* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 219, f. 104o, f. 116c; Bull. Jard. Bot. Btzg III, 12 (1932) 441, t. 14 f. 94.

Note. This species is intermediate between the West-Malaysian *littorale*-group (species 1–7) and the East-Malaysian species (9–13) with auricle-shaped stipules.

ssp. **maluense.**—*C. lian* H. J. LAM.—*C. quadrangulare* H. J. LAM.—**Fig. 21h.**

Tree 15–40 m by 15–60 cm. *Branchlets* 3–7 mm thick, glabrescent, often lenticellate; pith rather loose, vascular strands from many scattered small ones to some large peripheral ones. *Stipules* from caducous, inserted at the base of the petiole, scaly, 3 by 2 mm, to: persistent, inserted on the petiole up to ³/₄ cm from its base, auricle-shaped, up to 1¹/₂ by 1¹/₄ cm. *Leaves* 1–4-jugate. *Leaflets* ovate to oblong-elliptic, 4–15–25 by 3–10 cm, (sub)-coriaceous, smooth to more or less bullate, subglabrous, rarely rather densely tomentose beneath; base broadly cuneate to subcordate, nearly equilateral; margin entire; apex rather abruptly, shortly and bluntly acuminate, acumen often emarginate; nerves rather dense, 10–25 pairs (angle 90–60°, decreasing from base to apex), straight to faintly curved, abruptly arching at some distance from the margin. *Inflorescences* terminal and in the upper leaf-axils, paniculate, 1½–10 cm long, tomentose, flowers clustered. *Flowers* 3–6 mm long, outside tomentose. *Calyx* 1–4 mm high. *Stamens* 6 (in ♂ flowers a slight tendency to reduce this number), glabrous, in ♂ flowers more or less adnate to the disk, in ♀ flowers inserted on its rim. *Disk* glabrous to pilose, in ♂ flowers ovoid to globular, solid, ½–1 mm high; in ♀ ones adnate to the receptacle. *Pistil* partly pubescent. *Infructescences* paniculate, 4–10 cm long, tomentose to lenticellate, with up to 20 fruits; calyx flat to saucer-shaped, indistinctly 3-lobed, 1–1¼ cm diam. *Fruits* ovoid to ellipsoid, round (to quadrangular) in cross-section, 1¾–3 by 1–1¾ cm, glabrous; pyrene smooth, round to blunt-angular; lids 3–4 mm thick. *Seeds* 1(–2); sterile cells strongly reduced, sometimes more or less displaced to the periphery.

Distr. *Malaysia:* Central Celebes, Moluccas (Morotai, Batjan, Aru Islands), New Guinea (incl. also Schouten Island). Fig. 24.

Ecol. Primary rain-forests, 0–1100 m, *fl. fr.* Jan.–Dec.

Vern. *Kapur-barus, morohulo (motaha)*, Celebes, *lian*, Morotai, *pudjut, tebèngè*, Batjan, *aruk, nanari laki-laki* (♂), *n. pĕrampuan* (♀), *nasbin* (♀), *nasnon* (♂), *sisilo*, New Guinea.

Notes. *Ssp. maluense* is a rather variable population showing in many characters a gradual change from West to East. The main variations are found in the insertion of the stipules, the form of the leaflets, the number of the nerves, and the reduction of the sterile cells in the fruits. No sharply defined forms can be distinguished.

ssp. **borneense** Leenh. Blumea 8 (1955) 184.

Tree up to 20 m by 40 cm, buttressed. *Stipules* caducous, small, inserted at the conjunction of branchlet and petiole. *Leaflets* elliptic, 6–15 by 2¾–5½ cm (*c.* 2½ times as long as broad); nerves 10–12(–15) pairs. *Inflorescences* laxly paniculate, few-flowered. *Flowers* 8–9 mm long. *Stamens* slightly connate at base. *Disk* in ♂ flowers pistilloid, gradually narrowed into a filiformous rudimentary style. *Pistil* glabrous. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* E. Borneo (Peak of Balikpapan). Fig. 24.

Ecol. Alt. 0–700 m, *fl.* June-July.

Note. Intermediate between on one side *C. patentinervium* and *C. caudatum* and on the other side *C. maluense ssp. maluense.*

9. Canarium megacarpum Leenh. Blumea 8 (1955) 186, f. 3. —**Fig. 21d–e.**

Tree 35 m by 40 cm. *Branchlets* 1¼ cm thick, glabrescent; pith with many scattered small vascular strands. *Stipules* caducous, inserted on the base of the petiole, reniformous, 5 by 8 mm, densely tomentose, margin denticulate. *Leaves* 4–5-jugate. *Leaflets* ovate to elliptic-oblong, 15–17½(–19) by 5–7(–8½) cm, subcoriaceous, shortly fulvous-tomentose on midrib above and on all nerves beneath; base rounded to truncate; margin entire; apex rather abruptly shortly acute-acuminate; nerves 17–22 pairs (angle 55°), straight to faintly curved, only in the apical part distinctly arching. *Inflorescences, flowers* and *infructescences* unknown. *Fruits* ovoid, triangular in cross-section, 8 by 5 cm, glabrous; pericarp ½ cm thick, fibrous; pyrene sharply 3-winged, lids concave, scaberulous, 3–3½ mm thick. *Seeds* 2; sterile cell moderately reduced.

Distr. *Malaysia:* Dutch North New Guinea, once collected. Fig. 24.

Ecol. Primary forest. *Fr.* April.

Vern. *Anaiwokar*, Idore dial.

10. Canarium lamii Leenh. Blumea 8 (1955) 184, f. 2.

Tree 20 m by 50 cm. *Branchlets* 6–7 mm thick, scurfy; pith with a peripheral cylinder of small vascular strands. *Leaves* 3-jugate, glabrous. *Stipules* subpersistent, inserted on the petiole, 1–1½ cm from its base, decurrent, oblique-obovate, 1¼–2 by 1 cm, rather stiff. *Leaflets* ovate to lanceolate, 11–18 by 6–7 cm, coriaceous; base slightly oblique, rounded; margin entire; apex rather abruptly, shortly and bluntly acuminate; nerves 10–12 pairs (angle 60–80°), moderately curved, more or less distinctly arching close to the margin. *Inflorescences* and *flowers* unknown. *Infructescences* terminal, small, with 1 fruit; calyx flat, orbicular, 1¾ cm diam. *Fruits* ovoid, 6 by 4 cm, glabrous; pericarp ½–¾ cm thick, fibrous; pyrene smooth, rostrate at the apex, in cross-section rounded triangular; the lids ¾ cm thick, very hard. *Seeds* 1–2.

Distr. *Malaysia:* New Guinea (Hollandia), once collected in young secondary forest at very low alt., *fr.* in Oct. Fig. 24.

Vern. *Djaäto kĕnari.*

Note. Apparently related to *C. harveyi* Seem., a Melanesian species, which occurs from the Solomon Islands to Samoa.

11. Canarium sylvestre Gaertn. Fruct. 2 (1791) 99, t. 102; DC. Prod. 2 (1825) 79; Heyne, Nutt. Pl. (1927) 879; H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 54, t. 13 f. 104f, t. 15 f. 116a; Bull. Jard. Bot. Btzg III, 12 (1932) 442, t. 9 f. 53; *non* Bl. Mus. Bot. 1 (1850) 217 (= *C. denticulatum* Bl.).—*C. sylvestre alterum* Rumph. Herb. Amb. 2 (1741) 155, t. 49.—*C. sylvestre* Willd. Sp. Pl. 4 (1805) 760; Roxb. Hort. Beng. (1814) 49; Fl. Ind. 3 (1832) 137, *excl. syn. Pimela nigra et C. pimela.*—*C. simplicifolium* Engl. in DC. Mon. Phan. 4 (1883) 146.—*C. branderhorstii* Laut. Bot. Jahrb. 56 (1920) 322.—*C. appendiculatum* Laut. Bot. Jahrb. 56 (1920) 331.—**Fig. 22e.**

Tree *c.* 20 m by 40 cm, sometimes buttressed. *Branchlets c.* ½ cm thick, glabrescent; pith with some large peripheral vascular strands, sometimes also some central ones. *Stipules* persistent, inserted on the petiole at ¼–1 cm from its base, auricle-shaped, 1½–4 mm long, thinly tomentose. *Leaves* 0–3-jugate, glabrous. *Leaflets* oblong-lanceolate to elliptic-oblong, 8–21 by 3½–10 cm, chartaceous, reddish-brown to cinnamomeous when dry; base cuneate; margin entire; apex subabruptly, long, and slender, blunt-acuminate; nerves 8–15 pairs (angle 60–70°), faintly curved, distinctly arching near the margin. *Inflorescences* (♀ unknown) terminal and sometimes in the upper leaf-axils, paniculate, 4–32 cm long, glabrous. *Flowers* (♂) *c.* 3 mm long, glabrous outside. *Calyx* 2–3 mm high. *Stamens* 6–3, free, glabrous. *Disk* cushion-shaped, solid, *c.* 1 mm high, glabrous. *Infructescences* terminal, narrowly paniculate, 6–7 cm long, with few fruits; calyx flat, triangular to nearly orbicular, 9–12 mm diam. *Fruits* ovoid, 3–5½ by 1½–2¾ cm, round to bluntly triangular in cross-section, glabrous; pyrene smooth with a blunt rib in the apical part of each angle; lids 2½–3½ mm thick. *Seeds* 3–1; sterile cells mostly slightly reduced.

Distr. *Malaysia:* Moluccas (Morotai, Buru, Ceram, Ambon), New Guinea. Fig. 24.

Ecol. In primary mixed and sagu forests at low altitudes, up to 850 m, *fl.* mainly Aug., *fr.* April–Sept.

Uses. The wood, the resin and the seeds are sometimes used; they are of minor importance.

Vern. *Kai ia, nierlaaj,* Ceram, *kĕnari hutan, k. janele, nanari,* Ambon.

Note. BLUME, *l.c.*, misinterpreted a specimen of *C. denticulatum* BL. *f. fissistipulum* LEENH. as belonging to this species, and so erroneously recorded *C. sylvestre* from Sumatra. In this he was followed by MIQUEL (1859 & 1860) and by ENGLER (1883).

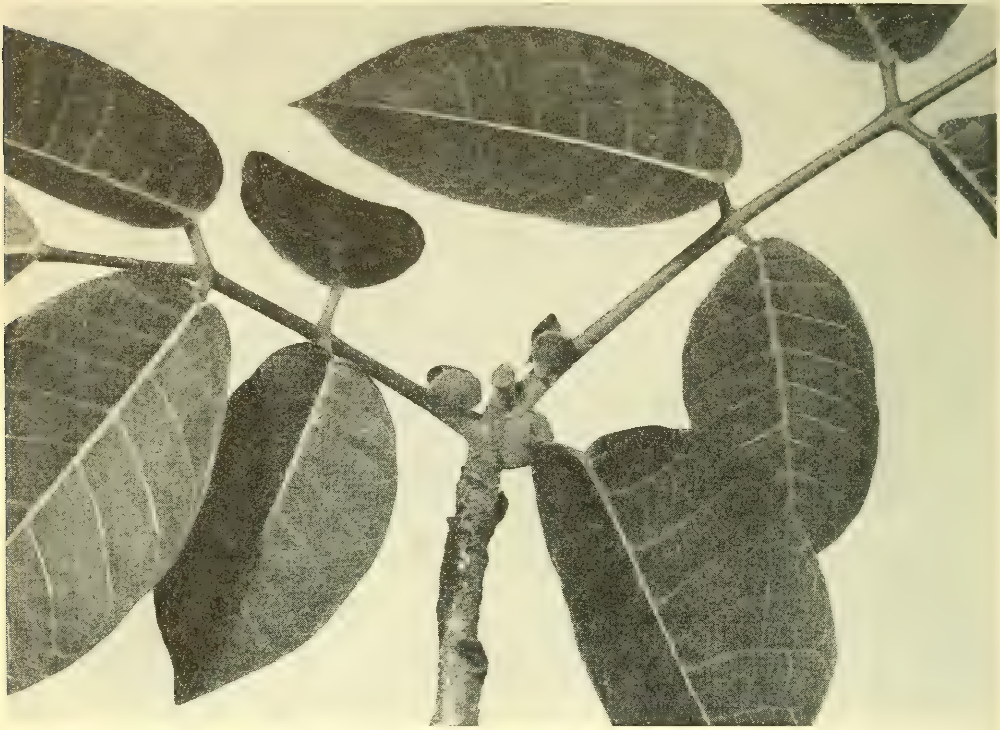

Fig. 25. Auricle-shaped stipules in *C. zeylanicum* (RETZ.) BL. from Ceylon (Cult. Hort. Bog. VII–B–13).

12. Canarium piloso-sylvestre LEENH. Blumea 8 (1955) 186.

Large tree. *Branchlets c.* 4 mm thick, long remaining densely ferrugineously woolly pubescent; pith with a number of small vascular strands, most of them arranged into a peripheral cylinder. *Stipules* subpersistent, inserted on the petiole up to 8 mm from its base, auricle-shaped to lingulate, up to 6 by 3½ mm, stiff, pilose. *Leaves* 1–2-jugate. *Leaflets* elliptic to obovate, 10–12 by 4½–6 cm, chartaceous, reddish-brown when dry, glabrous above, sparsely pilose beneath; base equilateral, cuneate; margin entire; apex rather abruptly long and slender blunt-acuminate; nerves 11–12 pairs (angle 60–70°), curved, distinctly arching at *c.* 3 mm from the margin, slightly sunken above. *Inflorescences* (♀ unknown) terminal, narrowly paniculate, *c.* 15 cm long, densely woolly pubescent. *Flowers* (♂) 8 mm long, glabrous outside. *Calyx* ¼ cm high, subtruncate. *Stamens* 3, slightly adnate to the disk, glabrous. *Disk* cylindrical, solid, 3-lobed, 2 mm high, glabrous. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* W. New Guinea (MacCluer Bay), once collected. Fig. 24.

Ecol. Alt. 50 m, *fl.* May.

Note. Closely related to *C. sylvestre* GAERTN.

13. Canarium salomonense B. L. BURTT, Kew Bull. (1935) 302.

ssp. **papuanum** LEENH. Blumea 8 (1955) 188, f. 5f.—**Fig. 21f.**

Buttressed tree up to 30 m by 30–50 cm, sometimes with stilt-roots. *Branchlets* 1/2–3/4 cm thick, glabrescent; pith with several small vascular strands, partly peripherally arranged. *Stipules* subcaducous, inserted on the petiole at 4–15 mm from its base, auricle-shaped, 3–4 by 7 mm. *Leaves* 2–3-jugate. *Leaflets* elliptic, 7–10 by 3–5 cm, chartaceous to coriaceous, glabrous; base rounded to subcordate; margin entire; apex abruptly, short- and blunt-acuminate; nerves 8–14 pairs (angle *c.* 70°) straight to slightly curved, distinctly arching at some distance from the margin. *Inflorescences* terminal, short ferrugineous-pubescent, glabrescent, ♂ ones laxly paniculate, 20–30 cm long, many-flowered, ♀ ones more slender, 8–20 cm long, less-flowered. *Flowers* tomentose outside, ♂ ones 4–5 1/2 mm long, ♀ ones *c.* 1 cm. *Calyx* in ♂ flowers 2 mm, in ♀ flowers 5 1/2 mm. *Stamens* 6, glabrous, adnate to the disk. *Disk* glabrous, in ♂ flowers cylindrical, 6-lobed, 1 mm high, with a central canal, in ♀ flowers adnate to the receptacle, free rim 6-undulate, 1 1/2 mm high. *Pistil* glabrous, in ♂ flowers none. *Infructescences* 10–12 cm long, with 1–4 fruits; calyx flat, faintly 3-lobed to orbicular, 1 cm diam. *Fruits* flattened ellipsoid, *c.* 3 1/2 by 2 1/4 by 1 1/2 cm, glabrous; pericarp fibrous; pyrene smooth, pointed at the base and with 3 strong, blunt, white ribs at the apex; lids 3–5 mm thick. *Seed* 1; sterile cells strongly reduced.

Distr. *Malaysia:* E. New Guinea (Papua, Northern Div.). Fig. 24.

Ecol. Rain-forest up to 400 m alt., *fl. fr.* Sept.

Uses. In the Solomon Islands *ssp. salomonense* is cultivated for its seeds.

Vern. *Akoreh, bananga, fifi(u), pèpèura.*

14. Canarium vulgare LEENH. Bull. Bish. Mus. *no* 216 (1955) 31, f. 13; Blumea 8 (1955) 188.—*C. vulgare tertia et quarta species* RUMPH. Herb. Amb. 2 (1741) 146, t. 47 F–I; LOTSY, in Rumph. Gedenkb. (1902) t. opp. p. 46.—*C. commune* L. Mant. 1 (1767) 127, *pro min. part., typo excl.*; BL. Bijdr. (1826) 1161, *p.p.*; R. & S. Syst. 7, 2 (1830) 1622; BL. Mus. Bot. 1 (1850) 214, *incl.* also *var. minor*; MIQ. Fl. Ind. Bat. 1, 2 (1859) 643; BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 531; Pharm. J. Trans. III, 6 (1875) 102; ENGL. in DC. Mon. Phan. 4 (1883) 112, t. 2 f. 35–39; KING, J. As. Soc. Beng. 62, ii (1894) 246; E. & P. Pfl. Fam. 3, 4 (1896) f. 136 A–E; ed. 2, 19a (1931) f. 211 A–E; K. & V. Bijdr. 4 (1896) 35; BACK. Fl. Bat. 1 (1907) 264; Schoolfl. (1911) 198; KOORD. Exk. Fl. Java 2 (1912) 433; Koord. Atlas 1 (1913) t. 149; HEYNE, Nutt. Pl. (1927) 873; PETCH, Ann. R. Bot. Gard. Perad. 11 (1930) 279, t. 35 & 36; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) f. 51, t. 15, f. 124; Bull. Jard. Bot. Btzg III, 12 (1932) 509; VAN HEURN & H. J. LAM, Blumea Suppl. 1 (1937) 97; STEEN. Trop. Natuur 27 (1938) 54; CORNER, Ways. Trees (1940) 178, t. 38; H. J. LAM in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 5; STEEN. Fl. Sch. Indon. ed. 2 (1951) 232.—**Fig. 19, 22g & 26–30.**

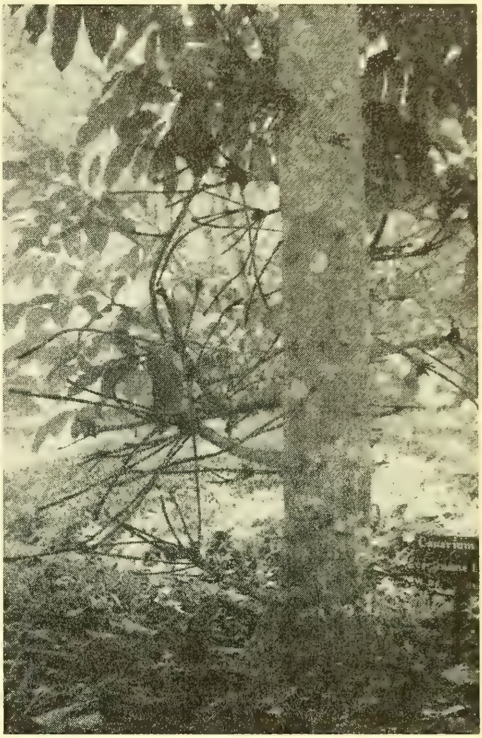

Fig. 26. Adventitious roots in *Canarium vulgare* LEENH., young stage (Cult. Hort. Bog. VI–D–1).

Tree up to 45 m by 70 cm; buttresses up to 3 m high and 1 1/2 m wide. *Branchlets c.* 1/2 cm thick, smooth, glabrous; pith with many vascular strands, partly peripherally arranged. *Stipules* rather caducous, inserted at the conjunction of the petiole and the branchlet, rarely entirely on the base of the petiole, oblong, 1–5 by 1/2–1 3/4 cm, apex rounded, margin entire, glabrous to slightly pulverulent. *Leaves* (2–)4–5-jugate, glabrous. *Leaflets* ovate to oblong, 5–16 by 2 1/2–7(–10) cm, chartaceous to subcoriaceous; base often slightly oblique, (broadly) cuneate; margin entire; apex gradually to subabruptly, rather long and slender-acuminate; nerves 12–15 pairs (angle 60–70°), straight to faintly curved, gradually arching at some distance from the margin. *Inflorescences* terminal (basal branches often axillary), broadly

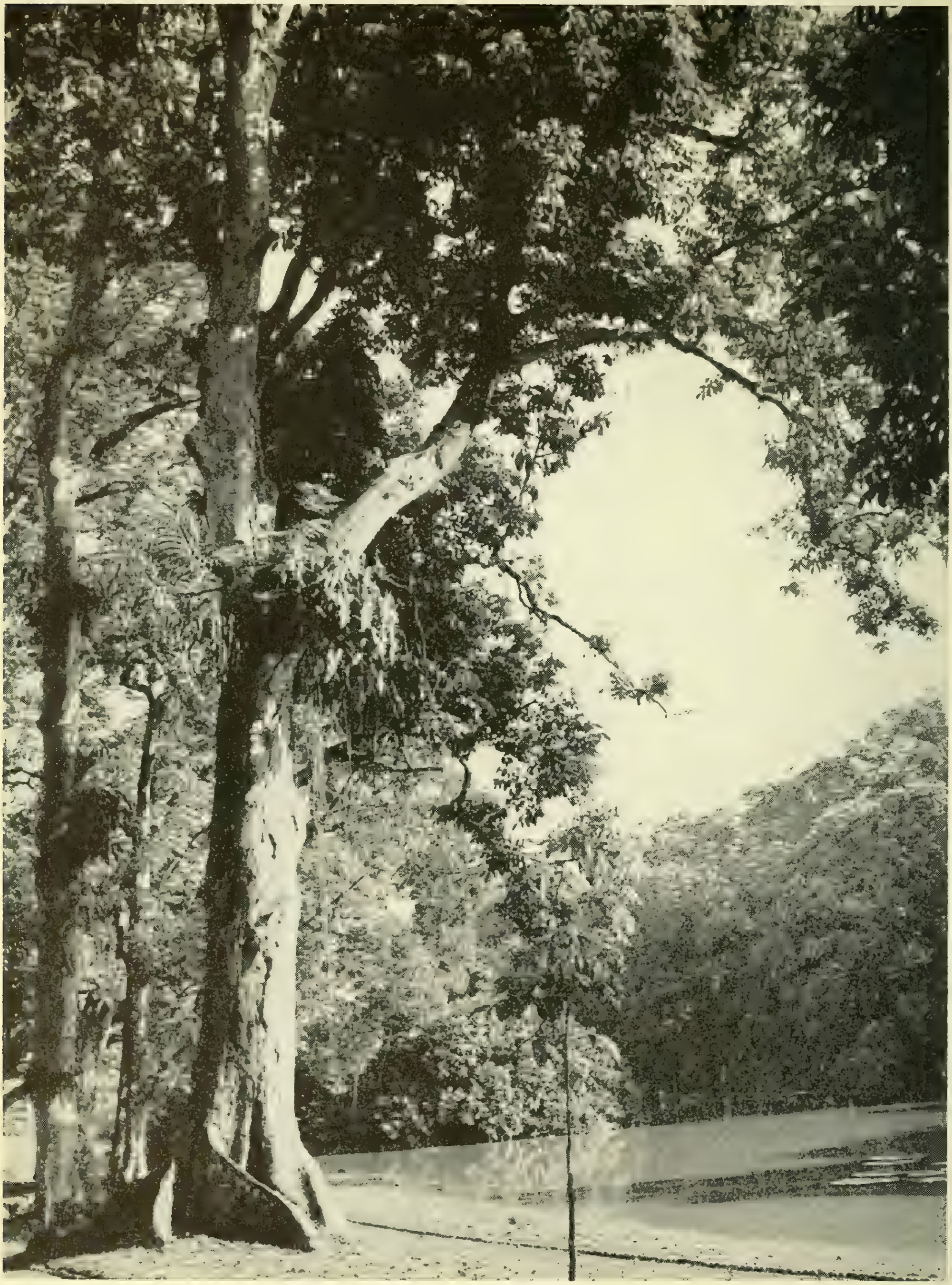

Fig. 27. *Canarium vulgare* LEENH. (Cult. Hort. Bog., Nov. 1955).

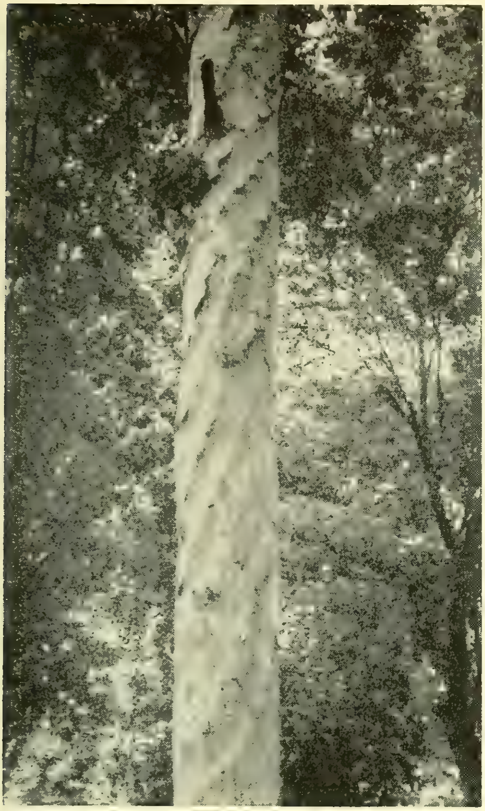

Fig. 28. *Canarium vulgare* LEENH. showing spiral peeling of the bark (Bogor, roadside).

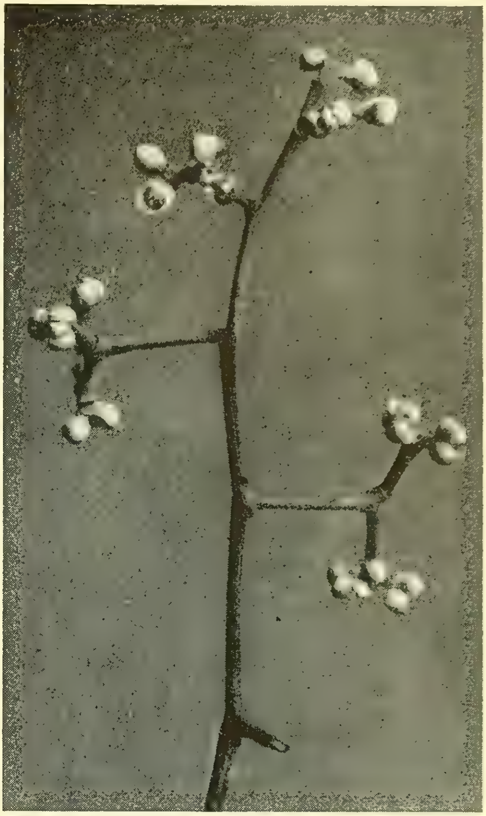

Fig. 29. *C. vulgare* LEENH. ♂ Inflorescence (Cult. Hort. Bog. VI–D–1a).

paniculate, minutely pulverulent, ♂ ones up to 35 cm long, main branches up to 20 cm, ♀ ones up to 20 cm long, main branches up to 10 cm. *Bracts* concave. *Flowers* tomentose, ♂ (sub)sessile, 5 mm long, ♀ stalked, 6–7(–12) mm, often with a concave receptacle. *Stamens* free, glabrous. *Disk* glabrous, in ♂ flowers solid, rather variable in form and shape, sometimes with a style-like appendix; in ♀ flowers adnate to the receptacle but for the rim. *Ovary* glabrous, in ♂ flowers none. *Infructescences* broadly paniculate, up to *c.* 15 cm long, with up to *c.* 12 fruits; calyx flat, orbicular with undulate margin, 7–13 mm diam. *Fruits* ovoid, round to slightly trigonous in cross-section, 3½–5 by 1½–3 cm, glabrous; pyrene smooth with 3 blunt, white ribs near the base; lids *c.* 4 mm thick. *Seeds* 3–1; sterile cells not strongly reduced.

Distr. *Malaysia:* Kangean & Bawean Isl. (near E. Java), Lesser Sunda Islands (Flores, Timor, Wetar, Tanimbar), Celebes, Moluccas (Talaud, Morotai, Sula, Ceram, Banda, Aru). Fig. 35.

Possibly naturalized in some other parts of Malaysia, cultivated in tropical regions all over the world.

Ecol. Mainly in primary forests on limestone, sometimes locally gregarious, *fl.* mainly March–June (Java: Aug.–Dec.), *fr.* mainly April–May.

Wood anat. DEN BERGER, Med. Proefst. Thee 97 (1926) 66 & Atlas pl. 11 fig. 44, Med. Proefst. Boschw. 13 (1926) 66 & Atlas ditto (*C. commune* L.) (hand lens); MOLL & JANSSONIUS, Mikr. Holzes 2 (1908) 108 (*C. commune* L.).

Uses. Planted as a shade-tree in nutmeg-plantations and as a roadside tree. The timber is rather soft and mainly used as firewood; in Bawean and Kangean it is also used for canoe-building; sometimes paddles are made out of the buttresses. The resin is not abundant and without importance. The seeds are highly estimated as a titbit, and are sometimes used as a substitute for almonds; the oil from the seeds is used as a substitute of coconut-oil. An emulsion of the seeds can be of importance as a baby-food (HEYNE, *l.c.*). For an analysis of the seed-oil see STEGER & VAN LOON, Rec. Trav. Chim. Pays-Bas 59 (1940) 168.

Vern. *Kanari*, M, *Java-almond*, E, *amand de Java*, Fr, *pokok kĕnari*, *rata kukana*, Mal. Pen., *kanari pandjang*, Sumatra, *kituwak*, Java, S, *kaju kanari*, *kanalè*, *kanali*, Kangean, *kodja*, Flores, Timor, *knarje*, Tanimbar, *dĕdi*, *kapur barus*, *rĕri*,

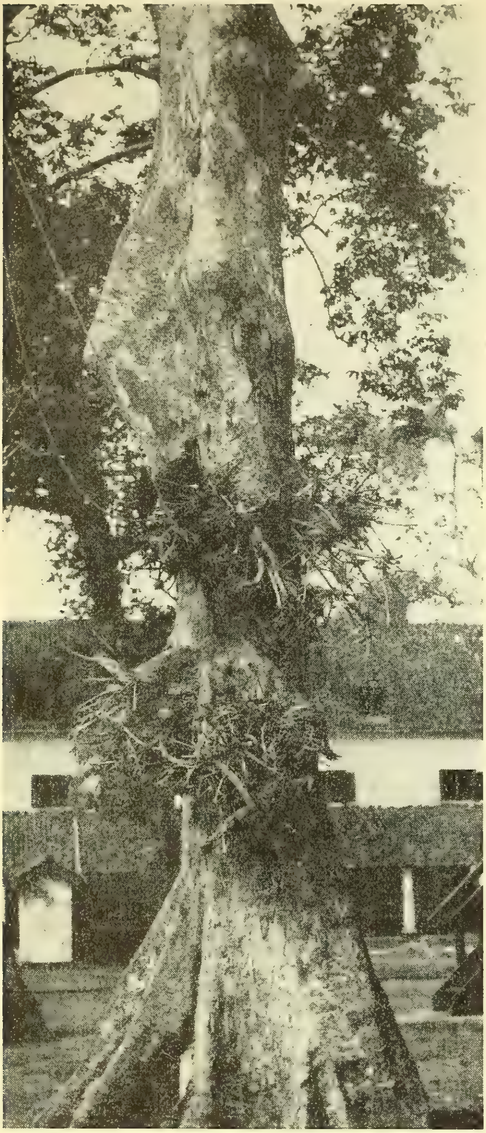

Fig. 30. Adventitious roots in *Canarium vulgare* LEENH., older stage (Makasser, *a.* 1937).

(w)ipalo, Celebes, *naki*, Talaud, *hika*, *(o)niar(a)*, Morotai, *njiha ambon*, *n. furu*, Ternate, *jal*, *jar*, Ambon.

Note. Closely related to *C. indicum* L. and for a long time not distinguished as a separate species; in consequence the synonymy of these two species is very complicated (see LEENHOUTS, Bull. Bish. Mus. *l.c.*).

15. Canarium indicum LINNÉ, Amoen. Acad. 4 (1759) 143; LEENH. Bull. Bish. Mus. *no* 216 (1955) 26, f. 12.—*C. vulgare prima et secunda species* RUMPH. Herb. Amb. 2 (1741) 145, t. 47 A–E.—*C. zephyrinum* RUMPH. Herb. Amb. 2 (1741) 151, t. 48; DUCHESNE, Rép. Pl. Utiles (1836) 289; BL. Mus. Bot. 1 (1850) 217; MIQ. Fl. Ind. Bat. 1, 2 (1859) 643; *non* F.-VILL. Nov. App. (1880) 40 (= *C. ovatum* ENGL.); ENGL. in DC. Mon. Phan. 4 (1883) 149; MERR. Int. Rumph. (1917) 304; HEYNE, Nutt. Pl. (1927) 879.—*C. commune* L. Mant. 1 (1767) 127, *pro maj. part.*, *typo incl.*; Syst. Veg. ed. 13 (1774) 741; LAMK, Enc. Bot. 1 (1783) 598; L. Syst. Veg. ed. 14 (1784) 885; ed. 15 (1797) 928; KOEN. & SIMS, Ann. Bot. 1 (1805) 360; WILLD. Sp. Pl. 4, 2 (1805) 759, *incl.* also *var.* β; DC. Prod. 2 (1825) 79, *incl.* also *var. zephyrinum*; R. & S. Syst. 7, 1 (1829) 78, *non* 7, 2 (1830) 1622 (= *C. vulgare* LEENH.); *non* BLANCO, Fl. Filip. (1837) 791 (= *C. asperum* BENTH.); *non* F.-VILL. Nov. App. (1880) 40 (= *C. luzonicum* A. GRAY); MERR. Int. Rumph. (1917) 301; *see also under C. vulgare* LEENH.—*C. mehenbethene* GAERTN. Fruct. 2 (1791) 98, t. 102, *nom. illeg.*; MIQ. Fl. Ind. Bat. 1, 2 (1859) 643; ENGL. in DC. Mon. Phan. 4 (1883) 149; in E. & P. Pfl. Fam. 3, 4 (1896) f. 136 F–H; ed. 2, 19a (1931) f. 211 F–H; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 12–13; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931–32) t. 5 f. 13–14, t. 15 f. 122a; Bull. Jard. Bot. Btzg III, 12 (1932) 515; VAN HEURN & H. J. LAM, Blumea Suppl. 1 (1937) 97; C. T. WHITE, J. Arn. Arb. 31 (1950) 91.—*C. moluccanum* BL. Mus. Bot. 1 (1850) 216, *incl.* also *var. obtusatum*; K. & V. Bijdr. 4 (1896) 33, 313; Ic. Bog. 1 (1897) t. 9; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 22^1, f. 28; BACK. Schoolfl. (1911) 197; KOORD. Exk. Fl. Java 2 (1912) 433; LAUT. Bot. Jahrb. 56 (1920) 320, *incl.* also *var. palla* and *f. porphyropyrena*; HEYNE, Nutt. Pl. (1927) 873.—*C. subtruncatum* ENGL. in DC. Mon. Phan. 4 (1883) 109.—*C. amboinense* HOCHR. Pl. Bog. Exs. (1904) 55; Bull. Inst. Bot. Btzg *no* 22 (1905) 5; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 22^{20}; HOCHR. Ann. Jard. Bot. Btzg Suppl. 3 (1910) 841; HEYNE, Nutt. Pl. (1927) 873.—*C. shortlandicum* RECHINGER, in Fedde, Rep. 11 (1912) 184.—*C. polyphyllum* (*non* K.SCH.) KRAUSE, Tropenpflanzer 17 (1913) 147.—*C. grandistipulatum* LAUT. Bot. Jahrb. 56 (1920) 321; LANE-POOLE, For. Res. (1925) 189.—*C. nungi* GUILLAUMIN, J. Arn. Arb. 12 (1931) 236.

var. **indicum.**—**Fig. 21g & 31–34.**

Tree up to 40 by 1 m, with buttresses. *Branchlets* 7–13 mm thick, glabrescent; pith with a peripheral cylinder of small vascular strands close to the inner side of the wood, central part with a second cylinder or some dispersed strands. *Stipules* persistent, inserted at the conjunction of branchlet and petiole—very rarely on the petiole up to 2 cm from its base—ovate to oblong, 1½–6 by 1¼–4 cm, striate to reticulate, pulverulent to glabrous, often slightly cordate at base, margin coarsely to minutely fimbriate-dentate. *Leaves* 3–7-jugate, glabrous. *Petiolules* rather long (¾–3 cm) and slender. *Leaflets* oblong-obovate to oblong-lanceolate, (5½–)7–28 by (2–)3½–11 cm, herbaceous

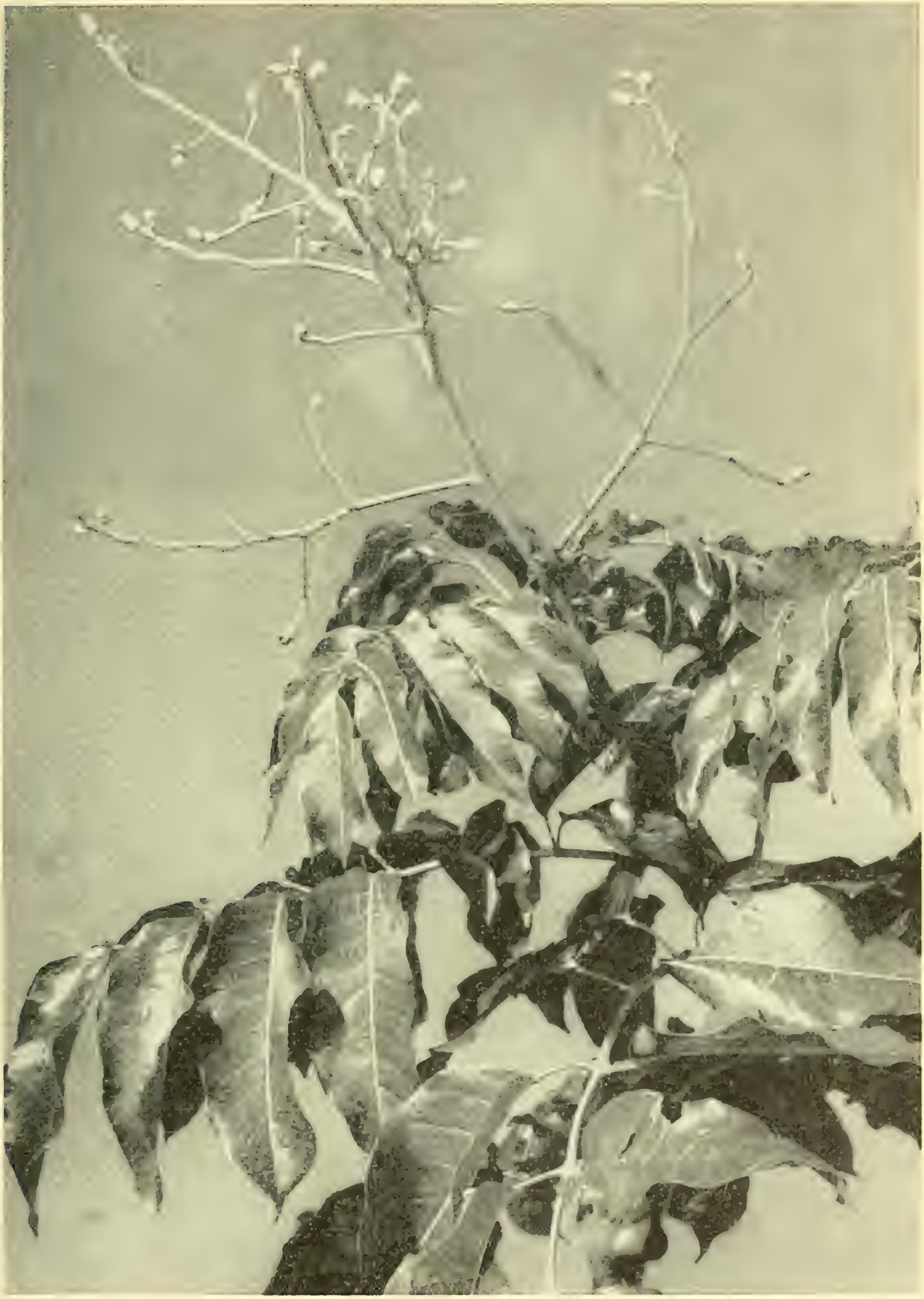

Fig. 31. *Canarium indicum* L. *var. indicum.* ♂ (Cult. Hort. Bog. II–M–G–88).

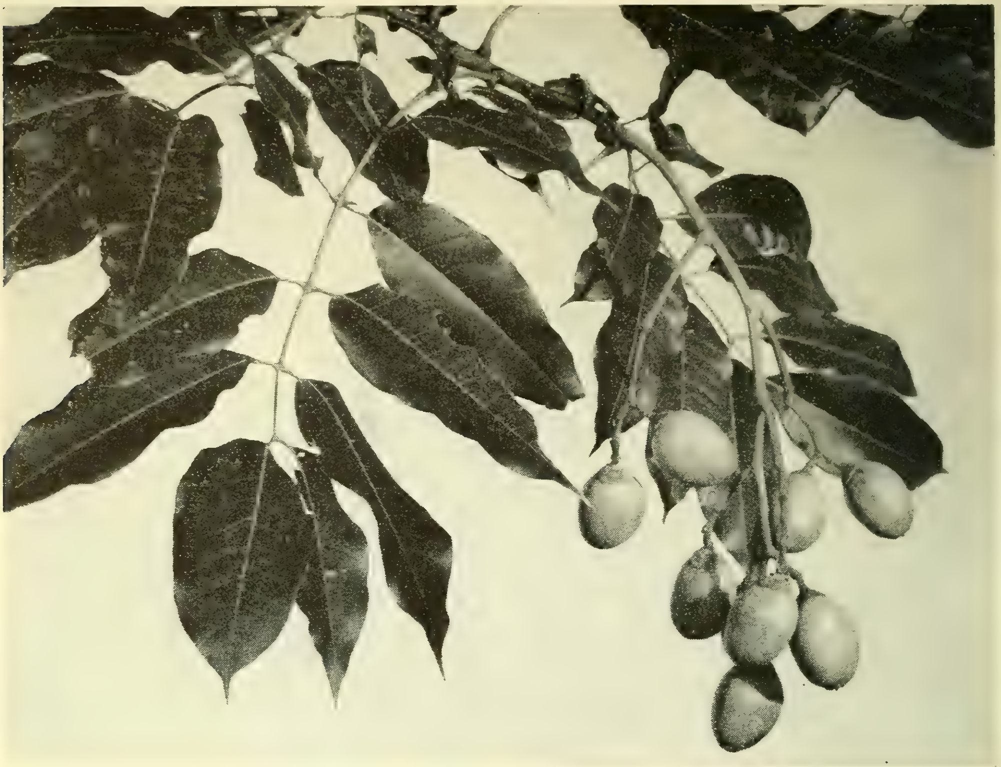

Fig. 32. *Canarium indicum* L. *var. indicum.* (Cult. Hort. Bog. II–M–G–88).

to coriaceous; base oblique, rounded to broadly cuneate; margin entire; apex gradually to subabruptly, bluntly acuminate; nerves (8–)10–15(–20) pairs (angle 85–55°, decreasing from base to apex), straight to faintly curved, faintly or not arching near the margin. *Inflorescences* terminal, broadly paniculate, 15–40 cm long, minutely tomentose, rather many-flowered; bracts concave, dentate at the apex, caducous. *Flowers* tomentose, ♂ ones subsessile, *c.* 1 cm long, ♀ ones shortly stalked, up to $1^{1}/_{2}$ cm long, with a concave receptacle. *Calyx* in ♂ flowers 5–7 mm long, in ♀ ones 7–10 mm. *Stamens* glabrous, in ♂ flowers free, in ♀ flowers adnate to the disk. *Disk* in ♂ flowers cushion-shaped, 1 mm high, glabrous, in ♀ flowers adnate to the receptacle except the minutely pilose margin. *Pistil* in ♂ flowers minute to none, in ♀ glabrous. *Infructescences* large, with up to *c.* 30 fruits; calyx flat, orbicular, margin often ruptured, $1^{3}/_{4}$–$2^{1}/_{2}$ cm diam. *Fruits* ovoid, round to slightly triangular in cross-section, $3^{1}/_{2}$–6 by ($1^{1}/_{2}$–)2–3 cm, glabrous; pyrene rounded triangular in cross-section, smooth except the 3 more or less acute ribs at base and apex; lids 3–4 mm thick. *Seeds* usually 1; sterile cells slightly reduced.

Distr. Solomon Islands, New Hebrides, New Britain, New Ireland, and *Malaysia:* N. Celebes (very probably naturalized), Moluccas (Ternate, Sula, Ceram, Ambon, Kei), and New Guinea. Fig. 35. Often cultivated, specially in Melanesia.

Ecol. Rain-forests at low altitude, rarely up to *c.* 250 m; planted up to 600 m or more. *Fl.* mainly Oct.–Dec., *fr.* mainly July–Dec.

Wood anat. WEBBER, Lilloa 6 (1941) 450 (*C. mehenbethene* GAERTN.).

Uses. Mainly the same as in *C. vulgare* LEENH., though of less importance. In Melanesia the seeds apparently are highly estimated as a food and several races are cultivated, mainly varying in the form and shape of the fruits.

Vern. *Kanari ambon, k. boh,* S, *kanaren,* J, *kanari ternate,* Minah., *njiha ambon, n. furu, n. sidaga,* Ternate, *kanari pandjang,* Batjan, *jal, jar,* Ambon, *nanari,* Banda, *kanari bagéa, k. bĕsar, k. nĕgri,* Moluccas, *baga, djaäto, galep, kanali, kubika, mahei, nawakara ai, tosar, totam, vo, wau,* N. Guinea, *a ngallip, baga, galapuar, galapuat, galip, garikoko, kalukalulu, lauele,* New Britain, *a ngarkok, hinuei* (♀), *h. annan* (♂), *h. palla, minuei,* New Ireland.

Notes. Closely related to and for a long time confused with *C. vulgare* LEENH., moreover related to *C. kaniense* LAUT. For an account of the complicated nomenclature see LEENH. *l.c.*

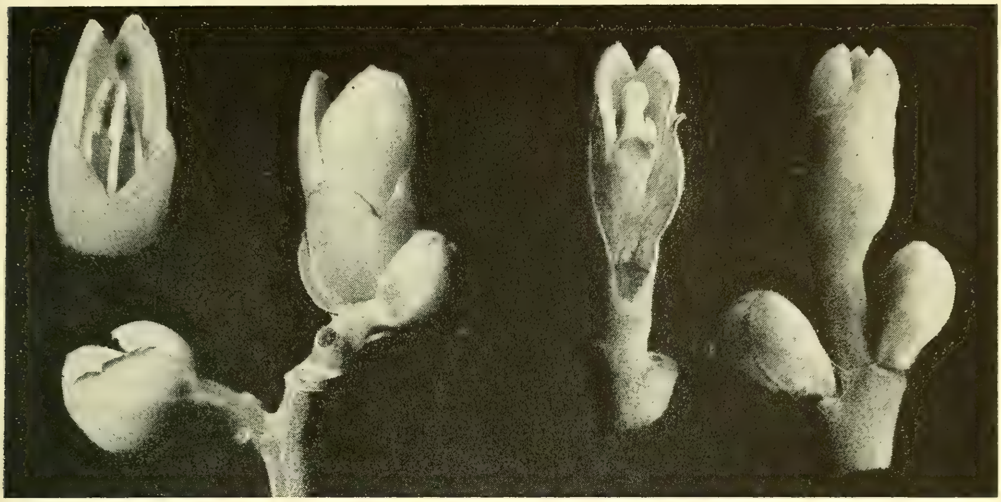

Fig. 33. *C. indicum* L. *var. indicum*. Left: ♂ flowers, one petal of single flower removed; right: ♀ flowers, part of single flower cut away (Cult. Hort. Bog. respectively VI–D–4 and VI–B–65a).

var. **platycerioideum** LEENH. Blumea 8 (1955) 182.

Very coarse. Branchlets up to 2¹/₂ cm thick. Stipules sometimes only inserted on the base of the petiole, orbicular to obovate, 4–12 by 4–14 cm, subcoriaceous, glabrous, margin undulating, nervation lax, anastomosing (stipules resembling the basal leaves of *Platycerium*). Leaves 5–8(or more?)-jugate, 80–135 cm long. Leaflets inequilateral, ovate, 25–35 by 13–16 cm. Flowers unknown. Fruits 6 by 3¹/₂–4 cm.

Distr. *Malaysia:* NW. New Guinea (Vogelkop).

Ecol. Collected only at altitudes up to 30 m.

Vern. *Anai, motarè, penies, sumgui.*

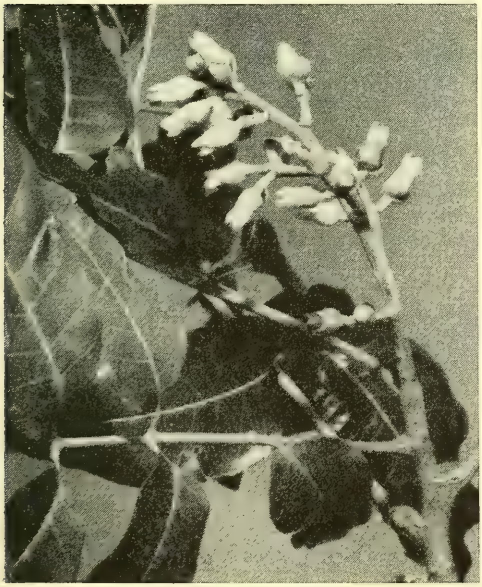

Fig. 34. *Canarium indicum* L. *var. indicum*. ♀ (Cult. Hort. Bog. VI–B–83).

16. Canarium kaniense LAUT. Bot. Jahrb. 56 (1920) 322; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 15 f. 121; Bull. Jard. Bot. Btzg III, 12 (1932) 515, t. 13 f. 88.—*C. gawadaense* BAKER *f*. J. Bot. 61 (1923) Suppl. 7; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104n; Bull. Jard. Bot. Btzg III, 12 (1932) 527, t. 14 f. 91.—**Fig. 1a–h.**

var. **kaniense.**—Synonymy as above.

Tree up to 40 m by 75 cm, sometimes with buttresses. *Branchlets* ¹/₂–1 cm thick, glabrescent; pith with one or two concentric cylinders of vascular strands. *Stipules* subpersistent, inserted either on the branchlet or on the petiole, elliptic to obovate, 1–3 by ¹/₂–2 cm, subcoriaceous, minutely pubescent to glabrous, margin repeatedly and more or less deeply dentate to slightly fimbriate, nervation coarse, anastomosing. *Leaves* 3–5(–6)-jugate, glabrous. *Leaflets* ovate to elliptic, 8–12 by 3¹/₂–7 cm, chartaceous to subcoriaceous; base slightly oblique, broadly cuneate to rounded; margin entire; apex gradually to subabruptly, shortly to rather long (up to 15 × 3 mm), blunt-acuminate; nerves 9–15 pairs (angle 50–80°), straight to faintly curved, sometimes arching near the margin. *Inflorescences* (♀ unknown) terminal and in the upper leaf-axils, narrowly paniculate, *c.* 30 cm long, densely tomentose, main branches up to *c.* 9 cm; flowers in glomerules; bracts like the stipules, though smaller and less deeply fimbriate. *Flowers* (♀ unknown) subsessile, 7 mm long, pubescent. *Calyx* 5 mm. *Stamens* glabrous, slightly adnate to the disk. *Disk* annular, 1–2 mm high, thinly pilose. *Pistil* columnar, 1¹/₂ mm high, glabrous. *Infructescences* terminal, narrowly paniculate, 25–30 cm long, thinly pilose, with 5–6 fruits; calyx flat, orbicular, 1$^1/_2$–2 cm diam., with remnants of an annular disk and of free stamens. *Fruits* ovoid, deltoid in cross-section, 5–6 by 3–4 cm, glabrous; pericarp fleshy; pyrene smooth, triangular, with hollow sides, sometimes with acute angle-ribs and/or faint median ribs; lids 2–5 mm thick. *Seeds* 1(–2); sterile cells slightly reduced.

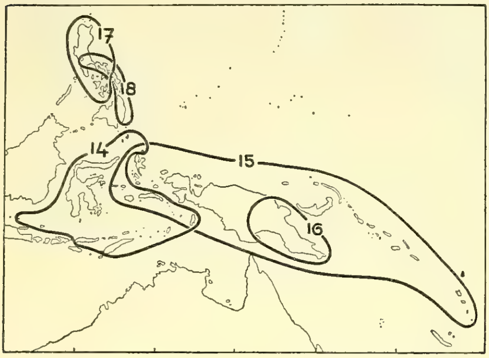

Fig. 35. Distribution of: 14. *C. vulgare* LEENH., 15. *C. indicum* L., 16. *C. kaniense* LAUT., 17. *C. luzonicum* (BL.) A. GRAY, 18. *C. ovatum* ENGL.

Distr. *Malaysia:* E. New Guinea. Fig. 35.

Ecol. In forests at (25–)1000–2000 m alt., *fl.* Dec., *fr.* Jan.–March.

Uses. The oily seeds are eaten.

Vern. *Piu*, Waigani, *usasi*, Upper Waria.

Note. Related to *C. indicum* L.; differing by its stipules and fruits.

var. **globigerum** LEENH. Blumea 8 (1955) 182.— **Fig. 21a–c, 22h.**

Stipules 3$^1/_2$–8 by 2–4 cm, the dentate margin densely fimbriate, segments subulate and branched, up to 2 cm. Leaves 4–6-jugate. Leaflets ovate to oblong, mostly 15–25 by 9 cm; abruptly caudate-acuminate, acumen up to 30 by 1 mm; nerves 12–18 pairs. Fruits globular, *c.* 5 cm diam.; epicarp egg-shell-like, pericarp somewhat fibrous; pyrene acutely 3-winged, specially in the lower half, lids slightly concave with a faint median rib; lids 1$^1/_2$ mm thick.

Distr. and ecol. Like *var. kaniense.*

Vern. *Utèti*, Orokaiva.

Note. Sharply defined only by its fruit-characters. As both varieties are very inadequately known, their status is still uncertain.

17. Canarium luzonicum (BL.) A. GRAY, Wilkes Exp. Bot. (1854) 374; MIQ. Fl. Ind. Bat. 1, 2 (1859) 651; ENGL. in DC. Mon. Phan. 4 (1883) 150; MERR. Publ. Gov. Lab. Philip. *no* 27 (1905) 30; *no* 29 (1905) 53; GUILLAUMIN, Bull. Soc. Bot. Fr. 55 (1908) 616, t. 19 f. 2; MERR. Philip. J. Sc. 3 (1908) Bot. 80; WHITFORD, Bull. For. Bur. Philip. 10^1 (1911) 56; MERR. Sp. Blanc. (1918) 207; W. H. BROWN, Min. Prod. Philip. For. 2 (1921) 40, 300, f. 11; MERR. En. Philip. 2 (1923) 351; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 56; Bull. Jard. Bot. Btzg III, 12 (1932) 532; BURK. Dict. (1935) 430; MANALO & WEST, Philip. J. Sc. 78 (1950) 111; QUIS. Med. Pl. Philip. (1951) 475.—*C. album* (*non* DC.) BLANCO, Fl. Filip. (1837) 793; ed. 2 (1845) 546; ed. 3, 3 (1879) 201; MERR. Publ. Gov. Lab. Philip. *no* 27 (1905) 30.—*Pimela luzonica* BL. Mus. Bot. 1 (1850) 220.—*C. commune* (*non* L.) F.-VILL. Nov. App. (1880) 40.—*C. triandrum* ENGL. in DC. Mon. Phan. 4 (1883) 145, t. 3 f. 19–22; JADIN, Contr. Téréb. (1894) t. 15 f. 9A.—*C. polyanthum* PERK. Fragm. Fl. Philip. 1 (1904) 95.—*C. carapifolium* PERK. Fragm. Fl. Philip. 1 (1904) 91.—*C. oliganthum* MERR. Philip. J. Sc. 10 (1915) Bot. 23; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 534.

Tree up to 35 m by 1 m or more. *Branchlets* 4–6(–8) mm thick, glabrescent, lenticellate; pith with many peripherally arranged vascular strands. *Stipules* caducous to subpersistent, inserted on the base of the petiole (up to 5 mm from the branchlet), orbicular, *c.* 8 mm diam., pubescent. *Leaves* 3–5-jugate, glabrous. *Leaflets* lanceolate to oblong, 6$^1/_2$–25 by 3$^1/_2$–8$^1/_2$ cm, subcoriaceous; base equilateral, broadly cuneate to cordate; margin entire; apex gradually, long and broadly, blunt-acuminate; nerves 14–18 pairs (angle *c.* 65°), straight to slightly curved, gradually to subabruptly arching at some distance from the margin. *Inflorescences* axillary, together pseudoterminal, paniculate, glabrescent, ♂ ones 10–25 cm long, ♀ ones 5–18 cm; main branches up to 4$^1/_2$ cm long, in ♂ ones many-flowered, in ♀ ones 3–5-flowered. *Flowers* subsessile, pubescent, ♂ 2$^1/_2$–4 mm long; ♀ 6–8 mm, with a concave receptacle. *Calyx* ♂ 1$^1/_2$ mm high, ♀ 5 mm. *Stamens* glabrous, ♂ 6–3, free, ♀ 6, slightly connate at the base. *Disk* ♂ cushion-shaped, flat, solid, $^1/_3$ mm high, densely tomentose; ♀ adnate to the receptacle, with a free rim, glabrous. *Pistil* ♂ none, ♀ pilose. *Infructescences* 4–10 cm long, glabrous, with 1–4 fruits; calyx flat, bluntly triangular, 10–12 mm diam. *Fruits* shortly ovoid to ellipsoid, round to bluntly triangular in cross-section, 2$^1/_2$–3$^3/_4$ by 1$^1/_2$–2 cm, glabrous; pyrene smooth; lids *c.* 2$^1/_2$ mm thick. *Seeds* 1(–2); sterile cells small.

Distr. *Malaysia:* Philippines (Mindoro, Luzon, Alabat Isl., Masbate, Ticao Isl., Bohol). Fig. 35.

Ecol. Common in primary forests at low and medium altitudes. *Fl.* (Apr.–)Aug.–Sept.(–Oct.), *fr.* (Aug.–)Jan.–Febr.(–May).

Wood anat. REYES, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 161 (hand lens).

Uses. The timber, which is not very hard, is sometimes used. This tree is the principal source of *manila-elemi* (see BROWN, *op. cit.* 40; VALENZUELA *et al.*, Philip. J. For. 6, 1949, 54; MANALO & WEST, *l.c.*; QUIS. *l.c.*). The seeds are eaten as *pili nuts*, though the main source of these is *C. ovatum* ENGL.

Vern. *Alañgi, alanki, ananggui, anteng, bakoog*, Ilk., *antang*, Ibn., *bakan*, Ting., *belis, pilauai, pisa, sahing, tugtugin*, Tag., *bulau*, Pang., *malapili*, Bik.

pagsahiñgin, *pagsainguin*, Rizal, *palsahiñgin*, Laguna, *pili*. The resin is known as *brea blanca* or *manila-elemi*; the fruits: *Chinese olives* or *pili nuts*.

18. Canarium ovatum ENGL. in DC. Mon. Phan. 4 (1883) 110; W. H. BROWN, Min. Prod. Philip. For. 2 (1921) 114, 300, f. 40; MERR. En. Philip. 2 (1923) 352; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 88, t. 15 f. 120b; Bull. Jard. Bot. Btzg III, 12 (1932) 533; BURK. Dict. (1935) 431; QUIS. Med. Pl. Philip. (1951) 476, 1036.—*C. pachyphyllum* PERK. Fragm. Fl. Philip. 1 (1904) 94.—*C. melioides* ELM. Leafl. Philip. Bot. 3 (1911) 1079; MERR. En. Philip. 2 (1923) 351.—**Fig. 22f.**

Tree up to 20 m by 50 cm. *Branchlets* 6–12 mm thick, glabrous, lenticellate; pith with many small vascular strands appressed to the wood. *Stipules* persistent, inserted on the petiole up to 6 mm from its base, deltoid to lingulate, 5–20 by 3–10 mm, acute, stiff-chartaceous, glabrescent. *Leaves* 2–4-jugate, glabrous. *Leaflets* ovate to elliptic, 4–24 by 2–12 cm, stiff-coriaceous; base oblique, (cuneate to) rounded to subcordate; margin entire; apex (rather) abruptly acuminate, acumen cuneate to long and slender, blunt; nerves 8–12 pairs (angle 60–90°), straight to faintly curved, rather abruptly or gradually arching at some distance from the margin. *Inflorescences* axillary, close together at the ends of the branches, narrowly paniculate to nearly racemose, 3–12 cm long, glabrescent, few-flowered; main branches decussate, up to $2^{1}/_{2}$ cm, with up to 5 flowers. *Bracts* concave. *Flowers* (sub)sessile, pubescent, up to 12 mm long, ♀ ones with a slightly concave receptacle. *Calyx* ♂ 7 mm high; ♀ 8–9 mm. *Stamens* 6, glabrous, ♂ slightly adnate to the disk, ♀ inserted on the rim of the disk. *Disk* ♂ cylindrical, 3–$3^{1}/_{2}$ mm high, solid, densely tomentose, rim 6-lobed; ♀ adnate to the receptacle, with 6-lobed rim, glabrous. *Pistil* ♂ none, ♀ glabrous. *Infructescences* 3–9 cm long, with 1(–2) fruit(s); calyx flat, orbicular, $1^{3}/_{4}$–2 cm diam. *Fruits* ovoid to ellipsoid, acute, triangular in cross-section, $3^{1}/_{2}$–$6^{1}/_{4}$ by 2–$2^{3}/_{4}$ cm, glabrous; pyrene triangular in cross-section, the sides slightly furrowed, angle-ribs rounded except at the acute base and apex; lids $1^{1}/_{2}$–2 mm thick. *Seed* 1; sterile cells strongly reduced.

Distr. *Malaysia:* Philippines (S. Luzon, Polillo, Samar, Leyte, Mindanao). Fig. 35. Sometimes cultivated, also in other parts of Malaysia and in Micronesia and Melanesia.

Ecol. Primary forests, up to 500 m. *Fl.* May–July, *fr.* Oct.–Dec.(–June).

Uses. One of the sources of *manila-elemi* (together with *C. luzonicum* A. GRAY) and the main source of *pili nuts*, which are used as almonds, and of *pilinut oil* (BROWN, *l.c.*; BURK. *l.c.*; QUIS. *l.c.*) and *pili-pulp oil* (L. T. MARAÑON *et al.*, Philip. J. Sc. 83, 1955, 359).

Vern. *Ananggi*, Sorsogon, *basiad*, *liputi*, *(pili-)pilaui*, Tayabas, *(ogat-)biauan*, Bagobos, *ogot*, Mindanao, *pilaui*, Polillo, *pili*.

19. Canarium odontophyllum MIQ. Sum. (1861) 525; Ann. Mus. Bot. Lugd. Bat. 4 (1869) 117; ENGL. in DC. Mon. Phan. 4 (1883) 108; H. J. LAM in Merr. Pl. Elm. Born. (1929) 118; Ann. Jard. Bot. Btzg 42 (1932) t. 15 f. 122b; Bull. Jard. Bot. Btzg III, 12 (1932) 519, t. 14 f. 89.—*C. beccarii* ENGL. in DC. Mon. Phan. 4 (1883) 107.—*C. palawanense* ELM. Leafl. Philip. Bot. 5 (1913) 1754.—*C. multifidum* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 215, t. 15 f. 122c; Bull. Jard. Bot. Btzg III, 12 (1932) 520.—**Fig. 22i.**

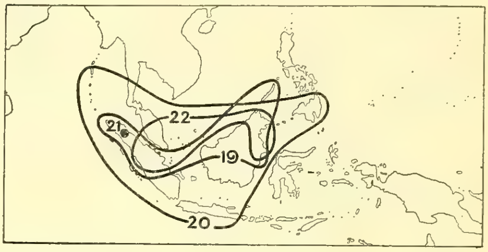

Fig. 36. Distribution of *Canarium denticulatum* BL. and allies: 19. *C. odontophyllum* MIQ., 20. *C. denticulatum* BL., 21. *C. karoense* H. J. LAM, 22. *C. megalanthum* MERR.

Tree up to 35 m by 50 cm, with buttresses. *Branchlets* $^{3}/_{4}$–3 cm thick, densely rusty tomentose, often glabrescent; pith with a peripheral cylinder of many small vascular strands. *Stipules* persistent, inserted near or on the base of the petiole, orbicular and dentate to oblong and repeatedly slit into 2–4 cm long lobes, specially at the base and apex, 2–9 by $1^{1}/_{2}$–$3^{1}/_{2}$ cm, minutely tomentose, subglabrescent, nervation coarse, anastomosing. *Leaves* 3–8-jugate. *Leaflets* oblong to lanceolate, 15–40 by 5–10 cm, coriaceous, sparsely pilose to densely tomentose beneath and on the midrib above; base subequilateral, broadly cuneate to subcordate; margin dentate to serrate; apex abruptly, short and slender, acute-acuminate; nervation slightly sunken above, strongly prominent beneath; nerves 15–28 pairs (angle 55–65–90°), straight to faintly curved, gradually curving towards the margin, rarely distinctly arching; intermediate veins often strongly developed. *Inflorescences* axillary, together pseudoterminal (sometimes truly terminal?), laxly paniculate, densely tomentose, ♂ ones 30–50 cm long, many-flowered, ♀ ones 15–20 cm long and with few flowers. *Bracts* often persistent, gradually passing into the stipules. *Flowers* pubescent outside, ♂ 4–7 mm long, ♀ 8–9 mm, with a slightly concave receptacle. *Calyx* 3-parted, ♂ $2^{1}/_{2}$–$4^{1}/_{2}$ mm high, ♀ 8 mm. *Stamens* glabrous, ♂ adnate to the disk, ♀ inserted on the rim of it. *Disk* glabrous, ♂ circular, flat, slightly concave in the center, 6-lobed, $^{1}/_{4}$–1 mm high; ♀ adnate to the receptacle, rim 1 mm high, faintly 6-lobed. *Pistil* ♂ strongly reduced to none, ♀ glabrous. *Infructescences* mostly broadly paniculate, 20–35 cm long, densely tomentose, with up to 40 fruits; calyx saucer-shaped, triangular, *c.* $1^{1}/_{2}$ cm diam. *Fruits* ovoid to ellipsoid, rounded triangular in cross-section, 2½–3½ by 1¾–2 cm, glabrous; pyrene smooth, faintly 3-ribbed; lids ½–2½ mm thick, bony. *Seed* 1; sterile cells more or less reduced.

Distr. *Malaysia:* Sumatra, Borneo, Philippines (Palawan). Fig. 36.

Ecol. In primary forests, up to 450 m. *Fl.* March–April and Sept.–Oct., *fr.* May–Nov.

Uses. Wood rather soft and of little use. Seeds edible.

Vern. *Danau madjang*, *kadjay*, Sum., *bundui bundui*, *dabai*, *dabang*, *dabu*, *dawai*, *kambajau (kĕmbajau, kumbajau)*, *kurihang*, Borneo.

Notes. Related to *C. denticulatum* BL. Specimens from N. and E. Borneo usually possess large and deeply incised stipules, thinner and less pilose leaves with less prominent venation.

20. Canarium denticulatum BL. Bijdr. (1826) 1162; R. & S. Syst. 7, 2 (1830) 1623; BL. Mus. Bot. 1 (1850) 217, *incl.* also *var. latifolia*; MIQ. Fl. Ind. Bat. 1, 2 (1859) 644; ENGL. in DC. Mon. Phan. 4 (1883) 136; K. & V. Bijdr. 4 (1896) 39; BACK. Schoolfl. (1911) 197; KOORD. Exk. Fl. Java 2 (1912) 434; RIDL. Fl. Mal. Pen. 1 (1922) 374; HEYNE, Nutt. Pl. (1927) 876; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104a, t. 15 f. 123 a & c; Bull. Jard. Bot. Btzg III, 12 (1932) 521, t. 14 f. 90; in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 6.—*C. sylvestre* (*non* GAERTN.) BL. Mus. Bot. 1 (1850) 217; MIQ. Fl. Ind. Bat. 1, 2 (1859) 644; Sum. (1861) 205; ENGL. in DC. Mon. Phan. 4 (1883) 114.—*C. fissistipulum* MIQ. Sum. (1861) 525; ENGL. in DC. Mon. Phan. 4 (1883) 115; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 70, t. 15 f. 123b; Bull. Jard. Bot. Btzg III, 12 (1932) 524.—*C. spectabile* MIQ. Ann. Mus. Bot. Lugd. Bat. 4 (1869) 116; ENGL. in DC. Mon. Phan. 4 (1883) 147.—*C. coccineo-bracteatum* KURZ, J. As. Soc. Beng. 41, ii (1872) 296.—*C. fuscum* ENGL. in DC. Mon. Phan. 4 (1883) 116; K. &. V. Bijdr. 4 (1896) 47; ROBINSON, Philip. J. Sc. 3 (1908) Bot. 185; BACK. Schoolfl. (1911) 197; KOORD. Exk. Fl. Java 2 (1912) 434.—*C. manii* KING, J. As. Soc. Beng. 62, ii (1894) 247.—*C. kunstleri* KING, J. As. Soc. Beng. 62, ii (1894) 248.—*C. laciniatum* ELM. Leafl. Philip. Bot. 3 (1911) 1084; MERR. En. Philip. 2 (1923) 350.—**Fig. 21j, 22k.**

Note. *C. denticulatum* is related to both *C. odontophyllum* MIQ. and probably to *C. karoense* H. J. LAM.

ssp. **denticulatum.—Fig. 37.**

Tree 20–30(–50) m by 40–80 cm, sometimes with low buttresses, rarely a shrub. *Branchlets* 4–8 mm thick, minutely tomentose, usually glabrescent; pith with many small vascular strands, arranged into 1 or 2 peripheral cylinders. *Stipules* persistent, inserted on the petiole, (0–)3–6 mm from the base, curved, pectinate to dendriform, the lobes laciniate to subulate, base narrow, (½–)1–2½(–4) by ¾–1½ cm, minutely tomentose. *Leaves* 2–6-jugate, 30–45 cm long, *glabrous*. *Leaflets* inequilateral, ovate to lanceolate, (5–)12–20 by 2–15 cm, coriaceous, glabrous (rarely sparsely pilose); base oblique, rounded; margin entire to sparsely dentate towards the apex (rarely totally dentate); apex subabruptly, long acute-acuminate; nerves (9–)11–17(–21) pairs (angle variable, 65–85°), faintly curved, gradually to abruptly distinctly arching at some distance from the margin, moderately prominent beneath. *Inflorescences* axillary, together pseudoterminal (rarely truly terminal), laxly and narrowly paniculate, 15–25 cm long, densely rusty tomentose, main branches up to 5 cm, ♂ with many clustered flowers, ♀ with 5–7 flowers. *Bracts* gradually passing into the stipules. *Flowers* densely pubescent, ♂ 4½ mm long, ♀ 7 mm with a slightly concave receptacle. *Calyx* ♂ 4 mm high, ♀ 5 mm. *Stamens* glabrous, ♂ adnate to the disk, ♀ inserted on the disk. *Disk* glabrous, ♂ annular, 12-lobed, ¾ mm high, fleshy; ♀ adnate to the receptacle, free rim ½ mm high. *Pistil* glabrous, in ♂ flowers ¼–½ mm high. *Infructescences* up to 20 cm long, densely tomentose, with 2–10 fruits; calyx broadly funnel-shaped, triangular, 12–14 mm diam. *Fruits* ellipsoid, faintly triangular in cross-section, 2½–3 by 1¼–1½ cm, glabrous; pyrene smooth; lids 1–1½ mm thick, bony. *Seeds* (3–)1; sterile cells strongly reduced, often without lumen.

Distr. S. Andamans, S. Burma, and *Malaysia:* Sumatra (also Simalur), Malay Peninsula (Perak), Java (E to Mt Wilis), Borneo, Philippines (Basilan, Mindanao). Fig. 36.

Ecol. Rain-forests at low altitudes, up to 700 m. *Fl.* Sum. mainly July–Sept., Mal. Pen. March.–July, Java June–Oct., Philip. April and Sept.–Oct., *fr.* Sum. mainly July–Sept., Mal. Pen. Jan., Java Sept.–Nov., Philip. May–July.

Wood anat. MOLL & JANSS. Mikr. 2 (1908) 107.

Vern. *Andalhe*, *asĕm*, *a. anda*, *a. damar*, *bĕka*, *damar mĕrasam*, *d. gota*, *madang rabung*, *mawah*, *mĕdang*, *rĕsung*, *tandikeh*, *tjintjin memal*, Sumatra, *bangkiring bala(h) (ujul)*, *b. uding*, *ganggo uding*, *silaora (delok)*, *s. pajo*, Simular, *sudur bajan*, Banka, *kanari alas*, *ki-solok*, *ki-tuak*, *maranginang*, *pisitan laju*, S, *kĕdojo*, *kĕnarèn*, *ra(h)u (wulan)*, *sadjĕng*, *wuloh bĕras*, J, *kanari utan*, *k. wana*, *langsĕb alas*, Java, *adal*, *alab-alab*, *bangkulat*, *djĕlapal gunung*, *indalus*, *kambayan*, *kayamuk*, *kĕlamoh*, *kuningam*, *lambuakat*, *madamsat*, *pĕnanasan borong*, *pinayasan*, *pininasan*, *talangsai*, Borneo; Philippines: *kalisan*, Mbo, *lancha-lancha*, Sul., *lankangan*, Lam., *ogat*, Bag., *kaju noach.*

ssp. **kostermansii** LEENH. Blumea 8 (1955) 181.

The main differences with *ssp. denticulatum* are: More slender tree, 12–20 m by 30 cm. All parts long remaining ferrugineous-pubescent. Leaves 2–4-jugate. Leaflets stiff-herbaceous, *densely pubescent beneath* and on the midrib above, *more or less glabrescent*; base nearly equilateral, sometimes broadly cuneate; margin entirely densely serrate (to dentate); apex more gradually, rather short- and slender-acuminate; nerves (14–)18–20 pairs, less distinctly arching. Inflorescences up to 35 cm long, more lax and with more flowers; main branches ♂ up to 15 cm, repeatedly branched, ♀ up to 8 cm, with up to 12 flowers. Fruits possibly slightly smaller (ripe fruits unknown).

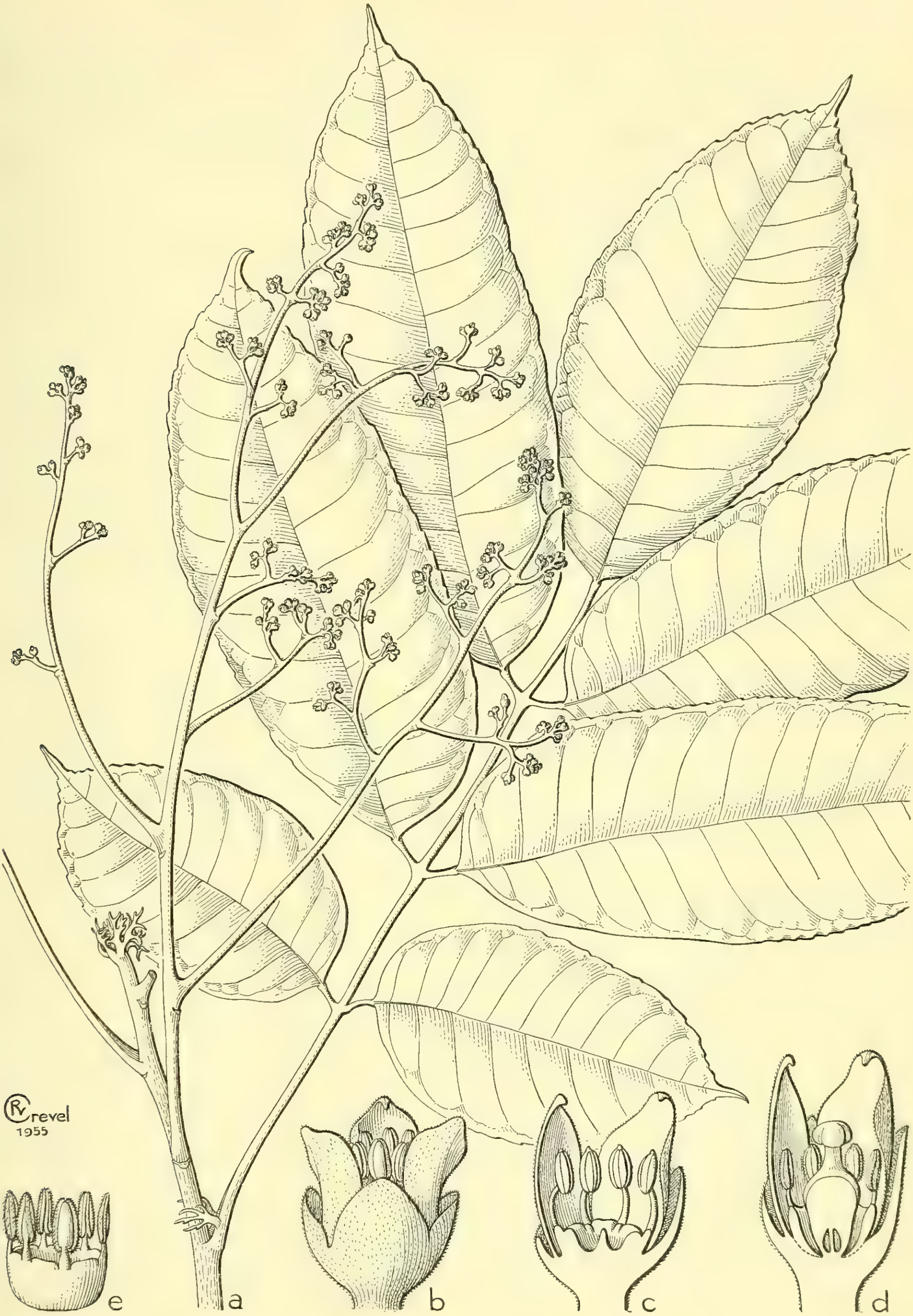

Fig. 37. *C. denticulatum* BL. *a.* Twig with ♂ flowers, *b.* ♂ flower, *c. ditto*, in section, *d.* section of ♀ flower, *e.* stamens and disk in ♀ flower (*a* × 1/2, *b–d* × 5, *e* × 7).

Distr. *Malaysia:* Borneo (E. Kutei: Sangkulirang).

Ecol. *Fl.* June–July, *fr.* Nov.

Vern. *Damar lilin.*

21. Canarium karoense H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 215, t. 15 f. 120a; Bull. Jard. Bot. Btzg III, 12 (1932) 514, t. 13 f. 87.

Tree. *Branchlets c.* 1 cm thick, minutely tomentose, glabrescent; pith with a number of peripherally arranged small vascular strands. *Stipules* persistent, inserted partly or entirely on the base of the petiole, ovate to lanceolate, coarsely pectinate, 1½–5 by 1½–3 cm, subcoriaceous, glabrous, lobes blunt, nervation anastomosing. *Leaves* 4–7-jugate, glabrescent. *Leaflets* ovate to oblong, 8–22 by 4–8 cm, subcoriaceous, glabrous; base broadly cuneate to rounded; margin entire; apex subabruptly, short- and blunt-acuminate; nerves 10–15 pairs (angle 55–70°), curving, not distinctly arching. *Inflorescences* (♂ unknown) axillary, narrowly paniculate to racemose, 5–9 cm long, tomentose. *Flowers* unknown. *Calyx* in very young fruits 12 mm high, tomentose. *Stamens* and *disk* unknown. *Pistil* glabrous, stalked. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* N. Sumatra (Karo Distr.), once collected. Fig. 36.

Ecol. Frequent in old forests, altitude unknown. *Fl.* Nov.–Dec.

Vern. *Banga kĕrah.*

Note. Possibly conspecific with *C. megalanthum* MERR.

22. Canarium megalanthum MERR. Philip. J. Sc. 30 (1926) 81; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 68, t. 16 f. 127d1; Bull. Jard. Bot. Btzg III, 12 (1932) 446, t. 9 f. 55.—**Fig. 22j.**

Tree up to 40 m by 60–70 cm, without buttresses. *Branchlets* ½–1 cm diam., rusty-tomentose; pith with a peripheral cylinder of scattered vascular strands. *Stipules* subpersistent, inserted on the petiole at ¼–¾(–3) cm from its base, 6–8 by 10–20 mm, deeply 3–4-lobed, stiff, densely and minutely fulvous-tomentose. *Leaves* (3–)4–5-jugate. *Leaflets* obovate, lanceolate or oblong, 9–20 by 4½–8½ cm, coriaceous, glabrescent; base oblique, cuneate to cordate; margin entire; apex gradually to abruptly, shortly and slenderly acute-acuminate; nerves (10–)13–19 pairs (angle 60–70°), faintly curved, abruptly, usually distinctly, arching close to the margin. *Inflorescences* pseudoterminal to terminal, terminal ones broadly and laxly paniculate, 25 cm long (♀), main branches up to 9 cm, with few flowers; pseudoterminal ones narrowly paniculate, 25–30 cm long (♂), main branches 6–11 cm, paniculate, *c.* 10-flowered; minutely tomentose. *Flowers* pubescent, ♂ 11 mm, ♀ 13–15 mm. *Calyx* broadly cupular, ♂ 7 mm, ♀ 9 mm. *Corolla* ♀ pubescent at both sides, ♂ inside glabrous. *Stamens* adnate to the disk, filaments glabrous. *Disk* glabrous, ♂ saucer-shaped, 1 mm high, rim undulate; ♀ cupular, 2½–3 mm high, truncate. *Pistil* long-pilose; ♂ none. *Infructescences c.* 25 cm long, sparsely tomentose, with 4–5 fruits; calyx saucer-shaped, 3-lobed, 2–2½ cm diam. *Fruits* ellipsoid, sometimes acute, bluntly triangular in cross-section, 5–5½ by 3½–4 cm, sparsely, near the apex densely, ferrugineously tomentose; pyrene smooth with 3, blunt to acute, angle-ribs, specially near the apex; lids 1–2 mm thick. *Seed* 1, spindle-shaped, acuminate at base, 4 by 1½ cm; fertile cell in cross-section circular, 1½ cm diam., sterile cells strongly reduced, without lumen.

Distr. *Malaysia:* Sumatra, Malay Peninsula, Borneo. Fig. 36.

Ecol. Rain-forests, up to 360 m. *Fl.* Sum.: Aug., Borneo: March, *fr.* May–July.

Uses. The wood is said to be hard. In Brunei this species is cultivated for its edible seeds which are among the largest of this genus. The resin is said to be abundant.

Vern. *Kamatoa, m(ĕ)ritus, rarawa damar,* Borneo.

Note. A rather remarkable species, without any doubt related to *C. denticulatum* BL., and possibly conspecific with the insufficiently known *C. karoense* H. J. LAM.

23. Canarium pseudopatentinervium H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 214, t. 13 f. 104e; Bull. Jard. Bot. Btzg III, 12 (1932) 490, t. 12 f. 77.—**Fig. 2h.**

Tree 20–38 m by 20–60 cm. *Branchlets c.* ¾ cm diam., glabrescent; pith with many peripherally arranged small vascular strands and often with a central cavity. *Stipules* none. *Leaves* 1–2(–4)-jugate, glabrescent. *Leaflets* ovate to elliptic, rarely oblong, 5–12½ by 2¼–7 cm, rigid, (sub)glabrous; base rounded (to broadly cuneate); margin entire; apex short-blunt-acuminate; nerves 7–14 pairs (angle 70–80°), faintly curved, not distinctly arching. *Inflorescences* (♂ unknown) terminal, paniculate, 8–15 cm long, densely tomentose, main branches up to 4 cm, racemose, with 10–15 flowers. *Bracts* subulate. *Flowers* (♂ unknown) subsessile, densely tomentose, buds 7 mm long. *Petals* distinctly unguiculate, apex incrassate-inflexed. *Stamens* free, glabrous. *Disk* adnate to the slightly concave receptacle, free rim 1 mm high, 6-lobed, the whole disk except for the outer base of the rim long-pilose. *Pistil*

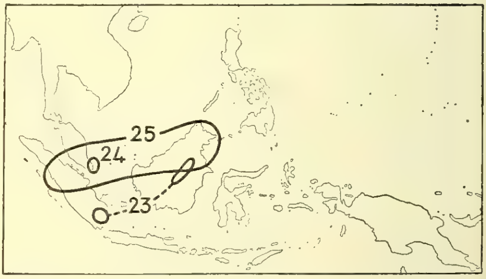

Fig. 38. Distribution of: 23. *C. pseudopatentinervium* H. J. LAM, 24. *C. grandifolium* (RIDL.) H. J. LAM, 25. *C. apertum* H. J. LAM.

densely pubescent. *Infructescences c.* 7 cm long, with 1 fruit; calyx flat, 3-lobed, *c.* 2 cm diam. *Fruits* ellipsoid, circular to rounded-triangular in cross-section, 5–7 by 2–3 cm, glabrous; pyrene truncate-triangular in cross-section with hollow sides, smooth or with a faint median rib on the lids, acutely angular and acute at both ends; lids 3–4 mm thick. *Seeds* 1(–2); sterile cells moderately reduced.

Distr. *Malaysia:* S. Sumatra, Banka, Borneo. Fig. 38.

Ecol. Primary forests, up to 700 m. *Fl.* March–April, *fr.* July and Oct.

Vern. *Tĕtak tundjuk*, Sumatra, *asam-asam*, Banka, *batu putih*, *engai*, *kĕlimah manuk*, *ukut*, Borneo.

Note. Closely related to *C. apertum* H. J. LAM and to *C. grandifolium* H. J. LAM, the only other species with unguiculate petals.

24. Canarium grandifolium (RIDL.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 215; Bull. Jard. Bot. Btzg III, 12 (1932) 527.—*Trigonochlamys grandifolia* RIDL. J. Str. Br. R. As. Soc. *no* 54 (1910) 31; Fl. Mal. Pen. 1 (1922) 381.—**Fig. 20a.**

Tree 35 m by 60 cm. *Branchlets* $^1/_2$–$^3/_4$ cm diam., densely fulvous-tomentose when young; pith dark-brown, hard, with peripherally arranged small vascular strands. *Stipules* none. *Leaves* 2–3-jugate, 25–40 cm long. *Leaflets* elliptic, 10–17 by 5–8 cm, stiff-chartaceous to coriaceous, densely tomentose beneath and on the midrib above, nervation prominent beneath; base slightly oblique, broadly cuneate to rounded; margin revolute, minutely fimbriate-serrate to entire; apex rather abruptly short-acute-acuminate; nerves 10–14 pairs (angle 65–75°), faintly curved, sometimes arching close to the margin. *Inflorescences* terminal, densely ferrugineously tomentose, ♂ paniculate, *c.* 18 cm long, flowers clustered, ♀ racemose to spicate, 6–10 cm long, with *c.* 12–15 flowers. *Bracts* subulate. *Flowers* pubescent, ♂ 13 mm, ♀ 15 mm with a slightly concave receptacle. *Calyx* ♂ 11 mm, ♀ 15 mm. *Petals* unguiculate, apex inflexed-acuminate, incrassate. *Stamens* free, glabrous. *Disk* ♂ cupular, 1 mm high, densely erect-pilose, ♀ densely pubescent, adnate to the receptacle, free rim 1 mm. *Pistil* not stalked, densely woolly pubescent; ♂ none. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* Malay Peninsula (Johore, Singapore), apparently rare. Fig. 38.

Ecol. *Fl.* Febr.

Note. Closely related to *C. apertum* H. J. LAM.

25. Canarium apertum H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 214, t. 5 f. 6; Bull. Jard. Bot. Btzg III, 12 (1932) 491, t. 12 f. 78; BUCKLEY, Mal. For. Rec. *no* 11 (1932) 36; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 8, *cum fig.*—*Santiria serrulata* ENGL. in DC. Mon. Phan. 4 (1883) 160, *non C. serrulatum* MIQ. 1859.

Tree 25–30(–43) m by 40–100 cm. *Branchlets* $^1/_2$–$^3/_4$ cm diam., sparsely tomentose or glabrescent; pith dark-brown, hard, with a peripheral sclerenchymatic cylinder (vascular strands usually invisible). *Stipules* none. *Leaves* 2–7-jugate. *Leaflets* oblong-elliptic to ovate, 4–13(–15$^1/_2$) by 2–5(–9) cm, rigid, subcoriaceous, subglabrous to more or less pubescent, specially on the prominent nerves beneath; base nearly equilateral, rounded to subcordate; margin often revolute, fimbriate, serrate (rarely dentate or repandous) to entire; apex acute to rounded, rarely emarginate; nerves 11–16(–18) pairs (angle *c.* 65°), straight or more or less irregularly curved, sometimes arching close to the margin. *Inflorescences* (♀ unknown) terminal, broadly paniculate, 10–30 cm long, densely rusty pubescent, main branches up to 13$^1/_2$ cm, broadly paniculate, many-flowered. *Bracts* subulate. *Flowers* (♀ unknown) *c.* 1 cm long, pubescent. *Calyx* 8–9 mm. *Petals* unguiculate, apex inflexed-acuminate, incrassate. *Stamens* free, glabrous. *Disk* cup-shaped, 1 mm high, densely erect-pilose. *Pistil* none. *Infructescences* terminal and sometimes in the upper leaf-axils, 6–8 cm long, rusty tomentose to glabrous, with 1 fruit; calyx saucer-shaped to cupular, deeply 3-lobed, 12–15 mm diam., with the remains of 6 stamens and a 1–2 mm high, faintly 6-lobed, rusty long-pilose disk. *Fruits* ovoid, acuminate, circular in cross-section, 4–5 by 2–2$^3/_4$ cm, fulvously tomentose, specially near the base and apex; pyrene rounded in cross-section, angle-ribs blunt, lids with a faint median rib each; lids up to 7 mm thick, very hard. *Seeds* 1(–2); sterile cells nearly invisible.

Distr. *Malaysia:* Sumatra, Malay Peninsula, Borneo. Fig. 38.

Ecol. Primary forests up to 200(–500) m. *Fl.* Febr. (Mal. Pen.), May–June (Borneo); *fr.* May (Mal. Pen.), Aug. (Borneo), Nov. (Sum.).

Wood anat. DESCH, Mal. For. Rec. 15^1 (1941) 63 (hand lens).

Vern. *Kĕdondong kidjai*, *k. rusa*, Sum., *kĕdondong sengeh*, Mal. Pen., *kĕdamu bikin*, *lenamun*, *tjĕlemu*, Borneo.

Notes. Closely related to *C. grandifolium* H. J. LAM, and also to *C. pseudopatentinervium* H. J. LAM.

It is very remarkable, that 2 out of these 3 species were at first described as *Santiria* (*incl.* also *Trigonochlamys*). Yet the fruit- and flower-characters are typically those of *Canarium*.

Incertae sedis

Sect. Regressiva subsect. Foliosa H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 209.

The relationship of the next 2 *spp.*, which are mutually closely related, is uncertain. In fertile characters they are close to *sect. Canarium*, in vegetative characters they remind of some species of *sect. Pimela*, specially of *C. australianum*.

26. Canarium pseudodecumanum HOCHR. Pl. Bog. Exs. (1904) 61; Bull. Inst. Bot. Btzg *no* 22 (1905) 88; Ann. Jard. Bot. Btzg Suppl. 3 (1910) 851; HEYNE, Nutt. Pl. (1927) 878; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104a; Bull. Jard. Bot. Btzg III, 12 (1932) 438, t. 9 f. 51; WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 6, *cum fig.*—*Canariopsis decumana* (*non* BL.) MIQ. Sum. (1861) 206, 527.—*Canarium decumanum* (*non* GAERTN.) ENGL. in DC. Mon. Phan. 4 (1883) 132; H. J. LAM in Merr. Pl. Elm. Born. (1929) 116.

Tree up to 50 m by 165 cm, with large buttresses. *Branchlets* $(^{3}/_{4}-)1^{1}/_{2}-2^{1}/_{2}$ cm diam., angular, glabrescent, leaf-scars large, terminal bud slender, 3–5 cm by 7–9 mm, densely ferrugineously woolly pubescent; pith thick, with many small vascular strands, appressed to the thin wood-cylinder. *Stipules* none. *Leaves* often nearly in whorls of four, (3–)4–6-jugate. *Leaflets* nearly sessile, lanceolate to oblong, 5–28(–33) by (2–)3–10(–12) cm, subcoriaceous, subglabrous above, densely minutely tomentose to sparsely stellately pubescent or nearly glabrous beneath; base rounded to subcordate; margin minutely serrulate (to subentire); apex rather abruptly, shortly acute-acuminate; nerves 20–25 pairs (angle variable), tortuous, more or less distinctly arching towards the margin, prominent beneath; reticulations very dense, waffle-like beneath. *Inflorescences* (♀ unknown) axillary, narrowly paniculate, up to 16 cm long, many-flowered, tomentose; flowers in glomerules. *Bracts* lanceolate to subulate. *Flowers* (♀ unknown) 7–9 mm long, pubescent. *Calyx* $3^{1}/_{2}$ mm high. *Stamens* free, glabrous. *Disk* cupular, 2 mm high, fleshy, densely erectly pilose. *Pistil* none. *Infructescences* unknown; calyx with remnants of a 6-lobed, fimbriate disk. *Fruits* ellipsoid, subtrigonous in cross-section, $7-8^{1}/_{2}$ by $4^{1}/_{2}-6$ cm, densely tomentose when young, glabrescent, scurfy; pyrene smooth, with 3 angle-ribs near the apex and often a faint median rib on each of the lids; lids 4–5 mm thick. *Seeds* (3–)2–1; all cells irregular-shaped, sterile ones slightly or not reduced.

Distr. *Malaysia:* Sumatra, Malay Peninsula, Borneo.

Ecol. Primary forests, up to 280 m. *Fl.* Apr. (Mal. Pen.), Oct. (Borneo), *fr.* March and Aug.–Nov. (Sum.).

Uses. The wood is very soft. The abundant resin is used for caulking canoes. An edible oil is pressed out of the seeds, which also are eaten.

Vern. *Damar likat, kadungdung, (kaju) tandikat, tondikat, tahola, toktohan,* Sumatra, *han,* S. Thailand, *damar kangar, lamèh, meoo, myior,* Malay Peninsula, *djĕlapat gala-gala sĕmut, djĕlmu, tampang kidjang,* Borneo, *lantuay (lantu air).*

Notes. Closely related to *C. decumanum* GAERTN. The two species are nearly vicariads, even in Borneo.

27. Canarium decumanum [RUMPH. Herb. Amb. 2 (1741) 166, t. 55] GAERTN. Fruct. 2 (1791) 99, t. 102; WILLD. Sp. Pl. 4, 2 (1805) 760; DC. Prod. 2 (1825) 80; R. & S. Syst. 7, 1 (1829) 80; *non* ENGL. in DC. Mon. Phan. 4 (1883) 132 (= *C. pseudodecumanum* HOCHR.); K. & V. Bijdr. 4 (1896) 48, 313; Ic. Bog. 1 (1897) t. 8; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 22^{13}, 23^{5}; BACK. Schoolfl. (1911) 198, *excl. specim. sumatr.*; KOORD. Exk. Fl. Java 2 (1912) 434; SENN in Karsten & Schenk, Veget. Bild. 10, 4 (1912) t. 22; KOORD. Atlas 1

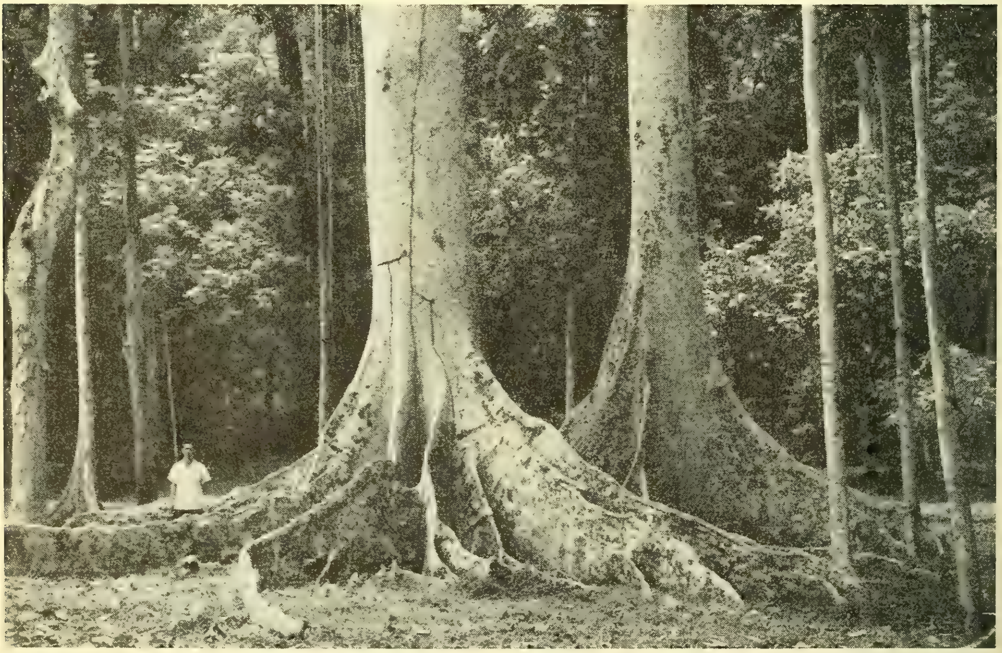

Fig. 39. Buttresses in *Canarium decumanum* GAERTN. (Cult. Hort. Bog. VI–E–5 & 16). Trees 33 years old.

(1913) t. 150; MERR. Int. Rumph. (1917) 300; HEYNE, Nutt. Pl. (1927) 876; *non* H. J. LAM in Merr. Pl. Elm. Born. (1929) 116 (= *C. pseudodecumanum* HOCHR.); H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931–'32) t. 6 f. 24–44, f. 52, t. 15 f. 115a; Bull. Jard. Bot. Btzg III, 12 (1932) 435; F. H. HILDEBRAND, Het Bosch 11 (1934) 267; H. J. LAM, in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 5.—*Pimela decumana* BL. Mus. Bot. 1 (1850) 223.—*Canariopsis decumana* BL. *ex* MIQ. Fl. Ind. Bat. 1, 2 (1859) 652; *non* MIQ. Sum. (1861) 206, 527 (= *C. pseudodecumanum* HOCHR.).—**Fig. 22a, 39 & 40.**

Tree, 30–60 by 1½–2 m, with very large buttresses (up to 8 m high and 5 m wide). *Branchlets* 1–1½ cm diam., angular, glabrescent, with large leaf-scars, terminal bud slender, acute, 4–5 cm by 6 mm, densely brown-tomentose; pith thick with many peripherally arranged small vascular strands. *Stipules* represented by the basal pair of leaflets, which are rather caducous—leaving a small circular scar—, inserted at the conjunction of branch and petiole and very small (petiolule 4–10 mm, blade 1½–2½ by ¾–2 cm). *Leaves* spirally arranged, (3–)4–5(–6)-jugate, 35–45 cm long. *Leaflets* ovate to oblong, 5–10–30 by 2½–5–10 cm, stiff-chartaceous to coriaceous, glabrescent; base rounded to subcordate; margin entire; apex gradually long and acutely acuminate; nerves 17–22–26 pairs (angle *c.* 60°), tortuous, towards the margin dissolving into a lax marginal reticulation, rather prominent beneath, some of the nerves more or less reduced (similar to intermediate veins); reticulations dense. *Inflorescences* axillary, narrowly paniculate, densely minutely tomentose, ♂ 4–19 cm long, many-flowered, main branches up to 6½ cm, flowers clustered; ♀ 5–7 cm, few-flowered, main branches very short. *Bracts* lanceolate to subulate. *Flowers* pubescent, ♂ 7–9 mm, ♀ 8–14 mm. *Calyx* ♂ 3½ mm high, ♀ 4½–7 mm. *Stamens* free, glabrous. *Disk* ♂ cushion-shaped, 2 mm high, faintly 6-lobed, densely pilose; ♀ 6-lobed, 1 mm high, fimbriate. *Pistil* pubescent, ♂ none. *Infructescences* subracemose, with few fruits; calyx flat, 1 cm diam. *Fruits* ellipsoid, subtrigonous in cross-section, 7–8½ by 4½–6 cm, glabrescent, scabrous; pyrene smooth except of 3 angle-ribs near the apex and a faint median rib on each of the lids; lids 4–5 mm thick. *Seeds* (3–)2–1; cells irregularly shaped, sterile ones not or slightly reduced.

Distr. *Malaysia:* E. Borneo, Moluccas (Morotai, Ternate, Batjan, Ceram), New Guinea (Vogelkop). According to RUMPHIUS (*l.c.*), also in S. Celebes, Buton, Halmaheira, the Sula Islands, and Buru. Not rarely cultivated, specially in Java.

Ecol. Primary forests at low altitudes. *Fl.* April–May, *fr.* June–Nov.

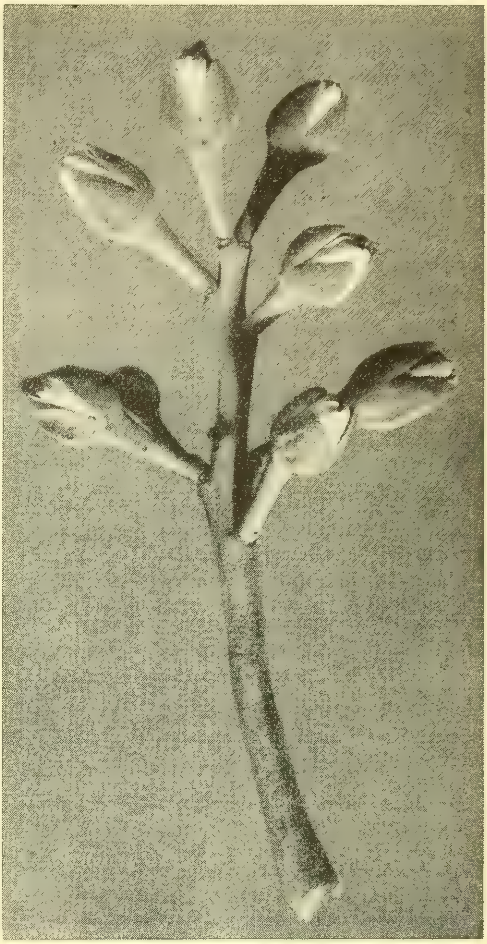

Fig. 40. *Canarium decumanum* GAERTN. ♀ (Cult. Bogor Palace Garden VII–9), *c.* × 2.

Uses. The resin and the seeds are used, but they are of no great importance.

Vern. *Kĕnari babi, k. sabrang,* Java, *djilapat, djĕlamu,* Borneo, *hapo, hoburu,* Morotai, *(njiha) hafo,* Ternate, *glama,* Ceram, *kanari kĕtjil,* Ambon, *damar amin, hafu bopolulo, h. gogira, h. sula, jal amin, jalo halat, jar amin, kamal amin, kami, kĕnari bĕsar, k. sula,* Moluccas.

Notes. Closely related to *C. pseudodecumanum* HOCHR.

Young specimens very much resemble *Flindersia schottiana* F. MUELL. (*Rutac.*), which however can easily be recognized by the presence of distinct pellucid oil-glands in the leaflets.

2. Section Pimela

DC. Prod. 2 (1825) 80.—*Pimela* LOUR. Fl. Coch. (1790) 407.—*Sect. Regressiva subsect. Subulata* H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 209.

Stipules subulate to lanceolate, not rarely absent; scars orbicular, minute. *Bracts* deltoid to subulate, not consisting of connate stipules (fig. 1i–j). *Leaflets* greyish-green when dry; margin entire to serrate; indument, if present, mostly consisting of hispid hairs. *Inflorescences* mostly axillary to pseudoterminal, very rarely terminal. *Stamens* often partly to entirely connate, rarely adnate to the disk. *Receptacle* in ♀ flowers nearly always flat, very rarely slightly concave. *Disk* usually 6-lobed, often pilose. *Pistil* very rarely stalked, mostly pilose. *Calyx* in fruit rarely more than 1 cm diam., outside usually glabrous, inside mostly sericeous, flat, lobes often reflexed. *Fruits* small, 2½–3½(–5) cm long; pyrene often with angle- and median ribs, sometimes entirely tuberculate.

Distr. Continental SE. Asia from S. India to S. China and Hainan, Andamans, *Malaysia*, Carolines, New Britain, N. Queensland, Solomon Isl., New Hebrides, Fiji, Samoa, and Tonga.

28. Canarium oleosum (LAMK) ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 241, f. 136 Q–S; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) 246, f. 8, 18. 22⁵, 23¹²⁻¹³, 25, 26P, 30; Rev. Gén. Bot. 22 (1910) 454, f. 2, t. 12 f. 2; MERR. Int. Rumph. (1917) 303; HEYNE, Nutt. Pl. (1927) 878; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 91, t. 13 f. 100–101; Bull. Jard. Bot. Btzg III, 12 (1932) 483, t. 11 f. 74; MEYER DREES, Comm. For. Res. Inst. *no* 33 (1951) 43.—*Nanarium minimum sive oleosum* RUMPH. Herb. Amb. 2 (1741) 162, t. 54.—*Amyris oleosa* LAMK, Enc. 1 (1783) 362. —*C. microcarpum* WILLD. Sp. Pl. 4 (1806) 760; POIR. in LAMK, Enc. Suppl. 2 (1811) 72; MIQ. Fl. Ind. Bat. 1, 2 (1859) 646; ENGL. in DC. Mon. Phan. 4 (1883) 125; VORDERMAN, Teysmannia 5 (1894) 111; HOCHR. Bull. Inst. Bot. Btzg *no* 22 (1905) 90, *incl. f. minor*; BOORSMA, Bull. Dép. Agr. Ind. Néerl. *no* 7 (1907) 29.—*C. laxiflorum* DECNE, Nouv. Ann. Mus. Hist. Nat. Paris, 3 (1834) 477; SPANOGHE, Linnaea 15 (1841) 188.—*C. pimela* (*non* KOEN.) SPANOGHE, Hook. Comp. Bot. Mag. 1 (1835) 346.—**Fig. 20b, 21l, & 41.**

Tree 17–20(–30) m by 25–50 cm; sometimes buttressed. *Branchlets* ¼–½ cm thick, soon glabrescent; pith with a peripheral cylinder of vascular strands. *Stipules* none. *Leaves* (0–)3–5(–7)-jugate, glabrous. *Leaflets* ovate to lanceolate, 2–18 by 1–7 cm, thin-chartaceous; base slightly oblique, cuneate to rounded; margin entire; apex gradually narrowed into a short, broad and blunt acumen; nerves 10–15 pairs (angle 60–80°), straight to slightly curved, rather abruptly and conspicuously arching at some distance from the margin; intermediate veins strongly developed; reticulations lax. *Inflorescences* axillary , slender, narrowly and laxly paniculate, (4–)30–45 cm, glabrous; branches patent but for the longer basal ones, up to 4½ cm (♂ ones sometimes up to 10 cm), long-stalked, ♂ ones many-flowered, ♀ ones up to 5-flowered. *Flowers* 5–7 mm long, glabrous, ♀ ones sometimes with a slightly concave receptacle. *Calyx* 2–3 mm high. *Stamens* glabrous, in ♂ flowers slightly connate at the base, in ♀ flowers free. *Disk* in ♂ flowers pistilloid, ovoid, sometimes shortly stalked, 1½ mm high, pilose at the apex, tapering into a short, style-like appendix; in ♀ flowers cupular, 6-undulate, 1 mm high, fimbriate. *Pistil* glabrous (very rarely tomentose). *Infructescences* slender, with up to 5 fruits; calyx flat, triangular, 3½–5 mm diam., with reflexed lobes. *Fruits* ovoid to obovoid, round in cross-section, 1¼–2 by ¾–1¼ cm, glabrous; pyrene faintly 6-ribbed, sometimes slightly rugose; lids 2 mm thick. *Seed* 1; sterile cells nearly obsolete.

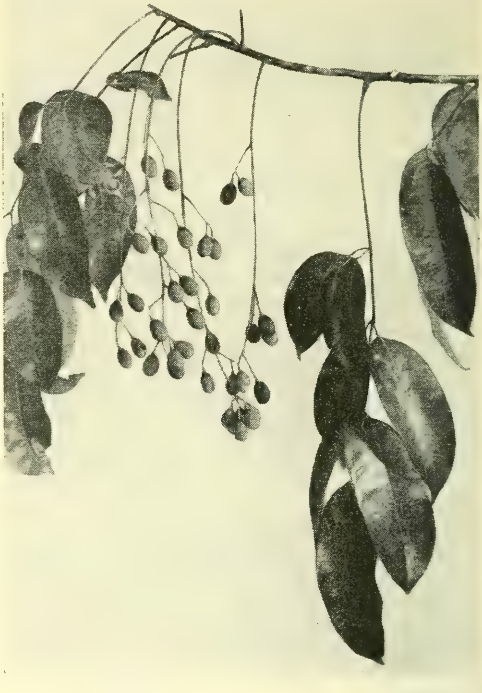

Fig. 41. *Canarium oleosum* (LAMK) ENGL. with fruits (Cult. Hort. Bog. VI–E–13).

Distr. New Britain and *Malaysia:* Lesser Sunda Islands (Alor, Timor, Wetar), N. Celebes, Moluccas (Morotai, Ternate, Batjan, Obi, Buru, Kei Islands), and New Guinea. Fig. 42.

Ecol. Primary and secondary forests, mostly below 400 m, rarely up to 700(–1200) m. *Fl.*

May–Nov., *fr.* May–Oct. (Dec. in New Britain).

Uses. The wood can be used as a light constructional timber. The wood of the buttresses is said to be one of the components of the scented wood *kaju rasamala*. The oily parts of the resin are used as a balm on wounds and for hair lotions; in New Guinea for the latter purpose it is mixed with coconut-oil.

Vern. Lesser Sunda Islands: *bamkalang babi*, Alor, *kesi, rani kalang bahi*, Timor; Moluccas: *iale(jalo) bandang*, Alf., *anto*, Ternate, *damar putih*, Batjan, *kaju rasamala*, Batjan, Obi, Buru, *kota aros*, Buru, according to Rumphius: *kanari (nanari) minjak*, Ambon, *aihau madelle*, Hitu, *janiri*, Manipa, *jasesel*, Bonoa; New Guinea: *manoi*, Centr. Div.; New Britain: *iqaqalip, puogo*.

Notes. Closely related to *C. balsamiferum* Willd. and on the whole rather uniform. The two forms, mentioned by H. J. Lam (Bull. 1932, *l.c.*), a small-leaved and a large-leaved one, are only vaguely distinguishable.

Some specimens from New Guinea have rather coriaceous leaflets; they have been collected at *c.* 1000 m. Some specimens, specially one from Morotai (Main & Aden 1425), are long remaining densely tomentose.

Guillaumin (Fl. Gén. I.-C. 1, 1911, 710) was the first to record this species from Indo-China. In this he based himself on *Pimela oleosa* Lour., typified by Indo-Chinese material and with a reference to the E. Malaysian *Nanarium oleosum* of Rumphius (the type of *Amyris oleosa* Lamk). Poiret *l.c.* erroneously referred Loureiro's species to *C. microcarpum* Willd. See also Merrill (Comm. Lour. 1935, 227). Already Engler (1883, *l.c.*) expressed doubt about this synonymy and H. J. Lam (Ann. Jard. Bot. Btzg 42, 1932, 208) gave a new name to the species of Loureiro, *viz C. engleri* H. J. Lam, which is up till now only known from Loureiro's description.

29. Canarium balsamiferum Willd. Sp. Pl. 4 (1806) 760; Engl. in DC. Mon. Phan. 4 (1883) 150; Merr. Int. Rumph. (1917) 301; Heyne, Nutt. Pl. (1927) 876; H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) t. 16 f. 127c2; Bull. Jard. Bot. Btzg III, 12 (1932) 485, t. 12 f. 75; Cretzoiu, in Fedde, Rep. 36 (1934) 266, *incl. var. typicum* and *var. englerianum*.—*C. odoriferum leve* Rumph. Herb. Amb. 2 (1741) 156, t. 50.—*Boswellia balsamifera* Spreng. Syst. Veg. 2 (1825) 313.—*Pimela glabra* Bl. Mus. Bot. 1 (1850) 222, *excl. basinym Boswellia glabra* Roxb.—*Pimela paucijuga* Bl. Mus. Bot. 1 (1850) 226.—*Canariopsis glabra* Bl. *ex* Miq. Fl. Ind. Bat. 1, 2 (1859) 653.—*Canariopsis paucijuga* Bl. *ex* Miq. *l.c.*; Engl. in DC. Mon. Phan. 4 (1883) 151; Merr. Int. Rumph. (1917) 305.—*C. celebicum* Engl. *ex* Koord. Nat. Tijd. N. I. 63 (1903) 97, *nomen*; Koord. Suppl. Cel. 2 (1922) t. 31; *op. cit.* Suppl. 3 (1922) 17.—*C. englerianum* Hochr. Pl. Bog. Exs. (1904) 56; Ann. Jard. Bot. Btzg Suppl. 3 (1910) 845.—*C. longissimum* Hochr. Pl. Bog. Exs. (1904) 58; Ann. Jard. Bot. Btzg Suppl. 3 (1910) 846.—*C. rooseboomii* Hochr. Pl. Bog. Exs. (1904) 62; Ann. Jard. Bot. Btzg Suppl. 3 (1910) 848.—*C. poeloetimbeo* Engl. *ex* Hochr. Pl. Bog. Exs. (1904) 58, *nomen*; Koord.-Schum. Syst. Verz. 3 (1914) 61.

Buttressed tree, 17–28 m by 20–40(–70) cm. *Branchlets* $^{1}/_{2}$–$1^{3}/_{4}$ cm thick, glabrescent; pith with many vascular strands, which are sometimes arranged in two concentric cylinders. *Stipules* none. *Leaves* (3–)5–8-jugate, glabrous. *Leaflets* lanceolate to oblong, 9–24 by 2–$9^{1}/_{4}$ cm, herbaceous to coriaceous; base broadly cuneate to slightly cordate; margin entire; apex acute, rather abruptly, short (*c.* 1 cm) and slenderly blunt-acuminate; nerves 8–15 pairs (angle 60–70°), little curved, rarely distinctly arching close to the margin; reticulations very slender and rather dense. *Inflorescences* axillary, glabrescent, slender, ♂ ones narrowly paniculate, 10–50 cm, main branches *c.* 2(–10) cm, patent, paniculate, 3–11-flowered; ♀ ones mostly racemose, 4–10 cm. *Flowers* (nearly) glabrous, ♂ ones 1 cm long, ♀ ones 5–6 mm. *Calyx* 3–5 mm high. *Stamens* glabrous, in ♂ flowers connate for 1–2 mm, in ♀ ones very slightly connate. *Disk* in ♂ flowers thick and ovoid to club-shaped, 4 mm high, more or less deeply (3–)6-lobed, with a central canal, pubescent, inner side and apex with long, erect hairs; in ♀ flowers cupular, $^{3}/_{4}$ mm high, 6-undulate, pubescent outside and long-fimbriate. *Pistil* densely pubescent except at the base; in ♂ flowers none. *Infructescences* in the more coarse specimens short and dense, 5–8 cm long, with 2–5 rather large, fertile fruits; in more slender specimens up to 25 cm long, slender, fruits smaller and often some of them sterile; calyx *c.* 7 mm diam., flat, 3-lobed, lobes reflexed. *Fruits* ovoid, acute, specially at the apex, round or slightly trigonous in cross-section, 2–$2^{1}/_{2}$–4 by $1^{1}/_{4}$–2 cm, glabrous or slightly pubescent at the top; lids conspicuous, faintly keeled, *c.* $2^{1}/_{2}$ mm thick. *Seeds* 3.

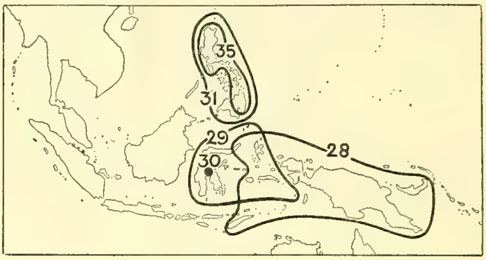

Fig. 42. Distribution of *C. oleosum* and allies: 28. *C. oleosum* (Lamk) Engl., 29. *C. balsamiferum* Willd., 30. *C. trigonum* H. J. Lam, 31. *C. euryphyllum* Perk., 35. *C. gracile* Engl.

Distr. *Malaysia:* Celebes, Moluccas (Talaud Islands, Morotai, Halmaheira, Buru, Ambon, Kai Islands). Fig. 42.

Ecol. In primary forests from low altitudes up to *c.* 700 m. *Fl. fr.* (mainly) May–July.

Uses. According to Rumphius the aromatic oil from the resin is highly estimated, as it is sweeter scented than that of most other *Canarium* species known to him.

Vern. Celebes: *damar nitih*, *kanari in talun*, *rerih in talim*, *solo (lewo)*, Minah., *djadjaro*, Tobelo, *wangkilowu*, Central Cel., *lemboa*, S. Cel., *salong baling*, *tulu-tim-beo*; Moluccas: *matimpunĕ*, *nakimpunĕ*, Talaud, *okie*, Buru, *kamakoan*, Ambon; *dammar sĕlan*.

Notes. The best subdivision of this variable species is that given by H. J. LAM (Bull. 1932, *l.c.*). As the characters are very vague and as the 3 forms are not geographically separated, he did not provide them with names.

The species is closely related to *C. trigonum* H. J. LAM and less so to *C. oleosum* ENGL.

30. Canarium trigonum H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 219; Bull. Jard. Bot. Btzg III, 12 (1932) 487, t. 14 f. 95.

Tree, 20–28 m by 20–30 cm. *Branchlets* 3–4 mm thick, glabrescent; pith with a peripheral cylinder of some large to many small vascular strands, in the latter case appressed to the wood. *Stipules* absent. *Leaves* 2–5-jugate, glabrous. *Leaflets* elliptic-lanceolate, 5$^1/_2$–15 by 2$^1/_2$–5 cm, chartaceous; base cuneate; margin entire; apex acute, rather abruptly, long and slender (5–15 by 1$^1/_2$–2 mm) blunt-acuminate; nerves 7–12 pairs (angle 55–65°), curved, not arching except in the apical part; reticulations lax. *Inflorescences* axillary, glabrous, slender, ♂ ones narrowly paniculate, *c.* 20 cm long, main branches patent, up to 1$^1/_2$ cm, 2–3-flowered; ♀ ones racemose, 4–8 cm long, with few flowers only. *Flowers* nearly glabrous, ♂ ones 4–5, ♀ 7–8 mm long. *Calyx c.* 3 mm long. *Stamens* in ♂ flowers connate for 1 mm, filaments pilose, anthers acute-acuminate; in ♀ flowers free, totally pilose. *Disk* cylindrical in ♂ flowers, 2 mm high, densely pubescent, with or without a central canal; in ♀ flowers cupular, 6-lobed, 1 mm high, fimbriate. *Pistil* densely pilose, in ♂ flowers absent. *Infructescences* small, with only one fruit; calyx flat with reflexed lobes, 7 mm diam. *Fruits* shortly ovoid, trigonous in cross-section, *c.* 3$^1/_2$ by 2$^1/_2$ cm; pyrene rounded-triangular in cross-section, the sides flat to slightly concave; lids thick; cells equally well developed.

Distr. *Malaysia:* Central Celebes. Fig. 42.

Ecol. In old forests, 200 m. *Fl. fr.* May–July.

Vern. *Karĕmatu*, *morohulo*, Tobelo.

Note. This apparently rare species is closely related both to *C. balsamiferum* WILLD. and to *C. euryphyllum* PERK.

31. Canarium euryphyllum PERK. Fragm. Fl. Philip. 1 (1904) 99; MERR. En. Philip. 2 (1923) 350; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 80; Bull. Jard. Bot. Btzg III, 12 (1932) 531.—*C. perkinsae* MERR. Publ. Gov. Lab. Philip. *no* 35 (1906) 26; En. Philip. 2 (1923) 352.—*C. todayense* ELM. Leafl. Philip. Bot. 3 (1911) 1087.—*C. purpureum* ELM. Leafl. Philip. Bot. 4 (1912) 1503.—*C. ramosii* MERR. Philip. J. Sc. 8 (1913) Bot. 374, *incl.* also *var. parvum*; En. Philip. 2 (1923) 353; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 532.—*C. paucinervium* MERR. Philip. J. Sc. 9 (1914) Bot. 364; En. Philip. 2 (1923) 352.—*C. stenophyllum* MERR. Philip. J. Sc. 10 (1915) Bot. 25; En. Philip. 2 (1923) 354.—*C. microphyllum* MERR. Philip. J. Sc. 13 (1918) Bot. 304; En. Philip. 2 (1923) 351.

Note. The leaflets of Philippine specimens of this and some other species are very variable in shape and size; on these characters a number of local species have been based.

var. **euryphyllum.**—*C. perkinsae* MERR.—*C. todayense* ELM.—*C. purpureum* ELM.—*C. stenophyllum* MERR.—*C. microphyllum* MERR.

Tree 10–15(–40) m by 10–25(–40) cm. *Branchlets* $^1/_4$–$^1/_2$ cm thick, soon glabrescent; pith with a peripheral cylinder of small vascular strands, the few central ones rarely arranged into a second cylinder. *Stipules* none. *Leaves* (2–)4–7-jugate, (nearly) glabrous. *Leaflets* elliptic (to lanceolate), slightly falcate, 4$^1/_2$–10–12 by 2–4 cm, very rarely nearly orbicular and straight, 3$^1/_2$ cm diam., mostly chartaceous, glabrous or subglabrous; base cuneate (to rounded); margin entire; apex abruptly, long and slender, blunt-acuminate; nerves (5–)8–10(–15) pairs (angle variable), straight, gradually curved towards the margin and indistinctly arching at *c.* 2 mm from it. *Inflorescences* axillary, narrowly paniculate to racemose, 15–20 cm, glabrescent; partial panicles often sessile, 2–3(–5)-flowered, rarely stalked, up to 3$^1/_2$ cm long and up to 12-flowered. *Flowers c.* 1 cm long, glabrous to very shortly pilose outside, specially the corolla. *Calyx* 3 mm high, widely cupular. *Corolla* much exserted, not slender. *Stamens* glabrous, in ♂ flowers faintly connate. *Disk* in ♂ flowers tubular to cupular, up to 2$^1/_2$ mm high, fimbriate, on the inner side densely pilose; in ♀ flowers annular, 6-undulate, 1 mm high, long-pilose. *Pistil* pilose, in ♂ flowers nearly always totally absent. *Infructescences* 10–20 cm long, glabrous, with up to 5 fruits; calyx flat, triangular, 5 mm diam., lobes reflexed. *Fruits* broadly elliptic, broadly triangular in cross-section, 2$^3/_4$–3 by 1$^1/_4$–1$^1/_2$ cm, glabrescent except for the apex, red; pyrene smooth; lids 2 mm thick; fruits often sterile. *Seed* 1; sterile cells rather strongly reduced.

Distr. *Malaysia:* Philippines (Palawan excepted). Fig. 42.

Ecol. Rather common tree in forests, up to 500 m (on Mt Katanglad, Mindanao, once collected at 1700 m). *Fl.* Nov.–June, *fr.* (mainly) April–Aug.

Uses. The wood is often said to be very hard.

Vern. *Analian*, C. Bis., *batuan-babui*, Mindoro, *bolabog*, *buntirau*, *magosayag*, P. Bis., *indur*, *pararuy*, Mindoro, *mayakyat*, *tabuali*, Tag., *ogat*, Bag., *palaspas*, Polillo, *malatagun*, Luzon, Camarines Sur.

var. **ramosii** (MERR.) LEENH. *nov. stat.*—*C. ramosii* MERR.—*C. paucinervium* MERR.

The main differences to *var. euryphyllum* are: Rather densely, hirsutely pilose on the branchlets, petioles, leaf-axes, petiolules and leaflets (midrib above, all nerves beneath). Leaves mainly 2–4-jugate. Leaflets less falcate, mainly 12–18 by 4$^1/_2$–6 cm, less stiff. Inflorescences more often paniculate and more-flowered. Flowers longer (14 mm). Fruits slightly broader (1½–1¾ cm), black; no sterile ones seen.

Distr. *Malaysia:* Philippines (Samar, Leyte, Mindanao: Surigao Prov. only).

Ecol. In forests at low altitudes. *Fl.* June–Sept., *fr.* (mainly) April–Aug.

Vern. *Malapiliai, milipiliai,* S. L. Bis.

32. Canarium kostermansii LEENH. Blumea 8 (1955) 191, f. 5a.

Tree, 30 m by 60 cm. *Branchlets* rather slender, up to 1 cm thick, brown tomentose; pith with 2 concentric cylinders of vascular strands. *Stipules* very caducous, inserted on the petiole 3–5 mm from its base, subulate, *c.* 6 mm, leaving a prominent scar. *Leaves* 6–7-jugate. *Leaflets* lanceolate, slightly oblique, 10–12 by 3–3½ cm, rather stiff chartaceous, glabrous; base unequally, broadly cuneate; margin entire; apex gradually narrowed into a long and slender (up to 15 by 3–4 mm), acute acumen; nerves 22–25 pairs (angle *c.* 60°), straight, faintly curving towards the margin, abruptly arching very close to the margin. *Inflorescences* (♂ unknown) axillary, racemose, 10–15 cm long, thinly tomentose, glabrescent. *Flowers* (♂ unknown) 12 mm long, with a slightly concave receptacle. *Calyx* 9 mm high. *Stamens* 4¼ and 5½ mm long, connate for 1½ mm; filaments glabrous. *Disk* annular, ½ mm high, up to 1½ mm fimbriate. *Pistil* glabrous. *Infructescences* unknown. *Fruits* (mature ones unknown) glabrous, 1-seeded.

Distr. *Malaysia:* Borneo (E. Kutei), once collected, 100 m, *fl.* June. Fig. 43.

Vern. *Ngalin.*

Note. This species is apparently related to *C. pilosum* BENN.

33. Canarium pilosum BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 533; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 121; KING, J. As. Soc. Beng. 62, ii (1894) 243; RIDL. J. Str. Br. R. As. Soc. *no* 33 (1900) 58; Fl. Mal. Pen. 1 (1922) 372, f. 39, *incl.* also *var. hirtellum*; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 212, t. 13 f. 104i, *incl.* also *var. hirtellum*; Bull. Jard. Bot. Btzg III, 12 (1932) 472, t. 11 f. 68; BURK. Dict. (1935) 432; LEENH. Bull. Bish. Mus. *no* 216 (1955) 24, f. 11.—*C. grandiflorum* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 533; Pharm. J. Trans. III, 6 (1875) 103; ENGL. in DC. Mon. Phan. 4 (1883) 122; KING, J. As. Soc. Beng. 62, ii (1894) 242; RIDL. J. Str. Br. R. As. Soc. *no* 33 (1900) 58; Fl. Mal. Pen. 1 (1922) 370; BURK. Dict. (1935) 429.—*C. hirtellum* BENN. in Hook. *f.* Fl. Br. Ind. 1 (1875) 534; Pharm. J. Trans. III, 6 (1875) 103; Hook. Ic. Pl. 16 (1887) t. 1575; ENGL. in DC. Mon. Phan. 4 (1883) 121; KING, J. As. Soc. Beng. 62, ii (1894) 244.—*C. motleyanum* ENGL. in DC. Mon. Phan. 4 (1883) 133; MERR. En. Born. (1921) 317.—*Dacryodes scandens* HUSSON, Blumea 7 (1952) 164, f. 1; KALKMAN, Blumea 7 (1954) 518.

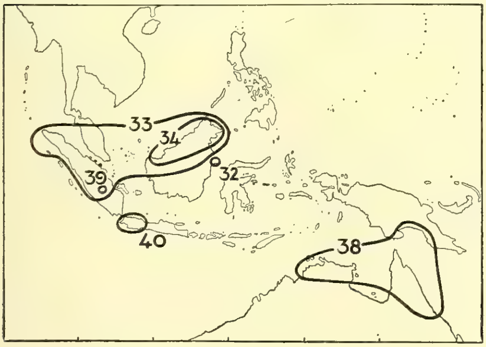

Fig. 43. Distribution of *C. pilosum* and allies: 32. *C. kostermansii* LEENH., 33. *C. pilosum* BENN., 34. *C. merrillii* H. J. LAM, 38. *C. australianum* F.v.M., 39. *C. intermedium* H. J. LAM, 40. *C. kipella* (BL.) MIQ.

Note. Two subspecies can be distinguished; a few intermediate specimens have been collected in S. Sumatra and E. Borneo. *C. pilosum* approaches *C. merrillii* in its *ssp. borneensis.*

ssp. **pilosum.**—*C. grandiflorum* BENN.—*C. hirtellum* BENN.—*C. motleyanum* ENGL.—**Fig. 21n.**

Tree, 10–28(–37) m by 20–45(–65) cm; buttresses, if present, up to 1 m high. *Branchlets* slender, ½–1 cm thick, long remaining densely woolly pubescent; pith with a peripheral cylinder of vascular strands, rarely also some in the central part. *Stipules* mostly persistent, inserted at the base of the petiole or on the petiole up to 2¼ cm from the base, subulate, up to 2 cm. *Leaves* (1–)2–4(–6)-jugate, more or less pubescent in all parts, rarely entirely glabrous. *Leaflets* ovate to oblong-lanceolate, 4–25 by 1½–10 cm, chartaceous, totally glabrous to pubescent on the midrib above and woolly pubescent beneath; base rounded to broadly cuneate; margin minutely serrulate to entire; apex gradually to subabruptly, short and bluntly to long and acutely acuminate; nerves 8–15 pairs (angle from base to apex 80–50°), curving, geniculate near the margin, often more or less arching. *Inflorescences* axillary to pseudoterminal, rarely terminal, glabrescent, rather few-flowered, ♂ ones narrowly paniculate, 4–10–26 cm long, ♀ ones more racemose, 1½–10 cm. *Flowers* 1–1¼ cm long, slender, specially the ♂ ones, densely pubescent outside. *Calyx* in ♂ flowers 2–4 mm high, in ♀ ones 5–6 mm. *Stamens* glabrous, in ♂ flowers 6–8 mm long, connate for 2–3 mm; in ♀ flowers 4 mm long, nearly entirely connate. *Disk* cupular, up to 1 mm high, pilose. *Pistil* pilose, in ♂ flowers very small. *Infructescences* 1½–10 cm long, with 1–4(–8) fruits crowded at the top of the stalk; calyx saucer-shaped, 3-lobed, 6–13 mm diam. *Fruits* oblong (to ovoid), at the apex nearly always truncate and with 3 'shoulders', rarely tapering, mostly rounded 3-angular in cross-section, (1¾–)2¼–3¼ by (¾–)1–1½ cm, glabrous except sometimes at the apex; pyrene smooth, the sides concave to faintly keeled; lids 1½(–3) mm thick. *Seed* nearly always 1, the sterile cells strongly reduced.

Distr. *Malaysia:* Sumatra (*incl.* also Simalur), Malay Peninsula, Borneo. A specimen from the Fiji Islands (Viti Levu: GILLESPIE 3434) is very probably derived from a cultivated or naturalized tree. Fig. 43.

Ecol. Rather common in primary forests, also in swamps, up to *c.* 350(–1250) m. *Fl.* (Dec.–) March–Aug.(–Oct.), *fruiting* (March–)April–July (–Nov.).

Uses. The wood is said to be durable against insects and is used for house-building.

Vern. Sumatra: *bantan kĕrosoh, damar kunang, kaju putih, mĕrasam daun alus*, Palemb., *mĕdang serababa*, Lamp., *awa surian, bangkiring sito bulung, surian uding, s. pajo, s. silai, s. sito bulung, tutun surian*, Simalur; Malay Peninsula: *kadondong krat, kĕjam pĕnggĕli*; Borneo: *alum pesa*, W. Born., *keramoh batu*, Sarawak, *damar lilin*, SE. Born.

Note. In one specimen (HENDERSON SF. 21429) I found fertile fruits and ♂ flowers.

ssp. **borneensis** LEENH. Blumea 8 (1955) 193, f. 5d.—*Dacryodes scandens* HUSSON.

Tree *c.* 10(–25) m high, very rarely a pseudoliane. Stipules absent. Leaves 0–5-jugate. Leaflets always glabrous; base sometimes subcordate; margin always entire; intermediate veins more strongly developed. Inflorescences narrower and with few flowers. Flowers glabrous, ♂ ones *c.* 5 mm long, less slender. Stamens in ♂ flowers slightly confluent at base. Disk in ♂ flowers rather variable, with or without a rudimentary pistil. Pistil in ♀ flowers glabrous. Fruits ellipsoid to fusiform, tapering at base and apex, 3¾–4½ by 1½ cm.

Distr. *Malaysia:* Borneo (Mt Kinabalu).

Ecol. In forests, *c.* 1500 m. *Fl.* Sept.–Oct. (Jan., March), *fr.* April, July, Sept.–Oct.

34. Canarium merrillii H. J. LAM, in Merr. Pl. Elm. Born. (1929) 117; Ann. Jard. Bot. Btzg 42 (1932) 213, t. 16 f. 133, *incl. var. originarium & var. villosum*; Bull. Jard. Bot. Btzg III, 12 (1932) 489, t. 12 f. 76.

Small tree, 10–20 m by 15–40 cm. *Branchlets* slender, glabrescent; pith not very compact, with some large peripheral vascular strands. *Stipules* very caducous, inserted at the base of the petiole, or on the petiole up to 1 cm from the base, subulate, 2–5 mm. *Leaves* 0–5-jugate. *Leaflets* (ob)ovate to lanceolate, (3–)5½–16 by (1¼–) 2¾–5½ cm, stiff chartaceous, upper side glabrous except the midrib, lower side with scattered to crowded papillae, sometimes each of them provided with a soft hair; base cuneate; margin entire; apex subabruptly narrowly acute-acuminate; nerves 6–14 pairs (angle 50–60°), gradually curving, more or less distinctly arching at some distance from the margin. *Inflorescences* glabrous or slightly pubescent, either in the upper leaf-axils, narrowly paniculate, few-flowered, or together forming one lax terminal panicle, in the latter case up to 30 cm long, main branches up to 15 cm, laxly paniculate, the ♂ ones with 15–20 flowers, ♀ ones with fewer flowers. *Flowers* 8–9 mm long, rather slender, nearly glabrous outside. *Calyx* 4–5 mm high. *Stamens* glabrous, in ♂ flowers 8 mm long, connate for ½–2¼ mm, in ♀ flowers 4–5 mm, connate for 2 mm. *Disk* 1½ mm high, fimbriate, in ♂ flowers cupular, rather thick, in ♀ flowers thinner and slightly 6-undulate. *Pistil* glabrous, in ♂ flowers absent. *Infructescences* shorter and more compressed than the inflorescences, main branches with 3–6 fruits each; calyx saucer-shaped, 3-lobed, 6–7 mm diam. *Fruits* elliptic, tapering specially to the apex, trigonous in cross-section, 2½–3 by 1.1–1½ cm, glabrous; pyrene rounded 3-angular, smooth; lids ½–1½ mm thick, bony. *Seeds* 1(–2), sterile cells compressed, linear.

Distr. *Malaysia:* Borneo (specially Br. N. Borneo). Fig. 43.

Ecol. In old forests, mostly at high altitudes (1000–1600 m), rarely in the lowlands. *Fl.* Sept.– March, *fr.* Jan.–Dec.

Uses. The wood is soft.

Vern. *Ogod*, Tambunan, *paninasan*, Kedayan, *piramu*, Sungei.

Notes. This species is related to *C. pilosum* BENN. (Sumatra, Malay Peninsula, Borneo), specially to its *ssp. borneensis* LEENH. and to *C. album* (LOUR.) DC. (Indo-China).

Though the inflorescences often look like being truly terminal, the terminal bud nearly always evolves after anthesis and the infructescences are then segregated into a number of axillary ones.

35. Canarium gracile ENGL. in DC. Mon. Phan. 4 (1883) 140; ELM. Leafl. Philip. Bot. 3 (1911) 1078; MERR. En. Philip. 2 (1923) 350; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 84; Bull. Jard. Bot. Btzg III, 12 (1932) 531.—*C. antonii* ELM. [*ex* MERR. En. Philip. 2 (1923) 350, *in syn.*] Leafl. Philip. Bot. 10 (1939) 3711, *descr. angl.*—**Fig. 20c & 21m.**

Often shrub-like tree, 5–15 m by 5–25 cm. *Branchlets* slender, glabrescent; pith loose with indistinct vascular strands, most of them peripherally arranged. *Stipules* absent. *Leaves* (1–)4–5 (–7)-jugate, glabrous. *Leaflets* oblique-elliptic, slightly falcate, (5–)8–14 by (2–)3–4½ cm, chartaceous; base cuneate; margin entire; apex abruptly, rather long and broadly (up to 2 by ½ cm) blunt-acuminate, acumen curved; nerves 9–11 pairs (angle *c.* 75° at the broader, 50–60° at the narrower side), straight to faintly curved, gradually more so towards the margin, more or less distinctly arching in the apical part only; reticulations lax. *Inflorescences* axillary, broadly and laxly paniculate, ♂ ones mostly 30–40 cm, ♀ ones 60–80 cm long, glabrous; all axes very slender; main branches patent, up to 10 cm (♀ ones up to 15 cm), repeatedly laxly cymose, terminal parts monochasial, 2–3 cm long, *c.* 10-flowered (♀ ones with fewer flowers); *bracts* broadly deltoid. *Flowers* 6–7 mm long, slender, glabrous outside, ♀ ones sometimes with a slightly concave receptacle. *Calyx* 3–3½ mm high. *Stamens* glabrous, slightly confluent at the base. *Disk* in ♂ flowers strongly developed, 2½ mm high, glabrous, *c.* globose, 6-lobed, ½ mm stalked, with a narrow central, conical canal, which is sometimes closed at the top, and which sometimes includes a minute rudiment of the pistil; in ♀ flowers 1 mm high, annular, faintly 6-lobed. *Pistil* glabrous. *Infructescences* with few fruits; calyx saucer-shaped, 3-lobed, 1 cm diam. *Fruits* ovate-oblong to bottle-shaped, bulging on one side, blunt at base and apex, the latter pointed by the persistent style-base, round in cross-section, 2½–3½ by 1¼–1½ cm, smooth, glabrous; pericarp very thin; pyrene smooth; lids 1–1½ mm thick, bony. *Seed* 1; sterile cells much reduced, linear, *c.* 6 by 1 mm; central canal strongly developed, 4–5 mm diam.

Distr. *Malaysia:* Philippines (Palawan excepted). Fig. 42.

Ecol. In primary forests at low and medium altitudes, rarely up to 600 m. *Fl.* Jan.–Oct., *fr.* (Jan.–)May–July.

Uses. Wood moderately hard.

Vern. *Bago*, Mindanao, *gisauan*, *kiod*, Mbo., *mamali*, Ma., *pagsahíñgan-dàgat*, *palaspas*, *pat-sahíngin*, *piling-langgàm*, *tiui*, Tag., *piling-okai*, Bik., *piling-langgàm*, *salong-igbabau*, P. Bis., *sahing-sàhing*, Mang., *tumagasag*, Bag.

36. Canarium dichotomum (Bl.) Miq. Fl. Ind. Bat. 1, 2 (1859) 648, *incl.* also *var. lucidula*; Engl. in DC. Mon. Phan. 4 (1883) 141; H. J. Lam, in Merr. Pl. Elm. Born. (1929) 116; Bull. Jard. Bot. Btzg III, 12 (1932) 447, t. 9 f. 57.—*Pimela dichotoma* Bl. Mus. Bot. 1 (1850) 222.—*C. endertii* H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) 210, t. 15 f. 117a; Bull. Jard. Bot. Btzg III, 12 (1932) 450, t. 10 f. 60; Kew Bull. (1936) 17.—**Fig. 22b.**

Tree, 15–32 m by 15–60 cm, rarely shrub-like and up to 7 m high; buttresses up to 1½ m high. *Branchlets* ½–2 cm thick, glabrescent; pith with a peripheral cylinder of minute vascular strands. *Stipules* caducous to persistent, inserted at the base of the petiole or slightly on the latter, subulate to linear, often abruptly broadened at base, ½–1½ cm. *Leaves* 3–5(–8)-jugate, glabrous. *Leaflets* ovate to oblong, 5–25(–36) by 2½–9(–13½) cm, chartaceous to coriaceous; base oblique, rounded to broadly cuneate; margin entire; apex gradually to subabruptly blunt-acuminate, acumen rather short and broad (–1½ by ½ cm); nerves 9–18 pairs (angle variable), straight to slightly curved, gradually, mostly distinctly, arching close to the margin. *Inflorescences* terminal, sometimes some additional axillary ones in the uppermost leaf-axils, laxly paniculate, glabrous, ♂ ones 19–42 cm long, many-flowered, ♀ ones 6–25 cm, with few flowers, axes dark red (*statu vivo*); main branches in ♂ inflorescences repeatedly dichotomous, up to 25 cm long, in ♀ ones not distinctly dichotomous, up to 6(–20) cm, flowers in cymules. *Flowers* (nearly) sessile, 6–9(–12) mm long, sometimes (even ♂ ones) with a slightly concave receptacle (best developed in the large-flowered, coarse Borneo-specimens), glabrous outside. *Calyx* 5–8 mm high. *Stamens* glabrous, in ♂ flowers confluent at the base, in ♀ flowers connate for the greater part; thecae in ♂ ones distinctly acuminate. *Disk* 1 mm high, in ♂ flowers cupular to flattened, pilose within, in ♀ flowers annular, faintly 6-undulate, minutely tomentose, margin fimbriate. *Pistil* in ♂ flowers much reduced, pilose; in ♀ flowers glabrous, sometimes with a 1 mm high pseudogynophore. *Infructescences* up to 40 cm long, main branches up to 17 cm, with 1–2(–10) fruits; calyx funnel-shaped, trigonous, 8–10 mm diam. *Fruits* narrowly oblong, acute at both ends, trigonous in cross-section, 2¾–4 by 1–2 cm, glabrous; pyrene acutely to rounded triangular; lids rarely with a median rib, 1½–2 mm thick. *Seeds* 1–2, sterile cells moderately reduced.

Distr. *Malaysia:* Sumatra, Borneo.

Ecol. In primary forests on dry grounds, at low altitudes (up to 850 m). *Fl.* mainly June–Aug., *fr.* (mainly) Sept.

Uses. The resin is clear and should be useful.

Vern. Sumatra: *tuala-tuala*, E.C., *damar mata kutjing*, W.C., *damar itam*, Bencoolen, *damar lang*, *pladjau*, Palemb.; Borneo: *arasa*, *kĕdondong*, *ketio bukit*, *mĕdang tehr*, Sarawak, *balajan*, *kanda dahan*, Br. N. Borneo, *bangkukuk*, *dawai*, *krondang*, *mutjih*, SE. Borneo.

Notes. A rather variable species. At first sight it seems possible to distinguish a coarse form, mainly collected in Borneo and representing *C. endertii* H. J. Lam, and a more slender form, comprising the Sumatra specimens, which is *C. dichotomum* Miq. *sensu stricto*. Typical specimens of *C. endertii* differ from typical specimens of *C. dichotomum* in their glabrescence, more lingulate, persistent stipules inserted on the petiole, larger inflorescences and flowers, and ♀ flowers with a concave receptacle. As there are intermediates to various degree an acceptable demarcation of two taxa is rendered impossible. The only thing to be said is that the Borneo specimens often look slightly coarser than the Sumatra ones.

37. Canarium fusco-calycinum Stapf *ex* Ridl. Kew Bull. (1930) 82; H. J. Lam, Bull. Jard. Bot. Btzg III, 12 (1932) 449, t. 9 f. 58.

Tree. *Branchlets* slender, minutely villous; pith with peripheral vascular strands. *Stipules* caducous, inserted at the base of the petiole, linear, 7 by 2 mm. *Leaves* 1–2(–3)-jugate. *Leaflets* ovate to oblong, 2–25 by 1½–12½ cm, stiff chartaceous, glabrous above except on the midrib, more or less densely pubescent beneath; base broadly cuneate to faintly cordate; margin entire; apex rounded, abruptly shortly and broadly to long, slender and acutely acuminate; nerves 10–24 pairs (angle 55–65°), faintly curved, geniculate near the margin, sometimes (in large leaflets) distinctly arching. *Inflorescences* (♀ unknown) terminal, pyramidal-paniculate, up to 40 by 30 cm, villous, many-flowered; main branches up to 20 cm, broadly paniculate. *Flowers* (♀ unknown) subsessile, buds ovoid, closed, 9 mm long. *Stamens* connate for the greater part. *Disk* cupular, small, erectly pilose, without rudimentary pistil. *Infructescences* and *fruits* unknown.

Distr. *Malaysia:* Borneo (Sarawak).

Ecol. *Fl.* April, Dec.

Notes. This apparently rare species is allied to *C. vrieseanum* ENGL. and *C. pilosum* BENN.

C. decipiens H. J. LAM (Ann. Jard. Bot. Btzg 42, 1932, 209) is probably conspecific (see under doubtful species).

38. Canarium australianum F.v.M. Fragm. 3 (1862) 15; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 529; WHITE, Proc. R. Soc. Queensl. 47 (1936) 55.— *C. australasicum* F.v.M. *ex* BENTH. Fl. Austr. 1 (1863) 377; ENGL. in DC. Mon. Phan. 4 (1883)

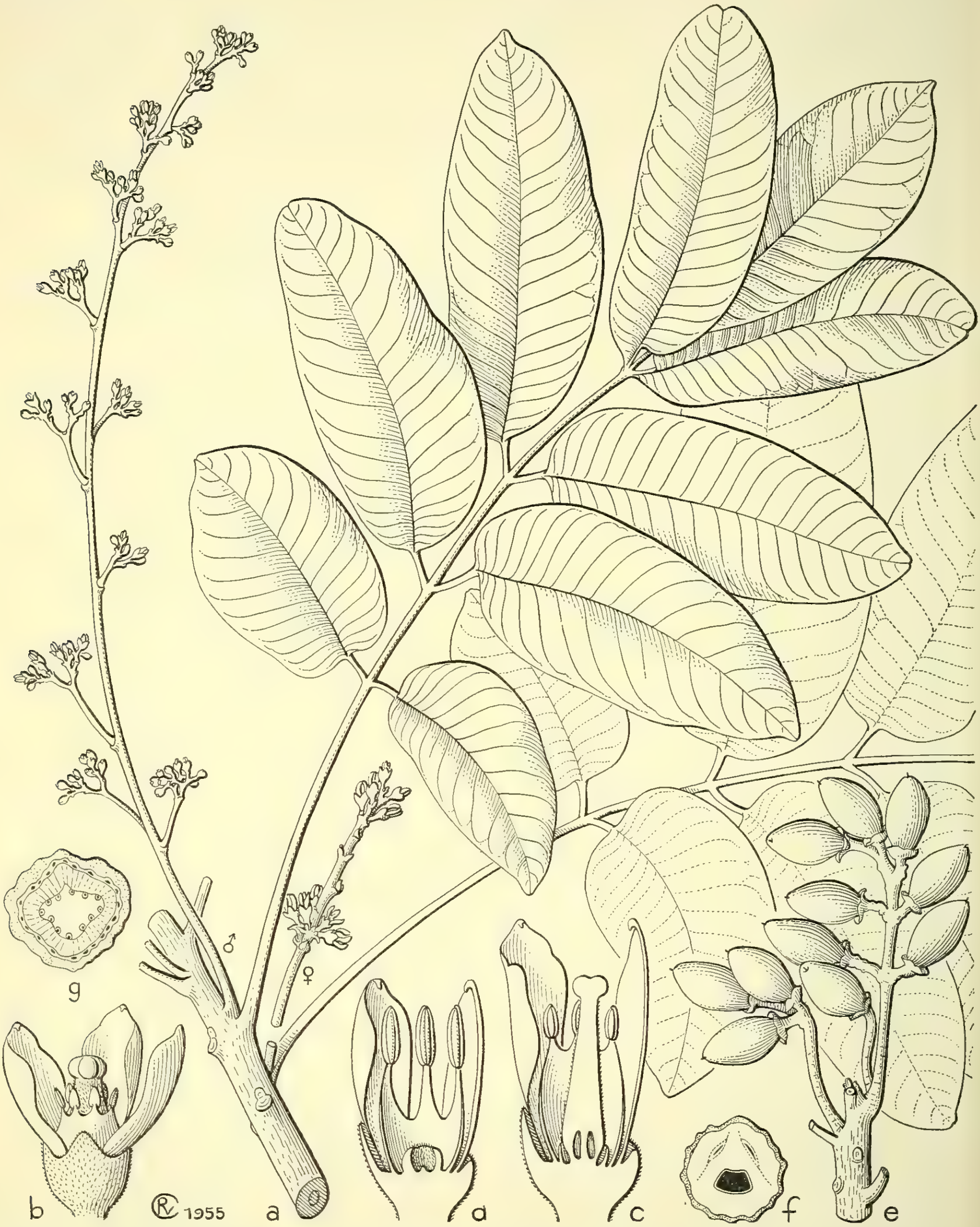

Fig. 44. *Canarium australianum* F.v.M. *a*. Twig with ♂ flowers and a ♀ inflorescence, *b*. ♀ flower, *c*. *ditto*, in section, *d*. ♂ flower in section, *e*. infructescences, *f*. cross-section of fruit, *g*. *ditto* of twig (*a* and *e* × 1/2, *b* × 3, *c–d* × 5, *f* nat. size, *g* × 2).

120; JADIN, Contr. Téréb. (1894) 88, f. 43; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) f. 136 J–P; ed. 2, 19a (1931) f. 211 J–P; F. M. BAIL. Rep. Br. New Guin. (1898) 31; GUILLAUMIN, Ann. Sc. Nat. IX, Bot. 10 (1909) f. 22[17]; WHITE, Proc. R. Soc. Queensl. 34 (1922) 38; *non C. australasicum* LEENH. Blumea 7 (1952) 159, *quae est C. baileyanum* LEENH.—*Sonzaya australiana* MARCH. Adansonia 8 (1868) 27, 64, t. 5.—**Fig. 44.**

Tree, 20(–30) m by 45 cm. *Branchlets c.* 1 cm thick, young parts shortly ferrugineously pubescent; pith with many small vascular strands, for the greater part (rarely all of them) peripherally arranged. *Stipules* caducous, inserted at the base of the petiole, rarely on the latter up to 11 mm from the base, subulate, 7–15 mm. *Leaves* 3–4(–6)-jugate. *Leaflets* ovate, 7–11(–17) by 3–7 cm, thinly coriaceous, glabrous or minutely tomentose beneath; base rounded to truncate, rarely cuneate or cordate, slightly oblique, in the apical pair of leaflets the lower leaflet-half mostly decurrent to the base of the petiolule; margin entire or slightly dentate; apex rounded to acute, sometimes truncate or shortly and broadly blunt-acuminate; nerves 15–24 pairs (angle mostly 75–80°), straight to slightly curved, often tortuous, rather abruptly distinctly arching at some distance from the margin. *Inflorescences* axillary, narrowly paniculate, fulvous tomentose; ♂ ones *c.* 25 cm long, ♀ ones 8–15 cm; branches up to 3 cm, ♂ ones with *c.* 12 flowers, ♀ ones with 3–4 flowers. ♂ *Flowers* 4–5 mm long, ♀ 6½ mm. *Calyx* respectively 2½ and 3½ mm high. *Stamens* glabrous, connate, in ♂ flowers for about half the length of the filaments, in ♀ flowers almost wholly. *Disk* in ♂ flowers truncate, deeply 6-grooved, ¾ mm high, with a central canal, outside glabrous, upper surface and inside densely woolly pubescent; in ♀ flowers annular, ¾ mm high, 6-lobed, glabrous. *Pistil* tomentose, in ♂ flowers nearly totally reduced. *Infructescences* up to 18 cm long with up to 5 fruits; calyx spreading, 3-angular, 9–10 mm diam. *Fruits* ovoid, round to rounded-triangular in cross-section, *c.* 2 by 1¼ cm, glabrous; pyrene rugulose, faintly 3-ribbed to the apex; lids 2 mm thick. *Seed* 1; sterile cells rather strongly reduced.

Distr. N. Australia (NE. Queensland and Arnhemsland) and *Malaysia:* SE. New Guinea (Wassi Kussa, Mabaduan, Pt Moresby). Fig. 43.

Ecol. In Papua only found in rain-forest (Mabaduan) and in monsoon-forest (Wassi Kussa), in Australia also in more open forests on rather dry, sandy soil, and on coastal, sparsely timbered dunes, always at low altitudes; apparently restricted to regions subject to a periodically dry period. *Fl.* Nov.–April, *fr.* (mainly) April–June.

Uses. In Australia, tin fossickers and miners are said to prefer the wood of this tree above all others available for making pick- and axe-handles. The resin is used by the aborigines for spear fastening.

Notes. Two varieties can be distinguished: *var.* **australianum** with densely short-tomentose undersurface of the leaflets, and *var.* **glabrum** LEENH. (Blumea 8, 1955, 189) with glabrous leaflets. Both varieties are also found in New Guinea. They do not exclude each other geographically.

According to WHITEHOUSE (*in sched.*), the fruits are eaten by birds, specially by Torres Street pigeons.

39. Canarium intermedium H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 213, t. 11 f. 76, t. 13 f. 104b; Bull. Jard. Bot. Btzg III, 12 (1932) 482.

Tree *c.* 35 m by 50–85 cm. *Branchlets c.* 9 mm thick, soon glabrescent; pith with many vascular strands, part of them peripherally arranged. *Stipules* absent. *Leaves* 3–6-jugate. *Leaflets* lanceolate, 4–12 by 2–3½ cm, chartaceous, glabrous; base rather oblique, broadly cuneate; margin entire; apex gradually, shortly and broadly blunt-acuminate; nerves 10–12 pairs (angle 50–60°), straight to faintly curved, gradually and distinctly arching at 1½–2 mm from the margin. *Inflorescences* (♂ unknown) axillary, narrowly paniculate, 11–18 cm, soon glabrescent; main branches up to 4½ cm, often with only one well-developed flower. *Flowers* (♂ unknown) 7 mm, glabrous. *Calyx* 4–6 mm high. *Stamens* glabrous, 3–3½ mm long, filaments almost wholly connate, sometimes with interstaminal teeth. *Disk* minute, annular, pilose. *Pistil* glabrous, stalked. *Infructescences c.* 15 cm, with 2–3 fruits, glabrous; calyx flat, 3-angular, 11 mm diam. *Fruits* elliptic, faintly trigonous in cross-section, *c.* 3 by 2 cm, apparently containing 2 *seeds*; sterile cell not very reduced.

Distr. *Malaysia:* S. Sumatra, in forest, 600–900 m. Fig. 43.

Vern. *Damar asam*, M.

Note. This species is closely related to *C. kipella* (BL.) MIQ. from W. Java.

40. Canarium kipella (BL.) MIQ. Fl. Ind. Bat. 1, 2 (1859) 646; ENGL. in DC. Mon. Phan. 4 (1883) 129; K. & V. Bijdr. 4 (1896) 41; BACK. Schoolfl. (1911) 197; KOORD. Exk. Fl. Java 2 (1912) 433; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104d, t. 15 f. 117c; Bull. Jard. Bot. Btzg III, 12 (1932) 480, t. 11 f. 73; in BACK. Bekn. Fl. Java (em. ed.) 6b (1948) 6.—*C. pimela* (*non* KOEN.) BL. Bijdr. (1826) 1162.—*Pimela kipella* BL. Mus. Bot. 1 (1850) 220.—*Pimela kitengo* BL. Mus. Bot. 1 (1850) 221.—*C. kitengo* MIQ. Fl. Ind. Bat. 1, 2 (1859) 647; ENGL. in DC. Mon. Phan. 4 (1883) 148; K. & V. Bijdr. 4 (1896) 46; BACK. Schoolfl. (1911) 199; KOORD. Exk. Fl. Java 2 (1912) 433.

Tree, 25 m, with small buttresses. *Branchlets c.* 8 mm thick, lenticellate, young parts densely ferrugineously woolly tomentose; pith with many vascular strands, sometimes arranged into 1 or more concentric cylinders. *Stipules* (nearly?) always absent. *Leaves* 4–8-jugate. *Leaflets* oblong-lanceolate, 7–16 by 2½–5(–6) cm, thinly chartaceous, glabrous; base often oblique, cuneate to truncate; margin entire; apex gradually shortly (*c.* 1 cm), broadly, and bluntly acuminate; nerves 14–17 pairs (angle 60–70°), faintly to strongly curved, gradually, often rather distinctly, arching at 1 mm from the margin. *Inflorescences* axillary, narrowly paniculate, densely woolly pubescent, glabrescent, ♂ ones 9–27 cm long, ♀ ones 7–15 cm; partial panicles about decussate, patent, rather long-stalked, ♂ ones up to 4–5 cm long, with up to 12 flowers, ♀ ones 2½ cm long, with 8–10 flowers. *Flowers* 7–8 mm long, slightly pubescent outside. *Calyx* ¼ cm high, nearly truncate. *Stamens* glabrous, 6–7 mm long, connate for 3–4 mm. *Disk* pilose, in ♂ flowers subglobose, 1½–2 mm high, with a central canal, in ♀ flowers cupular, 1 mm high, 6-undulate. *Pistil* glabrous, in ♂ flowers absent. *Infructescences* up to 20 cm long, thinly pilose, branches with 1 fruit only; calyx spreading, ½ cm diam. *Fruits* ovoid, round in cross-section, 2½–3¼ by 1–1½ cm, glabrous; pyrene ± 6-angular; lids rather thick. *Seeds* 1–2; sterile cell(s) often very reduced.

Distr. *Malaysia:* W. Java (Mt Salak; Palabuanratu). Fig. 43.

Ecol. In (?)hill forests, apparently a rare species. *Fl.* April–May, *fr.* May.

Wood anat. MOLL & JANSS. Mikr. 2 (1908) 108.

Vern. *Ki hudji, ki pĕla, ki tenjo, ki tuak.*

Note. Closely related to *C. intermedium* H. J. LAM.

41. Canarium pseudosumatranum LEENH. Blumea 8 (1955) 193, f. 4.—*C. sumatranum* (*non* BOERL. & KOORD.) H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 474, *pro min. parte* (*incl.* t. 11 f. 69b); WYATT-SMITH, Man. Mal. Timb. Trees, Burser. (1953) 7, *cum fig.*

Tree, up to *c.* 50 m by 120 cm, with short thick buttresses. *Branchlets* stout, *c.* 12 mm thick, glabrous but for the tomentose terminal bud; pith with a peripheral cylinder of small vascular strands closely appressed to the wood. *Stipules* absent. *Leaves* 7–9-jugate, glabrous. *Leaflets* narrowly lanceolate, 13–20 by 3½–5 cm, stiff-chartaceous; base slightly oblique, rounded to subcordate, often slightly decurrent; margin entire; apex gradually, long (*c.* 1 cm) and slender blunt-acuminate; nerves 16–20 pairs (angle *c.* 55°), straight to slightly curving, close to the margin strongly curving and indistinctly arching. *Inflorescences* (♀ unknown) axillary, narrowly paniculate, *c.* 20 cm long, glabrous, partial panicles nearly decussate, patent, up to 2 cm long, shortly stalked, laxly cymose, many-flowered; *bracts* small, triangular. *Flowers* (♀ unknown) 1 mm pedicelled, 7 mm long, slender. *Calyx* 2 mm high, (sub)-glabrous. *Petals* outside towards the top slightly rugose. *Stamens* glabrous, unequally high confluent at the base (*c.* 2–4 mm). *Disk* tubular, 1 mm high, thick-fleshy, on the rim and the inner side densely pilose; no pistil. *Infructescences* unknown. *Fruits* ovoid, round in cross-section, 5 by 2½ cm, glabrous; pericarp rather thick; pyrene with blunt angle-ribs, lids very distinct, each with an acute median rib; lids 2½ mm thick. *Seeds* 2, sterile cell slightly smaller.

Distr. *Malaysia:* Malay Peninsula. Fig. 45.

Ecol. Lowland and hill forests, *fl.* March–May, *fr.* Dec.

Vern. *Kala, kĕdondong sĕnggèh, lamshu, sĕn(g)g(a)i, surian (patu).*

42. Canarium sumatranum BOERL. & KOORD. in KOORD.-SCHUM. Syst. Verz. 2 (1910) 25; GUILLAUMIN, Ann. Jard. Bot. Btzg 26 (1912) 211, t. 16; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1931–32) t. 5 f. 3, t. 11 f. 78, t. 16 f. 132; Bull. Jard. Bot. Btzg III, 12 (1932) 474, t. 11 f. 69, *excl. fr.*

Tree up to 50 m by 120 cm, with up to 1½ m high buttresses; in young specimens the stem and branches thorny. *Branchlets* stout, 1½–2 cm thick, glabrous except the densely reddish-brown tomentose terminal bud which is *c.* 3½ cm long, acute and often curved; pith thick with numerous, scattered, small vascular strands, most of them crowded towards the periphery. *Stipules* nearly always absent, if present early caducous, inserted at the base of the petiole, subulate, *c.* 3 mm. *Leaves* 7–11-jugate, often without a terminal leaflet. *Leaflets* oblong, *c.* 20 by 5–8 cm, herbaceous (to subchartaceous), glabrous; base very broad, subcordate to broadly cuneate; margin entire; apex rounded, abruptly shortly and blunt-acuminate, or gradually long (–2½ cm) acute-acuminate; nerves 20–26 pairs (angle 80–90°), s-shaped to faintly curving, close to the margin abruptly strongly curving upwards and more or less distinctly arching. *Inflorescences* (♀ unknown) axillary, broadly and laxly paniculate, up to 45 cm long, many-flowered, slightly puberulous towards the tips or glabrous, main branches up to 17 cm, narrowly paniculate on a long stalk; *bracts* minute, squamate. *Flowers* (♀ unknown) subsessile, 8–9 mm long, glabrous outside. *Calyx* 3 mm high. *Petals* towards the top much incrassate with rugose lateral surfaces. *Stamens* glabrous, 7 mm long, connate for (2–)4–5 mm. *Disk* about globular, with 6 thick lobes and a central canal, 1 mm high, minutely pubescent, without pistil. *Infructescences* laxly paniculate, 20–30 cm long, with *c.* 15–20 fruits, glabrous; calyx saucer-shaped, triangular, 7 mm diam.; remains of the disk faintly 6-lobed, about 1 mm high, fimbriate. *Fruits* ovoid, rounded 3-angular in cross-section, 1½ by 1 cm, glabrous; pyrene nearly smooth; lids 1 mm thick. *Seeds* 2, sterile cell slightly smaller.

Distr. *Malaysia:* Sumatra, Malay Peninsula. Fig. 45.

Ecol. In primary and secondary forests, up to 500 m, *fl.* May, Oct., Nov. (Sum.), *fr.* Oct. (Mal. Pen.).

Wood anat. WEBBER, Lilloa 6 (1941) 450, Pl. 3 fig. 7.

Vern. Sumatra: *anglip batu,* Simalur, *bĕnĕmil, buwil,* Sum. E.C., *damar lang,* Palemb., *damar gung,* Lamp., *mandung kĕmajan.*

Notes. In the Malay Peninsula the closely related *C. pseudosumatranum* LEENH. is much more common than this species. These two species were always confused, though they differ in many points.

The thorns, which are unique in the genus, are acutely conical, up to 7 by 4 by 3 mm, concentrically scaly, grey; probably they are derived from adventitious buds.

43. Canarium hirsutum Willd. Sp. Pl. 4 (1805) 760; Engl. in DC. Mon. Phan. 4 (1883) 150; Merr. Int. Rumph. (1917) 302; Heyne, Nutt. Pl. (1927) 877; H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) t. 13 f. 104c, t. 15 f. 117d, t. 16 f. 127d3 and f. 134; Bull. Jard. Bot. Btzg III, 12 (1932) 466, t. 11 f. 67; Burk. Dict. (1935) 430; H. J. Lam in Back. Bekn. Fl. Java (em. ed.) 6b (1948) 7; Leenh. Bull. Bish. Mus. *no* 216 (1955) 14, f. 7.—*C. odoriferum hirsutum* Rumph. Herb. Amb. 2 (1741) 157, t. 51.—*C. hispidum* Bl. Cat. (1823) 109; Bijdr. 17 (1826) 1163, *incl.* also *var. scabrum*; R. & S. Syst. 7 (1829–30) 81, 1624; Hassk. Flora 27 (1844) 617, *incl. var. majus*; Engl. in DC. Mon. Phan. 4 (1883) 131, *incl.* also *var. tomentellum*; K. & V. Bijdr. 4 (1896) 43; Koord. Minah. (1898) 375; Soler. Syst. Anat. Dicot. (1899) 217, f. 43F; Hochr. Bull. Inst. Bot. Btzg *no* 22 (1905) 86, *incl. f. minor*; Guillaumin, Ann. Sc. Nat. IX, Bot. 10 (1909) 238, f. 22^4; Back. Schoolfl. (1911) 198; Koord. Exk. Fl. Java 2 (1912) 433; Blaauw, De tropische Natuur in Schetsen en Kleuren ed. 2 (1917) t. 6; Ridl. Fl. Mal. Pen. 1 (1922) 374; Henders. Gard. Bull. S.S. 5 (1930) 91.—*Boswellia hirsuta* Spreng. Syst. Veg. 2 (1825) 313, *non* Sm. in Rees, 1819.—*C. altissimum* Bl. Bijdr. 17 (1826) 1163; Engl. in DC. Mon. Phan. 4 (1883) 130; Merr. En. Philip. 2 (1923) 355.—*Pimela hirsuta* Bl. Mus. Bot. 1 (1850) 223.—*Pimela hispida* Bl. Mus. Bot. 1 (1850) 224, *incl.* also *var. axillaris*, *imbricata* and *scabra*.—*Pimela altissima* Bl. Mus. Bot. 1 (1850) 225.—*C. multipinnatum* Llanos, Fragm. Pl. Filip. (1851) 107; Blanco, Fl. Filip. ed. 3, 3 (1879) 87; F.-Vill. Nov. App. (1880) 40; Merr. Sp. Blanc. (1918) 207; En. Philip. 2 (1923) 351; Beans *& al.* Philip. J. Sc. 48 (1932) 299–302, t. 2 f. 2.—*Canariopsis altissima* Bl. *ex* Miq. Fl. Ind. Bat. 1, 2 (1859) 651.—*Canariopsis hispida* Bl. *ex* Miq. Fl. Ind. Bat. 1, 2 (1859) 652, *incl.* also *var. tomentella*.—*Canariopsis hirsuta* Bl. *ex* Miq. Fl. Ind. Bat. 1, 2 (1859) 653.—*C. riedelianum* Engl. in DC. Mon. Phan. 4 (1883) 130.—*C. greshoffii* Koord. Minah. (1898) 375; Nat. Tijd. N. I. 63 (1903) 95; Suppl. Cel. 2 (1922) t. 26; *op. cit.* 3 (1922) 14.—*C. emarginatum* Engl. *ex* Koord. Nat. Tijd. N. I. 63 (1903) 97, *nomen*; Suppl. Cel. 2 (1922) t. 25; *op. cit.* 3 (1922) 13.—*C. bersamifolium* Perk. Fragm. Fl. Philip. 1 (1904) 90.—*C. radlkoferi* Perk. Fragm. Fl. Philip. 1 (1904) 96.—*C. warburgianum* Perk. Fragm. Fl. Philip. 1 (1904) 99; Merr. En. Philip. 2 (1923) 355.—*C. ahernianum* Merr. Philip. J. Sc. 1 (1906) Suppl. 70; Whitford, Philip. J. Sc. 1 (1906) Suppl. 415; Merr. En. Philip. 2 (1923) 415. —*C. racemosum* Merr. Philip. J. Sc. 3 (1908) Bot. 141; Elm. Leafl. Philip. Bot. 3 (1911) 1077; Merr. En. Philip. 2 (1923) 353.—*C. nervosum* Elm. Leafl. Philip. Bot. 2 (1908) 482; Leafl. Philip. Bot. 7 (1915) 2566; Merr. En. Philip. 2 (1923) 352.—*C. costulatum* Elm. Leafl. Philip. Bot. 3 (1911) 1080; Merr. En. Philip. 2 (1923) 349.—*C. ellipsoideum* Merr. Philip. J. Sc. 10 (1915) Bot. 26; En. Philip. 2 (1923) 350.—*C. robustum* Merr. Philip. J. Sc. 11 (1916) Bot. 184; En. Philip. 2 (1923) 353.—*C. subcordatum* Ridl. J. Str. Br. R. As. Soc. *no* 82 (1920) 175; Fl. Mal. Pen. 1 (1922) 374.—*C. longiflorescens* Elm. [*ex* Merr. En. Philip. 2 (1923) 352, *in syn.*] Leafl. Philip. Bot. 10 (1939) 3713, *descr. angl.*—*C. oxygonum* Quis. & Merr. Philip. J. Sc. 37 (1928) 155.—*C. bataanense* Merr. *ex* Sasaki, Cat. Gov. Herb. Formosa (1930) 295, *nomen.*—*C. multijugum* H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) 212, t. 5 f. 5; Bull. Jard. Bot. Btzg III, 12 (1932) 476, t. 11 f. 7.

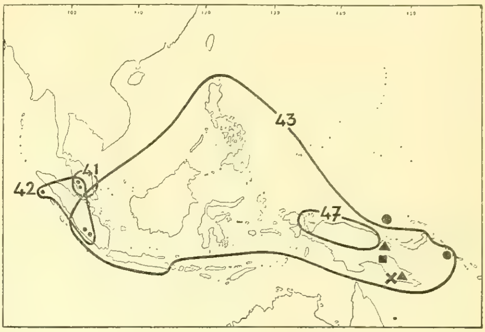

Fig. 45. Distribution of *Canarium hirsutum* and allies: 41. *C. pseudosumatranum* Leenh., 42. *C. sumatranum* Boerl. & Koord. (known localities indicated by dots), 43. *C. hirsutum* Willd., 44. *C. macadamii* Leenh. (■), 45. *C. chinare* Grutt. & H. J. Lam (●), 46. *C. rigidum* (Bl.) Zipp. *ex* Miq. (▲), 47. *C. polyphyllum* K.Sch., 48. *C. cestracion* Leenh. (×).

KEY TO THE VARIETIES

1. Pyrene with some straight ribs only (at most 3 at every angle and a median one on every lid); fruits very variable, mostly densely pilose. Leaves 4–12-jugate; leaflets usually broader, specially near the base. Inflorescences narrowly paniculate . . . . *ssp.* **hirsutum**
 2. Stipules present . . . . . . *var.* **hirsutum**
 2. Stipules absent . . . . . . *var.* **beccarii**
1. Pyrene deeply irregularly furrowed all over the surface; fruits short and broad, sparsely pilose to nearly glabrous. Leaves 6–10-jugate; leaflets relatively narrow, sparsely tomentose to glabrous. Inflorescences rather broadly paniculate . . . . . . *ssp.* **multicostulatum**
 3. Stipules absent . . *var.* **multicostulatum**
 3. Stipules present . . . . *var.* **leeuwenii**

ssp. **hirsutum.**—All synonyms mentioned under the species except two varieties.

Tree *c.* 10–25(–48) m by 20–60(–200) cm. *Branchlets* very stout, 1½–3 cm thick, the tip ferrugineously pubescent; pith large, with many small vascular strands, which are all or nearly all appressed to the wood-cylinder (rarely all scattered). *Stipules* nearly always present, rather caducous, inserted on the petiole ½–5 cm from its base, subulate, 4–12 mm, pubescent. *Petiole* thick (up to 2 cm at the base) with sharp edges. *Leaves* 4–13-jugate, up to 2 m long, pubescence variable. *Leaflets* subsessile except the basal ones, mostly ovate to rather narrowly lanceolate, 5–45 by 2¹/₂–15 cm, chartaceous, rough to sparsely pilose; base rounded to cordate; margin entire; apex gradually to rather abruptly short-acuminate; nerves 12–30 pairs (angle 60–90°), straight to slightly curved, usually not arching but for the apical ones. *Inflorescences* axillary, laxly paniculate (♂) to subracemose (♀), ♂ up to 70 cm long, ♀ up to 30 cm, ♂ flowers usually crowded in many-flowered glomerules, ♀ ones single or in few-flowered cymules; usually densely tomentose. *Flowers* 1–1¹/₄ cm long, short-stalked. *Calyx* shallowly cupular, subtruncate, 1¹/₂–3¹/₂ mm high. *Corolla* much exserted, densely appressedly fulvous-tomentose without. *Stamens* free, filaments slender, pilose, in ♂ flowers *c.* 1 cm, twisted, in ♀ flowers *c.* ¹/₂ cm. *Disk* in ♀ flowers 6-lobed, 1 mm high, pilose, in ♂ flowers cupular, *c.* 2 mm high, densely erect-pilose. *Pistil* sometimes stalked, densely pilose; in ♂ flowers (nearly) absent. *Infructescences* recurved to pendulous, racemose, up to *c.* 15 cm long and with few fruits, to paniculate, more than 30 cm long and with many fruits; calyx 4–16 mm diam., flat, lobes often recurved. *Fruits* nearly always with long-remaining, irritating, stiff, reddish-brown hairs, ovoid, 2–6¹/₄ by 1³/₄–4¹/₂ cm, otherwise rather variable (see varieties).

Distr. Carolines (Palau), Solomon Islands, and throughout *Malaysia*, not yet known from the Lesser Sunda Islands. Fig. 45.

Ecol. Rather common in primary, rarely in secondary forests, in wet to dry localities, mostly at low altitudes (rarely up to 1800 m). *Fl. fr.* throughout the year, *fl.* specially Febr.–July, *fr.* specially April–Sept.

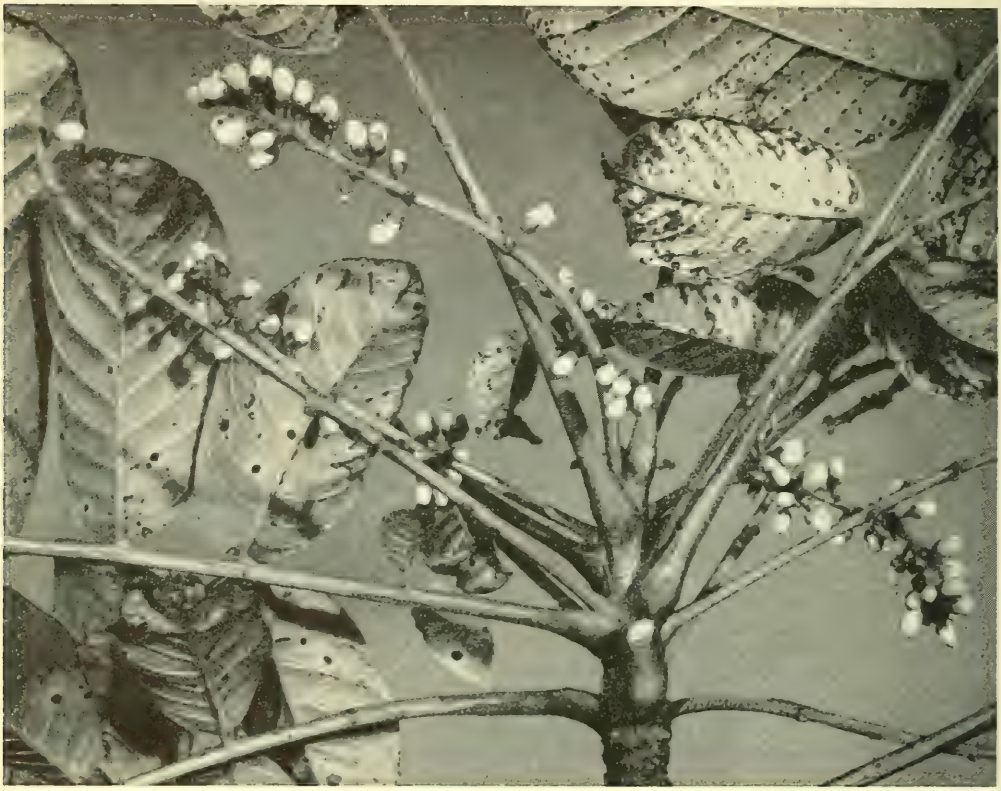

Fig. 46. *Canarium hirsutum* WILLD. ♂ (Cult. Hort. Bog. VI–D–7).

Wood anat. MOLL & JANSSONIUS. Mikr. Holzes 2 (1908) 102 (*C. hispidum* BL.).

Uses. Wood moderately hard to rather soft. 'According to the natives of Bukidnon decoction of roots is good for stomach trouble' (SULIT). Resin rather abundant and probably of some importance (see BUCKLEY, Mal. For. Rec. *no* 11, 1932, 29).

Vern. Sumatra: *Damar mata kutjing putih*, W. Coast; Malay Peninsula: *si(si)kat*, Perak, *sengei*, Pahang, *damar degun*; Java: *dahu*, *ki bontèng*, *ki gugula*, *ki harĕpang*, *ki lang(g)ir*, *ki mĕrang*, *ki tiwu*, *ki tuwak*, W. Java, *kĕnarèn*, *klawer*, *rahu (lanang)*, *sapi*, *trawel*, Central Java, *djambĕjan*, *djaran*, *djunggrang*, *kaju*, *kĕdojo*, *kĕna-*

rèn, kètèh, surèn, E. Java, *biru*; Kangean: *kanale bulu*; Bawean: *kadudja*; Borneo: *kurihang*, E. Born., *kambayau burong, lampakau, lukangi*, Br. N. Born., *kieng*; Anambas Isl.: *si(si)kat*; Karimata: *bajur*; Philippines: *aduas, dulit, katong-matsing, kiñao-aeta, kuyag*, Tag., *bakayan, bugo*, P.Bis., *malapiliai*, S.L.Bis., *paluahan*, C.Bis., *salong*, Bis., *buang-amu*, Lan., *hagushus*, Bik., *ibeng*, Klg., *ibu*, Mbo, *kalana, ogat-somagasa*, Bag., *kal-làg*, Ibn, *kiñaotao*, Neg., *mala-apayos*, Pang., *pala-tàñgan*, Ilk, *kibang*, Mindoro, *kadabu-dabu, ogat-calauwa*, Mindanao; Celebes: *bobang, kanari jaki, kanene uwak sĕla, kuni uwak, mahakalu, (ma)malapa(k), mamalopok, mawowang, mohong kalau, papoko, solo lèwo*, N. Cel., *lahu*, Central Cel., *tontong*, Mak., *raganogalu*, Buton, *saumbawa*; Moluccas: *mede-mede*, Morotai, *loli hapo, mede-mede, niha i fufuru, titi ma silo*, Halmaheira, *kĕnari utan, njiha banga, sesilo*, Ternate, *hahume lassai*, Manipa, *sowe waer*, Wai, *dok*, Ceram, *kamakoan*, Ambon; *pokok damar degun*, Mal.

Notes. In one specimen (Mindanao: L. ZWICKEY 601) I found the petals densely, appressedly pilose within; in another ♂ specimen (Celebes: POSTHUMUS 2344) the stamens were slightly confluent at the base.

Boswellia hirsuta SMITH in REES (Cycl. 39, 2, 1819) is not, as mentioned in the Index Kewensis, synonymous with this species; the description, given by SMITH, is based on a remark by ROXBURGH (Pl. Corom. 3, 1811, 5) referring to a plant from the Ballagaut Mountains, which in all probability is a true *Boswellia*, and which has wrongly been associated with *Canarium odoriferum hirsutum* RUMPH. by ROXBURGH.

var. **hirsutum.—Fig. 46.**

Stipules present. Pyrene with 3–12 straight ribs; fruit long remaining pilose. Seeds 1–2, sterile cells more or less reduced.

Distr. Carolines (Palau Isl.) and throughout *Malaysia*, except New Guinea and New Britain.

Note. Widely distributed variety, specially polymorphous in fruit characters which tend to be more or less geographical.

var. **beccarii** LEENH. Blumea 8 (1955) 189.

Pith of the branchlet with many, scattered, small, vascular strands. Stipules absent. Leaflets sparsely, patently stiff-pilose on the nerves beneath; nerves 14–16 pairs. Fruit ellipsoid, round in cross-section, acute at apex, 2$^3/_4$–3 by 1$^3/_4$–2 cm; pyrene rostrate, gibbous, angle-ribs acute, lids with acute median rib; 2 sterile cells.

Distr. *Malaysia:* SE. Celebes.

Note. The taxonomic position and status of this variety remains doubtful.

ssp. **multicostulatum** LEENH. Blumea 8 (1955) 191, f. 5e.—*C. hirsutum* WILLD. *f.* ζ *(multicostulatum)* H. J. LAM.—*C. multijugum* H. J. LAM.

var. **multicostulatum.**

Stipules absent. Leaves 9–10-jugate. Nerves 20–25(–30) pairs. Leaflets glabrous. Fruits broadly ovate terete, 2 by 1$^1/_2$–1$^3/_4$ cm, nearly glabrous; pyrene deeply and irregularly furrowed.

Distr. *Malaysia:* Moluccas (Halmaheira).

var. **leeuwenii** LEENH. Blumea 8 (1955) 191.—*C. hirsutum* WILLD. *f.* ϑ *(leeuwenii)* H. J. LAM.

Pith of the branchlets very fibrous. Stipules present. Leaves 6-jugate. Leaflets glabrescent; nerves 14–15 pairs. Fruits nearly globose, 3$^1/_2$ by 2$^3/_4$ by 2$^3/_4$ cm, nearly glabrous, with very thick (4 mm), fibrous pericarp; pyrene irregularly shallowly furrowed (peach-like), 2 cells sterile.

Distr. Solomon Islands, New Britain, and *Malaysia:* New Guinea.

44. Canarium macadamii LEENH. Blumea 8 (1955) 191, f. 5c.

Large tree. *Branchlets* slender, somewhat scabrous, lenticellate; pith with a peripheral cylinder of vascular strands, central ones more or less clearly cylindrically arranged. *Stipules* inserted at the base of the petiole, linear, 5–6 mm, glabrous, as are the leaves and the inflorescences. *Leaves* 2–4-jugate. *Leaflets* oblique-ovate, 12–15 by 6–8 cm, subcoriaceous; base very oblique, rounded; margin entire; apex abruptly, shortly (5 mm) blunt-acuminate; nerves 14–16 pairs (angle 60–70°, in the basal part up to 90°), straight to slightly curved, vaguely to distinctly arching close to the margin. *Inflorescences* (♀ unknown) axillary, narrowly paniculate, *c.* 12 cm long; branches up to 2$^1/_2$ cm, with up to 15 clustered flowers. *Flowers* (♂) 7 mm long, short-pedicelled, glabrous outside, with a slightly concave receptacle. *Calyx* 4$^1/_2$ mm high. *Stamens* slightly confluent at base. *Disk* conical, 1$^1/_2$ mm high, halfway with a 6-lobed rim, glabrous, with a central canal, widening to the base and enclosing the rudimentary pistil. *Infructescences* unknown, calyx flat, triangular, 5 mm diam., lobes reflexed. *Fruits* ellipsoid, round in cross-section, 3$^1/_2$ by 1$^1/_2$ cm, acuminate at the apex, glabrous; pyrene smooth; lids 3 mm thick. *Seed* 1, sterile cells moderately reduced.

Distr. *Malaysia:* New Guinea (Morobe Distr.: Wau), once collected. Fig. 45.

Ecol. Forested slope, on rich clay or loam soil, locally common, 1500 m.

45. Canarium chinare GRUTTERINK & H. J. LAM, in LEENH. Bull. Bish. Mus. *no* 216 (1955) 7, f. 4.

Tree up to 25 m. *Branchlets* slender, scabrous, tips sparsely appressedly pubescent; pith with many vascular strands, partly arranged in a peripheral cylinder. *Stipules* caducous, inserted at the conjunction of petiole and branchlet on a faintly prominent 2–3 mm long rim, oblong-lingulate to subulate, 1$^1/_2$–6$^1/_2$ mm. *Leaves* 2–4-jugate, glabrous. *Leaflets* oblong-elliptic (to oblong-ovate), 5–11 by 2–4$^1/_2$ cm, coriaceous; base cuneate; margin entire; apex abruptly, bluntly short-acuminate; nerves 10–14 pairs (angle 50–55°), gradually curved towards the margin, apical ones always, the rest sometimes distinctly arched. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, subracemose, 4–8 cm long, with

1–2 fruits; calyx saucer-shaped, 3-lobed, 8 mm diam.; remains of 6 fimbriate disk-lobes present. *Fruits* subovoid, tapering at the base, about round in cross-section; pyrene more or less prominently 3-keeled; lids *c.* 2¹/₂ mm thick. *Seed* 1, sterile cells very slightly reduced.

Distr. Solomon Islands, in *Malaysia:* Admiralty Islands (Los Negros). Fig. 45.

Ecol. Rain-forests, up to 950 m. *Fr.* Febr. (Admir. Isl.), Aug. (Solomon Isl.).

Note. The identity of the Los Negros specimen (NGF 558) is not quite certain.

46. Canarium rigidum (BL.) ZIPP. *ex* MIQ. Fl. Ind. Bat. 1, 2 (1859) 648; ENGL. in DC. Mon. Phan. 4 (1883) 142, t. 3 f. 3–5; in E. & P. Pfl. Fam. 3, 4 (1896) f. 136 V–W; ed. 2, 19a (1931) f. 211 V–W; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 85; Bull. Jard. Bot. Btzg III, 12 (1932) 478, t. 11 f. 71, *excl. syn. Pimela (Canariopsis, Canarium) angustifolia* BL.—*Pimela rigida* BL. Mus. Bot. 1 (1850) 222.

Slender tree up to 25 m. *Branchlets* rather stout, 7–12 mm thick, glabrous but for the tips; pith with a peripheral closed cylinder of small vascular strands. *Stipules* absent. *Leaves* 6–12-jugate, glabrous. *Lateral petiolules* 2–11 mm. *Leaflets* lanceolate, 6¹/₄–15 by 1¹/₄–4 cm, chartaceous; base rounded to subcordate; margin entire; apex gradually, long and slender-acuminate; nerves 15–20 pairs (angle 70–85°), irregular, not to faintly curved, abruptly arching at *c.* 1–2 mm from the margin; intermediate veins strongly developed. *Inflorescences* (♀ unknown) axillary, laxly paniculate, 10–20 cm long, glabrous, peduncle globular-thickened at the base; main branches subdecussate, up to 5 cm, dichotomously branched, crowded-9–12-flowered. *Flowers* (♀ unknown) subsessile, glabrous, 6 mm long. *Calyx* 3 mm high. *Petals* much incrassate towards the apex, the broadened and flattened margins of the apical part rugose. *Stamens* glabrous, 4¹/₂–5 mm long, connate for 2 mm. *Disk* cushion-shaped with elevated margin, 1 mm high, minutely pubescent on the upper surface, with a central canal, but without a rudimentary pistil. *Infructescences* 12–25 cm long, with 1–3 fruits, glabrous; main branches up to 6 cm; calyx shallowly saucer-shaped with a 3-lobed margin; remains of a circular, fimbriate disk present. *Fruits* ellipsoid, tapering at the base, acuminate at the apex, rounded 6-angular in cross-section, 4 by 2–2¹/₂ cm, glabrous; pericarp rather thick and fleshy; pyrene circular in cross-section with many irregular, longitudinal ribs, which are up to 5 mm high and 1–2 mm wide; lids 2¹/₂ mm thick. *Seed* 1, sterile cells only slightly reduced.

Distr. *Malaysia:* New Guinea. Fig. 45.

Ecol. Primary and secondary forests, both at low altitude and up to 1000–1200 m, *fr.* March.

47. Canarium polyphyllum K.SCH. in K.SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 63; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 77; Bull. Jard. Bot. Btzg III, 12 (1932) 479, t. 11 f. 72; *non* KÄRNBACH, Bot. Jahrb. Beibl. 37 (1893) 16, and M. KRAUSE, Tropenpflanzer 17 (1913) 147, *cum fig.* (very probably these both refer to *C. indicum* L.).—*C. ledermannii* LAUT. Bot. Jahrb. 56 (1920) 328, f. 2A–E.—**Fig. 20d.**

Tree, up to 30 m high, with buttresses. *Branchlets c.* ³/₄ cm thick, glabrous, the velvety young parts excepted; pith with many minute vascular strands, closely appressed to the wood-cylinder. *Stipules* absent. *Leaves* 3–8-jugate. *Leaflets* narrowly oblong, 5¹/₂–20 by 2¹/₂–8 cm, chartaceous, glabrous but for the minutely pubescent midrib above and midrib and main nerves beneath; base rounded (to subcordate); margin entire; apex rounded, rather abruptly, shortly and acute-acuminate; nerves 11–24 pairs (angle 60–70–90°), slightly irregular, strongly curving towards the margin, indistinctly arching remote from it; intermediate veins strongly developed. *Inflorescences* (♀ unknown) axillary, laxly paniculate, 15–48 cm long, pubescent towards the tips; partial panicles up to 8 cm long, long-stalked, cymose, *c.* 15-flowered, flowers clustered; *bracts* persistent, deltoid, 1 mm long. *Flowers* (♀ unknown) subsessile, 6 mm long, glabrous, pink. *Calyx* 2¹/₂–3 mm high. *Petals* thickened towards the apex, the inflexed apiculum much thickened and rugose. *Stamens* glabrous, *c.* 4¹/₂ mm long, connate for *c.* 1¹/₂ mm. *Disk* 1 mm high, cushion-shaped, faintly 6-lobed, deepened towards the centre, narrowed at base, long-pilose on the upper surface; no pistil. *Infructescences* racemose to paniculate, 10–25 cm long, with 5–7 fruits, glabrescent; main branches up to 5 cm long, with 1–2 fruits; calyx flat, faintly 3-lobed to circular, 8–10 mm diam., margin slightly undulate; remains of a 6-lobed, long-fimbriate disk present. *Fruits* ellipsoid, tapering at both ends, rounded 3-angular to circular in cross-section, 4–5 by 2–2¹/₂ cm, glabrous; angle-ribs of the pyrene acute, surface of the lids slightly undulate; lids *c.* 1 mm thick. *Seed* 1, sterile cells slightly reduced.

Distr. *Malaysia:* New Guinea. Fig. 45.

Ecol. In dense to open primary forests, up to *c.* 400 m, *fl.* June–Nov., *fr.* Sept.

Vern. *Hoddjai*, Manokwari.

48. Canarium cestracion LEENH. Blumea 8 (1955) 189, f. 5g.—**Fig. 21k.**

Tree *c.* 20 m. *Branchlets* 8 mm thick, glabrous; pith fibrous by many, scattered small vascular strands. *Stipules* very caducous, inserted on the twig near the base of the petiole, leaving a minute scar. *Leaves* 3–5-jugate, glabrous. *Leaflets* ovate-lanceolate, 11–20 by 4¹/₂–7 cm, stiff-chartaceous; base rounded to broadly cuneate; margin entire; apex gradually narrowed into a short, broad and blunt acumen; nerves 10–12 pairs (angle 65–75°), straight to faintly curved, more strongly curved towards the margin, more or less distinctly arching at some distance from it. *Inflorescences* and *flowers* unknown. *Infructescences* axillary, racemose, 15–20 cm long, with 1–3 fruits, glabrous; calyx flat, 3-angular, 6–8 mm diam., lobes reflexed. *Fruits* ellipsoid, acuminate at base and apex, narrowly triangular in cross-section, 4–4½ by 2½–2¾ by *c.* 1½ cm, glabrous; pyrene deeply furrowed, angle-ribs very prominent, as are the median ribs of the lids; lids 3½ mm thick. *Seeds* 1–2; fertile cells long and narrow, sterile ones nearly fully reduced.

Distr. *Malaysia:* E. New Guinea (Central Prov.), once collected. Fig. 45.

Ecol. In forests, 500 m. *Fr.* July.

49. Canarium vrieseanum ENGL. in DC. Mon. Phan. 4 (1883) 142, t. 3 f. 15–18; KOORD. Suppl. Cel. 2 (1922) t. 30; Suppl. 3 (1922) 17; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 455, t. 10 f. 63.—*C. williamsii* C. B. ROBINSON, Philip. J. Sc. 3 (1908) Bot. 185; W. H. BROWN, Min. Prod. Philip. For. 2 (1921) 302, f. 37; MERR. En. Philip. 2 (1923) 355.—*C. tongcalingii* ELM. Leafl. Philip. Bot. 3 (1911) 1082; MERR. En. Philip. 2 (1923) 354.—*C. sibulanense* ELM. Leafl. Philip. Bot. 3 (1911) 1085; MERR. En. Philip. 2 (1923) 353.—*C. dolichophyllum* MERR. Philip. J. Sc. 10 (1915) Bot. 20; En. Philip. 2 (1923) 350.—*C. villosiflorum* ELM. Leafl. Philip. Bot. 7 (1915) 2569.

Tree 15–25(–31) m by 30–45 cm, buttresses small or absent. *Branchlets* slender to rather stout, nearly always densely, minutely woolly ferrugineous-pubescent, as are the leaves, inflorescences and sometimes the infructescences; pith with a peripheral cylinder of rather large vascular strands. *Stipules* inserted on the petiole up to 1½ cm from the base, often ribbon-shaped, tapering, and falcate, ⅖–1 cm. *Leaves* 3–5(–7)-jugate. *Leaflets* ovate to oblong, 7–30 by 3–12 cm, chartaceous, more or less densely fulvous-pubescent on the midrib above and on all nerves beneath, rarely nearly glabrous; base slightly oblique, rounded to cuneate; margin entire; apex rather abruptly, up to 3 cm long, slender-acuminate; nerves rather prominent beneath, 12–18(–24) pairs (angle 55–75°), parallel, straight or slightly curved, more strongly curving towards the margin, gradually and vaguely arching close to it. *Inflorescences* axillary, narrowly paniculate (♂) to racemose (♀), 20–30(–60) cm long, 1–3(–5) cm wide, main branches patent, about 1½ cm long, 3–5-flowered (♀ ones 1–3-flowered), rarely some basal ramifications strongly developed. Buds fusiform, slender, fulvous-tomentose, closed. *Flowers* 6–10 mm long, nearly sessile. *Calyx* 6–8 mm high. *Stamens* glabrous, in ♂ flowers slightly and irregularly confluent at the base; in ♀ flowers free. *Disk* in ♀ flowers faintly 6-lobed, 1–2 mm high, fimbriate; in ♂ flowers ovoid, 1 mm high, pilose, with a central canal. *Pistil* densely pilose, ♂ none. *Infructescences* ascending to erect, 10–20(–45) cm long, with *c.* 5–10(–40) fruits; calyx flat, deeply 3-lobed (lobes not reflexed), ¾–1½ cm diam. *Fruits* ovoid, acute, round in cross-section, 1¾–3¼ by ¾–2¼ cm, remaining velvety for a long time; pyrene very faintly 6-ribbed, nearly smooth; lids *c.* 2½ mm thick. *Seed* 1.

Distr. *Malaysia:* Philippines (Mindanao, according to H. J. LAM also in Luzon), Central and N. Celebes. A record from Buru, Moluccas, based on a cultivated tree in the Bogor Botanical Garden, is doubtful. Fig. 47.

Ecol. In primary and secondary forests up to 500 m, *fl.* July–Dec.(–Febr.), *fr.* Dec.–Febr. (Celebes), March–June (Philip., *f. stenophyllum*), July–Oct. (Philip., *f. williamsii*).

Uses. The wood is said to be rather tough and hard, rarely more soft. The seeds are edible. Locally the resin is used for lighting purposes.

Vern. Mindanao: *gapog, gisau,* Sul., *biauan, magasurud,* Bag., *ogat, sagasa(k),* Mbo.; Celebes: *are, kon ne uwal, solo (lewo, in koko),* Minahasa.

Notes. Rather polymorphous species, which can easily be subdivided into three local forms.

The typical form (*f.* **vrieseanum**), which is restricted to Celebes, is the more slender one: branchlets less than 1 cm thick, leaves 3–5-jugate, leaflets lanceolate and moderately hairy, inflorescences narrowly paniculate, infructescences mostly racemose.

The second form, *f.* **williamsii** (C. B. ROB.) LEENH. *nov. stat.* (syn.: *C. williamsii* C. B. ROB., *C. dolichophyllum* MERR., *C. villosiflorum* ELM.), from Mindanao, is characterized by its stouter and more pilose habit, with 6–7-jugate leaves, large and ovate leaflets, and larger and more widely paniculate inflorescences and infructescences, the latter with many more fruits.

The third form, *f.* **stenophyllum** LEENH. (Blumea 8, 1955, 194), is restricted to Davao Prov. (Mindanao). This is also a rather stout form, characterized by its many-jugate, nearly glabrous leaves with oblong, stiff leaflets, *c.* 20 by 4 cm; nerves many and dense; fruits rather small (*c.* 1¾ by 1¼ cm), as are the inflorescences.

This species is related to *C. asperum* BENTH., specially to its *var. clementis* LEENH. from the Philippines.

50. Canarium acutifolium (DC.) MERR. Int. Rumph. (1917) 302; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 11 f. 58, t. 13 f. 104j, t. 15 f. 117b; Bull. Jard. Bot. Btzg III, 12 (1932) 451, t. 10 f. 61; H. J. LAM & HUSSON, Blumea 7 (1952) 164; CHATTAWAY, Austr. J. Bot. 1 (1953) 30, f. 3.—*Dammara nigra* RUMPH. Herb. Amb. 2 (1741) 160, t. 52.—*? C. nigrum* ROXB. [Hort. Beng. (1814) 49, *nomen*] Fl. Ind. ed. CAREY 3 (1832) 138.—*Marignia acutifolia* DC. Prod. 2 (1825) 79; HENSCH. Vita Rumph. (1833) 116.—*Pimela acutifolia* BL. Mus. Bot. 1 (1850) 221.—*Pimela laxiflora* BL. Mus. Bot. 1 (1850) 221.—*C. longiflorum* ZIPP. *ex* MIQ. Fl. Ind. Bat. 1, 2 (1859) 647; ENGL. in DC. Mon. Phan. 4 (1883) 125.—*C. rostratum* ZIPP. *ex* MIQ. Fl. Ind. Bat. 1, 2 (1859) 647, *nom. illeg.*; ENGL. in DC. Mon. Phan. 4 (1883) 128.—*C. lineistipula* K. SCH. & LAUT. Fl. Schutzgeb. (1901) 379; LAUT. Bot. Jahrb. 56 (1920) 331; LANE-POOLE, For. Res. (1925) 98.—*C. aemulans* LAUT. Bot. Jahrb. 56 (1920) 326, f. 2 F–O; ENGL. in E. & P. Pfl. Fam. ed. 2, 19a (1931) f. 213 F–O; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 81; Bull. Jard. Bot. Btzg III, 12 (1932) 453.—*C. legitimum* (*non* MIQ.) HEYNE, Nutt. Pl. (1927) 877, *pro maj. parte.*—*C. leeuwenii* H. J. LAM, Ann. Jard. Bot.

Btzg 42 (1932) 210; Bull. Jard. Bot. Btzg III, 12 (1932) 449, t. 9 f. 59.

Distr. *Malaysia:* Central Celebes, Moluccas, and New Guinea. Fig. 47.

Notes. The inflorescences of this species sometimes contain witches' brooms like those which are common in *C. asperum* BENTH. *Cf.* fig. 48.

Apparently *var. celebicum* is the most primitive (6 stamens), *var. acutifolium* the most specialized form of this species (3 stamens); *var. aemulans* is interrelated between the two forms, differing mainly from the latter by the number of stamens. The species as a whole is closely related to *C. asperum* BENTH. *ssp. papuanum* LEENH.

KEY TO THE VARIETIES

1. Stamens 3 . . . . . *var.* **acutifolium**
1. Stamens 6.
  2. Nerves 20–25 pairs . . . *var.* **celebicum**
  2. Nerves 12–15 pairs . . . *var.* **aemulans**

var. **acutifolium.**—Synonymy as above, with the exception of *C. aemulans.*—**Fig. 22c.**

Tree, 20(–40) m by 20–90 cm; buttresses, if present, up to 3 m high. *Branchlets* up to $1^1/_2$ cm thick, soon glabrescent; pith with a peripheral cylinder of vascular strands, closely appressed to the wood-cylinder, central part nearly always disappearing (very probably by the action of ants). *Stipules* subpersistent, inserted at the base of the petiole, filiform, $1^1/_2$–$3^1/_2$ cm long. *Leaves* (2–)3–5 (–7)-jugate. *Leaflets* ovate to narrowly oblong, 12–30 by 4–$11^1/_2$ cm, chartaceous, glabrous; base slightly oblique, rounded to broadly cuneate; margin entire; apex abruptly, rather long and slender ($^3/_4$–2 by $^1/_4$ cm) blunt-acuminate; nerves 11–15–20 pairs (angle 80–90°), slightly, towards the margin more strongly, curved, more or less distinctly arching close to the margin. *Inflorescences* axillary, laxly pyramidal-paniculate, nearly always glabrous, ♂ ones up to 50 cm, ♀ ones up to 40 cm long, main branches up to 20 cm, partial panicles long-stalked, many-flowered. *Flowers c.* 4 mm long, shortly pedicelled, glabrous outside, ♀ ones with a slightly concave receptacle. *Calyx* 2–$2^1/_2$ mm high. *Stamens* 3, free, glabrous. *Disk* glabrous, in ♂ flowers irregularly shaped, $1^1/_2$ mm high, with a central canal in which the minute rudimentary pistil is immersed; in ♀ flowers a faintly 3-lobed rim, 1 mm high. *Pistil* glabrous. *Infructescences* like the inflorescences, rigid, with many fruits; calyx flat, triangular, 3–$3^1/_2$ mm diam., tips of the lobes reflexed. *Fruits* ovoid, acute, round in cross-section, 12–15 by 8–10 mm, glabrous; pericarp thin; pyrene tuberculate; lids $1^1/_2$–2 mm thick. *Seed* 1, sterile cells strongly reduced.

Distr. *Malaysia:* Moluccas (Kei Islands, according to RUMPHIUS also on Manipa, Kelang, Ceram, and Ambon), New Guinea (incl. also P. Japen, Waigeo, Misool, and Aru Islands).

Ecol. In New Guinea apparently the most common species of the genus, both in primary and in secondary forests, specially in more open places (forest-edges, river-banks, clearings), mostly on wet (sometimes temporarily inundated) clayey soil, up to *c.* 200(–700) m. *Fl.* mainly July–Sept., *fr.* mainly Jan.–March.

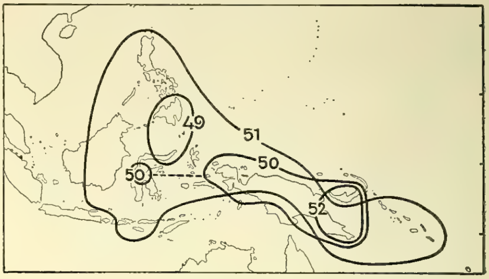

Fig. 47. Distribution of *Canarium asperum* and allies: 49. *C. vrieseanum* ENGL., 50. *C. acutifolium* (DC.) MERR., 51. *C. asperum* BTH., 52. *C. schlechteri* LAUT.

Uses. Wood rather soft to very hard, tough, but easily splitting. The resin, though abundant, seems to be of little importance; it is used for lighting purposes and for caulking boats.

Vern. Moluccas: *isse felu, jar (jal) mete, kama mete, solo kokelu,* Ambon, *canari itam, damar itam, dammar galla-galla*; New Guinea: *sakenau,* Waigeo, *bowwie, (i)ja(k)ko, je, kwasodja, mengkis, sumgui, wassedjah,* Vogelkop, *kieta, ogoseya,* Gulf Distr., *degamtoto, mundrum, muri (nuri), ongoi, orngo, sisira, wairo,* N. Div., *rogoray.*

Notes. I have included *C. leeuwenii* H. J. LAM in this variety. The only specimen known of this is DOCTERS VAN LEEUWEN 10643; it bears very young fruits and differs from typical *C. acutifolium* by its dense, hirsute, reddish-brown tomentum. The hairiness is very variable in most species of *Canarium,* and this specimen was collected at a rather high altitude (700 m).

PLEYTE noted on his *no* 1020 from Misool that the specimen was a pseudoliana 30 m by 4 cm; other collections from him in adjacent localities are, however, from trees; I have my doubts about this field note.

var. **celebicum** LEENH. Blumea 8 (1955) 188.

Branchlets solid; pith with a peripheral cylinder of vascular strands and some scattered ones in the central part. Stipules inserted on the petiole at 1–5 mm from the base, up to $1^1/_2$ cm. Leaflets oblong to lanceolate, 10–22 by 4–6 cm; the apex more gradually narrowed; nerves 20–25 pairs, nearly straight. Inflorescences and flowers (♂ unknown) thinly tomentose. Stamens 6. Disk 6-lobed, pilose as is the pistil. Fruit-calyx 5–6 mm diam.

Distr. *Malaysia:* Central Celebes.

Ecol. Collected at 250–400 m; *fl.* July.

var. **aemulans** (LAUT.) LEENH. *nov. stat.*—*C. aemulans* LAUT.

Differing from *var. celebicum* in its leaflets, which are ovate to oblong, 7–18 by $3^{3}/_{4}$–$8^{1}/_{2}$ cm, abruptly acuminate, and with 12–15 pairs of nerves. Fruits subglobular, $1^{3}/_{4}$ by $1^{1}/_{2}$ cm; sterile cells less reduced.

Distr. New Britain and *Malaysia:* NE. New Guinea (Kani Mts).

Ecol. Up to 1000 m, *fl. fr.* Dec., April–May.

51. Canarium asperum Benth. in Hook. Lond. J. Bot. 2 (1843) 215; Engl. in DC. Mon. Phan. 4 (1883) 135; H. J. Lam, Bull. Jard. Bot. Btzg III, 12 (1932) 461, t. 10 f. 66; Meijer Drees, Comm. For. Res. Inst. *no* 33 (1951) 42; Leenh. Bull. Bish. Mus. *no* 216 (1955) 10, f. 5; Blumea 8 (1955) 189.—*Dammara nigra legitima* Rumph. Herb. Amb. 2 (1741) t. 53.—*C. commune* (*non* L.) Blanco, Fl. Filip. (1837) 791; Merr. Publ. Gov. Lab. Philip. *no* 27 (1905) 30; Sp. Blanc. (1918) 207.—*C. pimela* (*non* Koen.) Blanco, Fl. Filip. ed. 2 (1845) 545, t. 343; ed. 3, 3 (1879) 200, t.; Merr. *ll.cc.*—*Pimela legitima* Bl. Mus. Bot. 1 (1850) 222.—*Pimela villosa* Bl. Mus. Bot. 1 (1850) 223.—*Pimela denticulata* Bl. Mus. Bot. 1 (1850) 226.—*C. legitimum* Miq. Fl. Ind. Bat. 1, 2 (1859) 647; Engl. in DC. Mon. Phan. 4 (1883) 127; Merr. Int. Rumph. (1917) 300.—*Canariopsis villosa* Miq. Fl. Ind. Bat. 1, 2 (1859) 652.—*Canariopsis aspera* Miq. Fl. Ind. Bat. 1, 2 (1859) 653.—*Canariopsis denticulata* Bl. *ex* Miq. Fl. Ind. Bat. 1, 2 (1859) 654.—*C. villosum* Benth. & Hook. *f. ex* F.-Vill. Nov. App. (1880) 40; Vidal, Sinopsis (1883) 19, t. 28 f. A; W. H. Brown, Min. Prod. Philip. For. 2 (1921) 49, f. 13; Merr. En. Philip. 2 (1923) 354; F. M. Yenko *et al.* Philip. J. Sc. 55 (1934) 5, 9, t. 7 f. 3.—*C. molle* Engl. in DC. Mon. Phan. 4 (1883) 109.—*C. minutiflorum* Engl. in DC. Mon. Phan. 4 (1883) 123; Merr. En. Philip. 2 (1923) 351.—*C. zollingeri* Engl. in DC. Mon. Phan. 4 (1883) 127; Koord. Exk. Fl. Java 2 (1912) 434; Heyne, Nutt. Pl. (1927) 880.—*C. cumingii* Engl. in DC. Mon. Phan. 4 (1883) 132; Elm. Leafl. Philip. Bot. 3 (1911) 1077.—*C. luxurians* Engl. in DC. Mon. Phan. 4 (1883) 146, *nom. illeg.*—*C. solo* Engl. *ex* Koord. Nat. Tijd. N. I. 63 (1903) 98, *nomen*; Suppl. Cel. 2 (1922) t. 29; *op. cit.* Suppl. 3 (1922) 16.—*C. treubianum* Engl. *ex* Koord. Nat. Tijd. N. I. 63 (1903) 98, *nomen*; Suppl. Cel. 2 (1922) t. 32; *op. cit.* Suppl. 3 (1922) 18.—*C. calophyllum* Perk. Fragm. Fl. Philip. 1 (1904) 91; Merr. En. Philip. 2 (1923) 349; H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 83; Bull. Jard. Bot. Btzg III, 12 (1932) 529.—*C. juglandifolium* Perk. Fragm. Fl. Philip. 1 (1904) 93; Merr. Publ. Gov. Lab. Philip. *no* 35 (1906) 28.—*C. lucidum* Perk. Fragm. Fl. Philip. 1 (1904) 94; Merr. En. Philip. 2 (1923) 351; H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 82; Bull. Jard. Bot. Btzg III, 12 (1932) 530.—*C. polyneurum* Perk. Fragm. Fl. Philip. 1 (1904) 96; Merr. En. Philip. 2 (1923) 353.—*C. stachyanthum* Perk. Fragm. Fl. Philip. 1 (1904) 97; Merr. Publ. Gov. Lab. Philip. *no* 35 (1906) 29.—*C. thyrsoideum* Perk. Fragm. Fl. Philip. 1 (1904) 98; Merr. Publ. Gov. Lab. Philip. *no* 35 (1906) 28.—*C. valetonianum* Engl. [*ex* Koord. Nat. Tijd. N. I. 63 (1903) 98, *nomen*] *ex* Hochr. Pl. Bogor. Exs. (1904) 63; Bull. Inst. Bot. Btzg *no* 22 (1905) 86; Ann. Jard. Bot. Btzg Suppl. 3 (1910) 850; Koord. Suppl. Cel. 2 (1922) t. 33; *op. cit.* Suppl. 3 (1922) 18.—*C. koordersianum* Engl. [*ex* Koord. Nat. Tijd. N. I. 63 (1903) 97, *nom. nud.*] *ex* Hochr. Pl. Bogor. Exs. (1904) 63; Koord. Suppl. Cel. 2 (1922) t. 27; *op. cit.* Suppl. 3 (1922) 14.—*C. reticulatum* Merr. Philip. J. Sc. 3 (1908) Bot. 141; En. Philip. 2 (1923) 353; H. J. Lam, Bull. Jard. Bot. Btzg III, 12 (1932) 530, *non C. reticulatum* Ridl. Kew Bull. (1930) 83 *quae est Dacryodes rostrata* H. J. Lam.—*C. clementis* Merr. Philip. J. Sc. 3 (1908) Bot. 142; Elm. Leafl. Philip. Bot. 3 (1911) 1078, *incl. var. perumbrinum.*—*C. leytense* Elm. Leafl. Philip. Bot. 3 (1911) 1081.—*C. apoense* Elm. Leafl. Philip. Bot. 3 (1911) 1083; Merr. En. Philip. 2 (1923) 349.—*C. ogat* Elm. Leafl. Philip. Bot. 3 (1911) 1086; Merr. En. Philip. 2 (1923) 352; H. J. Lam, Bull. Jard. Bot. Btzg III, 12 (1932) 352.—*C. sibuyanense* Elm. Leafl. Philip. Bot. 4 (1912) 1502.—*C. euphlebium* Merr. Philip. J. Sc. 8 (1913) Bot. 372; En. Philip. 2 (1923) 350.—*C. wenzelii* Merr. Philip. J. Sc. 9 (1914) Bot. 363; En. Philip. 2 (1923) 355.—*C. heterophyllum* Merr. Philip. J. Sc. 10 (1915) Bot. 19; En. Philip. 2 (1923) 350.—*C. lagunense* Merr. Philip. J. Sc. 10 (1915) Bot. 21; En. Philip. 2 (1923) 350.—*C. barnesii* Merr. Philip. J. Sc. 10 (1915) Bot. 22; En. Philip. 2 (1923) 349.—*C. sanchezii* Merr. Philip. J. Sc. 10 (1915) Bot. 27; En. Philip. 2 (1923) 353.—*C. agusanense* Elm. Leafl. Philip. Bot. 7 (1915) 2564; Merr. En. Philip. 2 (1923) 349.—*C. subvelutinum* Elm. Leafl. Philip. Bot. 7 (1915) 2566.—*C. urdanetense* Elm. Leafl. Philip. Bot. 7 (1915) 2568; Merr. En. Philip. 2 (1923) 354; H. J. Lam, Bull. Jard. Bot. Btzg III, 12 (1932) 531.—*C. samarense* Merr. Philip. J. Sc. 11 (1916) Bot. 183; Merr. En. Philip. 2 (1923) 353.—*C. tamborae* Laut. Bot. Jahrb. 56 (1920) 327.—?*C. fulvum* Laut. Bot. Jahrb. 56 (1920) 330; H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) t. 16 f. 127c^{1}; Bull. Jard. Bot. Btzg III, 12 (1932) 458, t. 10 f. 64.—*C. unifoliolatum* Merr. Philip. J. Sc. 17 (1921) 267; En. Philip. 2 (1923) 354; H. J. Lam, Bull. Jard. Bot. Btzg III, 12 (1932) 533.—*C. papuanum* H. J. Lam, Ann. Jard. Bot. Btzg 42 (1932) 211, t. 12 f. 86, t. 13 f. 104k; Bull. Jard. Bot. Btzg III, 12 (1932) 459, t. 10 f. 65.

Notes. *C. luxurians* Engl. was based upon a specimen with witches' brooms in the inflorescences, a feature which is rather common in this species, and which is furthermore only known from *C. acutifolium* (DC.) Merr. They represent very dense, but sterile structures, up to 25 cm diam. (see fig. 48); according to K. B. Boedijn they are caused by a fungus. A figure of the abnormal flower is given by H. J. Lam, Bull. *l.c.* t. 10 f. 66d.

The identity of *C. fulvum* Laut., the type specimen of which consists only of young leaves and ♂ flowers (with nearly free stamens) remains uncertain as the decisive differential characters between *C. asperum* and *C. schlechteri* are found in the mature leaves, the fruits, and sometimes in the ♂ flowers (if the stamens are connate).

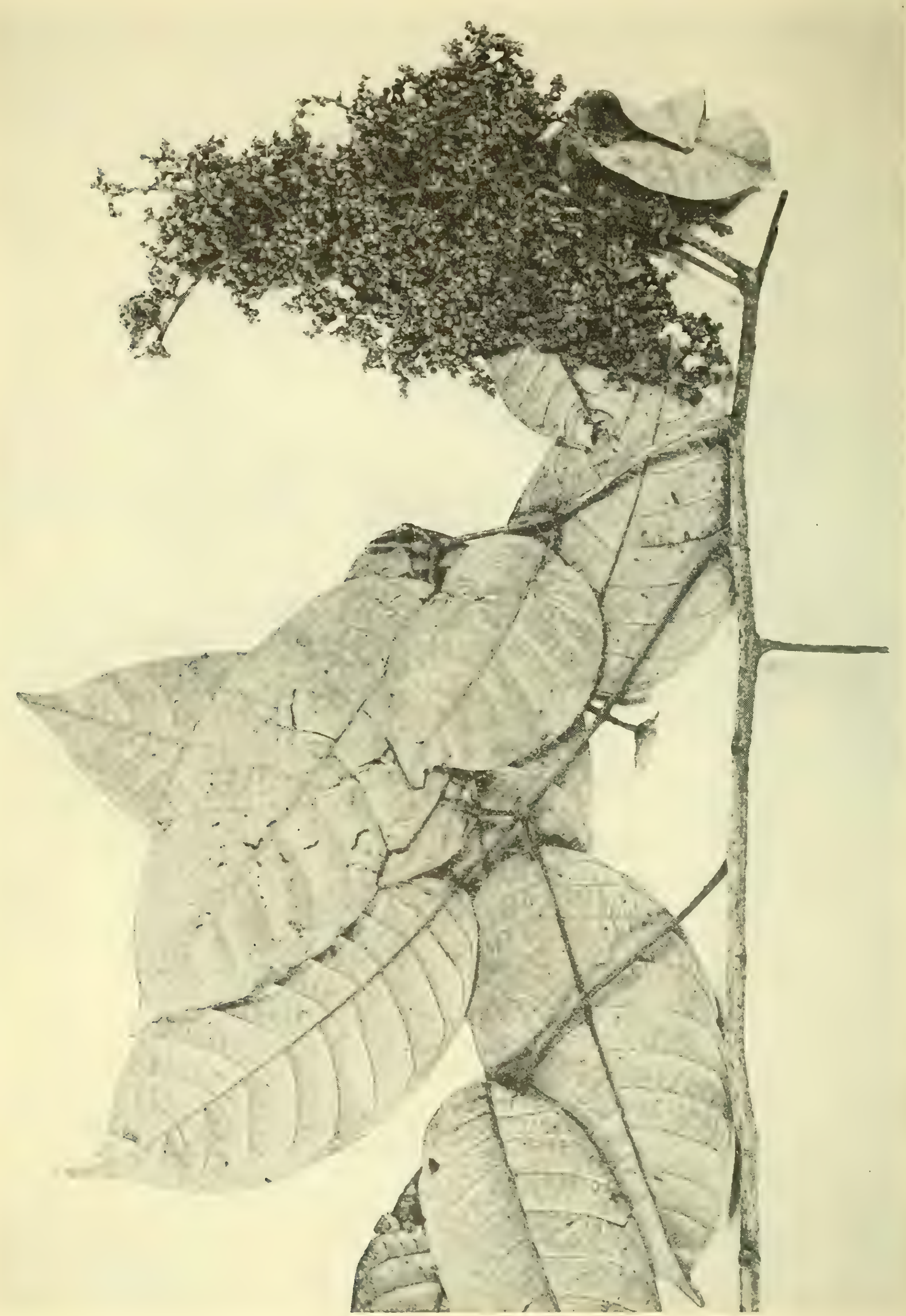

Fig. 48. Witches' broom in the inflorescence of *Canarium asperum* BTH. (MAIN & ADEN 946).

KEY TO THE INFRASPECIFIC TAXA

1. Inflorescences spicate to narrowly paniculate. *var.* **asperum**
1. Inflorescences more widely branched.
  2. Inflorescences compoundly spicate. *var.* **clementis**
  2. Inflorescences paniculate . . *ssp.* **papuanum**

subsp. **asperum** *var.* **asperum.**—All synonyms of the species except *C. clementis* MERR., *C. leytense* ELM., *C. wenzelii* MERR., and *C. papuanum* H. J. LAM.

Tree 8–35 m by 5–70(–more than 100) cm, rarely a shrub, very rarely buttressed. *Branchlets* rather slender, nearly always glabrous but for the tip; number and arrangement of vascular strands in the pith very variable. *Stipules* subpersistent or caducous, inserted beside the petiolar base or rarely on the petiole up to $1^1/_4$ cm from the base, subulate, 1–10 mm. *Leaves* 0–6-jugate. *Leaflets* very variable, ovate to elliptic, rarely obovate or lanceolate, 4–30 by 2–10 cm, generally rather rigid, chartaceous to coriaceous, glabrous or more or less pilose on the midrib above and on all nerves beneath; base rounded to cuneate, slightly oblique; margin entire, in young plants often serrulate to dentate and with tufts of hair on the teeth; apex mostly more or less abruptly, up to *c.* 2 cm long, tapering to narrowly, acutely to bluntly acuminate; nerves rather prominent beneath, (7–)12–15(–20) pairs (angle 50–80°), straight to slightly curved, sometimes abruptly arching close to the margin. *Inflorescences* axillary, spicate to subracemose, ♂ ones sometimes narrowly paniculate, these up to *c.* 40 cm long, ♀ ones 1–20(–32) cm, mostly slender and flexible, pendulous to ascending, sometimes rigid and erect; more or less hirsutely pubescent to glabrous. *Flowers* 3–7 mm long, ♀ ones very rarely with a slightly concave receptacle. *Calyx* $1^1/_2$–5 mm high. *Stamens* glabrous, $1^1/_2$–5 mm long, free, rarely slightly connate at the base or adnate to the disk. *Disk* pilose, in the ♀ flowers 3- or 6-lobed to subtruncate, *c.* 1 mm high; in the ♂ flowers cup-shaped with sometimes a small ovarial rudiment, to subglobose, with or without a central canal, more or less 6-lobed, up to $1^1/_2$ mm high. *Pistil* pubescent, rarely glabrous. *Infructescences* (nearly) spicate, flexible to rigid, with many fruits; *calyx c.* $2^1/_2$–5 mm diam. with strongly reflexed lobes (*asperum*-type) to *c.* 1 cm diam., funnel-shaped, deeply 3-lobed (*calophyllum*-type). *Fruits* ovoid to subglobose, subacute, round or slightly trigonous in cross-section, 9–14 by 4–11 mm, glabrous; pyrene smooth to slightly rugose, rarely very faintly 6-ribbed; lids *c.* 2 mm thick. *Seed* 1; sterile cells nearly to entirely reduced.

Distr. Solomon Islands, in *Malaysia:* Bawean & Kangean Isl. near E. Java, Lesser Sunda Isl. (Sumbawa, Sumba, Flores; according to MEIJER DREES also in Timor), Borneo (apparently rare), Philippines, Celebes, Moluccas, and New Guinea. Fig. 47.

Ecol. Apparently common in primary and secondary forests on very different, dry to wet, sometimes marshy, soils, sometimes found in more open forests or savannahs. Mainly occurring at low altitudes, up to *c.* 500 m, more rarely, specially in the Philippines, found at altitudes above 1000 m (up to 1800 m). *Fl. fr.* chiefly March–Oct.

Wood anat. REYES, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 161, pl. 24 fig. 3 (hand lens); WEBBER, Lilloa 6 (1941) 450.

Uses. The wood is said to be moderately hard, sometimes hard to very hard, or rather soft; it is of little durability. The resin is locally used for fuel and lighting purposes and sometimes recorded as caulking material for canoes and for painting hats. For the composition of the resin see BROWN, *l.c.* (under *C. villosum*).

Vern. *Kaju pukĕl, kĕdu (kĕntu), popoah,* Bawean, *kanang,* Kangean, *kahé, karitak ku kasih,* Sumba, *hetji, kessi,* Sumbawa, *enduèng, kadjawanda, nangi (watu), neni,* Flores, *pu(lo)t,* Borneo; Philippines: *alagatli, anagatli, ananggi, anunggi, malapilauai, nani-saliing, pacharingen, pagsaingan, pagsaingin, pagsahingin-maliit, pal(a)sahingen, panhinhin, patsaingin, pilauai bulog, sahing, saliang,* Tag., *antang,* Ibn., Neg., *antel, anten(g), dolit,* Ilk., *bakayan, bua, lonai, magsaguid, milipili, panganhauon, saleng, salgnan, salong, salosadugan, sanai, saong-saong, sulusalungan,* Bis., *bakiau, dalit,* Pang., *biawan, sandoka,* Ma., *binsauan, gotkuton,* Mbo., *brea,* Zamboanga, *bulo,* Pamp., *chaiket, chamusil, kihu, tabul,* Ig., *danganarai, gapog,* Sub., *dulit, palsaingin,* Sbl., *gagnan, malolugna, sagasa(g), sauangan,* Buk., *giret, koribo,* Neg., *ogat,* Bag., *pili pili,* Bik., *pisa,* Ting., *pulutan,* Lan., *anagalti;* Celebes: *damar djahat, d. reri, kĕnari jaki, solo, s. in tanah, s. kulo, s. lewo, s. ni tiei, s. rĕndai,* Minah., *damar-damar, prĕmpang,* S. Cel.; *damara,* Saleier, *biolo,* P. Muna, *kanaré,* Buton; Moluccas: *nakimbarawo, natimbarawo,* Talaud, Karakelang, *nirihaka, wehaka,* Morotai, *njiha puru,* Ternate, *dammar djadjaruwa,* Batjan, *damar itam,* Ambon; N. Guinea: *ijako, mangkès, mengkès,* Manokwari, *manifen,* Biak.

Notes. The type variety of this extremely variable species is itself also rather polymorphous, specially in leaf characters, particularly in the Philippines.

var. **clementis** (MERR.) LEENH. *nov. stat.*—*C. clementis* MERR.—*C. leytense* ELM.—*C. wenzelii* MERR.

Leaves 3–4(–5)-jugate. Leaflets medium-sized (10–17 by 5–8 cm), glabrous to densely ferrugineously tomentose beneath; nerves 15–20 pairs; veins transverse, dense. *Inflorescences* compoundly spicate, flowers in glomerules.

Distr. *Malaysia:* Philippines (Luzon, Leyte, Mindanao).

ssp. **papuanum** (H. J. LAM) LEENH. Bull. Bish. Mus. *no* 216 (1955) 12.—*C. asperum* BENTH.; LAUT. Nova Guinea 8 (1912) 827; Bot. Jahrb. 56 (1920) 327.—*C. papuanum* H. J. LAM.

Inflorescences more widely and laxly paniculate.

Distr. *Malaysia:* New Guinea, (low to) 1000–1800 m.

Notes. Rather dubious taxon, which for the time being can probably best be inserted here.

Rather variable in its vegetative and its flower parts. The ovariodisk in the ♂ flowers is quite variable in shape: the toadstool-shaped one, mentioned by H. J. LAM, I have also observed in some Philippine specimens of *ssp. asperum*. The triangular fruits, also mentioned by H. J. LAM, though looking quite different from those of *ssp. asperum*, are in my opinion of minor importance, as they are all young or sterile.

DOCTERS VAN LEEUWEN 10536 is said to have been collected of a climbing plant.

52. Canarium schlechteri LAUT. Bot. Jahrb. 56 (1920) 328; H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) t. 12 f. 87, t. 15 f. 117c; Bull. Jard. Bot. Btzg III, 12 (1932) 454, t. 10 f. 62.—*C. gutur* DE MIKLOUHO-MACLAY, Proc. Linn. Soc. N.S.W. 10 (1885) 353, 357, *nomen*.—**Fig. 20e.**

Tree up to 25 m by 30–40 cm, sometimes faintly buttressed. *Branchlets* slender, glabrescent; pith with many rather small vascular strands, peripheral ones distinctly, central ones more or less distinctly, cylindrically arranged. *Stipules* inserted on the petiole up to 3 cm from the base, rather caducous, filiform, 2–3 mm. *Leaves* 3–6-jugate, glabrous to about woolly pubescent. *Leaflets* ovate to lanceolate, (5–)12–20 by (3–)5–7 cm, subcoriaceous, glabrous or thinly puberulous on the midrib above and on the nerves beneath; base slightly oblique, rounded to subcordate, sometimes attenuate; margin entire; apex acute, more or less abruptly short acute-acuminate; nerves 11–20 pairs (angle 50–60°), straight to slightly curved, not to distinctly and abruptly arching near the margin, nerves and veins often slightly sunken above, prominent beneath; intermediate veins not rarely well developed. *Inflorescences* (♀ unknown) axillary, narrowly paniculate, 12–22 cm long, sparsely tomentose to glabrous, main branches up to 1½ cm, up to 9-flowered; *bracts* subpersistent, subulate, up to 8 mm. ♂ *Flowers* (♀ unknown) slender, 8–9 mm long, short-stalked. *Calyx* nearly truncate, 3 mm high, tomentose to scabrous. *Stamens* 7–8 mm long, glabrous, irregularly confluent at the base for up to 2 mm, tube more or less adnate to the disk. *Disk* 3 mm high, narrowly cupular to cylindrical, rim pilose, truncate to somewhat undulate, rudimentary ovary minute. *Infructescences* axillary, up to *c.* 10 cm long, glabrous, with 1–3 fruits; calyx saucer-shaped, triangular, 1 cm diam.; remains of the disk 1 mm high, slightly 6-lobed, fimbriate. *Fruits* fusiform, acute, round to slightly triangular in cross-section, 4 by 2 cm, glabrous; pyrene acutely 6-ribbed to deeply furrowed all over the surface; lids *c.* 3 mm thick; cells small, elliptic to round. *Seeds* 1–2.

Distr. New Britain and *Malaysia:* E. New Guinea. Fig. 47.

Ecol. Rain-forests up to 250 m, *fl.* June, Aug., and Nov., *fr.* March, May–Sept.

Uses. Produces a damar-like resin. The seeds are edible.

Vern. New Guinea: *bitung*, Morobe, *aropir*, *banaga*, *ongoi*, *pipiu*, *tawaia*, North. Div., *gutur*, Maclay Coast, *dokolo*, Upper Waria, *laudindiniha*, Dawa Dawa; New Britain: *apete*, Rabaul.

Note. See for the identity of *C. fulvum* LAUT. under the former species.

Doubtful

Canarium decipiens H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 209; Bull. Jard. Bot. Btzg III, 12 (1932) 447, t. 9 f. 56.

The type specimen of this species (unknown coll. 296 in BO) is very scanty and the locality is unknown. In my opinion it is possibly related to or even conspecific with *C. fusco-calycinum* STAPF.

Excluded

Canarium angustifolium (BL.) MIQ. Ann. Mus. Bot. Lugd. Bat. 4 (1869) 117; H. J. LAM, Bull. Jard. Bot. Btzg III, 12 (1932) 479, t. 11 f. 71d, *sub C. rigidum* ZIPP.—*Pimela angustifolia* BL. Mus. Bot. 1 (1850) 226.—*Canariopsis angustifolia* MIQ. Fl. Ind. Bat. 1, 2 (1859) 653.

The type consists of a twig with leaves apparently taken from a sapling or sucker. It is certainly not *burseraceous* and possibly represents a young specimen of a *Connaracea* or a *Meliacea*.

Canarium vrieseo-teysmannii H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 216; Bull. Jard. Bot. Btzg III, 12 (1932) 528, t. 14 f. 92.

The type (JUNGHUHN, Sumatra, in L; erroneously localized as 'DE VRIESE & TEYSMANN, Moluccas') consists of incomplete leaves and loose ♂ inflorescences. In all probability it is *meliaceous*; the leaves exactly match those of *Aphanamixis*, the flowers apparently differ from any known *Meliaceous* genus; it is possibly a mixture.

Excluded

Amyris ? maritima JACQ. Enum. Pl. Carib. (1760–61) 19; LLANOS, Mem. R. Acad. Cienc. Madr. IV, III, 2 (1856) 503 ('*Ansyris*'); F.-VILL. Nov. App. (1880) 41.—LLANOS refers with doubt a fruit from the forests of 'Angat' to this American *rutaceous* plant, classified by FERNANDEZ-VILLAR in the *Burseraceae*.

Boswellia ? integra and *obliqua* BLANCO, Fl. Filip. ed. 2 (1845) 242–243 = *? Dysoxylum sp. (Meliac.)*, *cf.* MERR. Sp. Blanc. (1918) 210.

Bursera ? nitida (TURCZ.) F.-VILL. Nov. App. (1880) 41 = *Glycosmis pentaphylla* (RETZ.) CORREA *(Rutac.)*, *cf.* MERR. En. Philip. 2 (1923) 334.

Ganophyllum BL. Mus. Bot. 1 (1850) 230 and *Filicium* THW. En. Pl. Zeyl. (1864) 408 are *Sapindaceae*.

Icica ? timoriensis DC. Prod. 2 (1825) 78 = *Pleiogynium timoriense* (DC.) LEENH. Blumea 7 (1952) 159 (*Anacardiac.*).

SCYPHOSTEGIACEAE (C. G. G. J. van Steenis, Leyden)

1. SCYPHOSTEGIA

STAPF, Trans. Linn. Soc. Lond. II, Bot. 4 (1894) 217, t. 17; HUTCHINSON, Fam. Fl. Pl. 1 (1926) 229, f. 168; BAEHNI, C.R. Soc. Phys. Hist. Nat. Genève 54 (1937) 91–92; Ber. Schweiz. Bot. Ges. 48 (1938) 22–28, f. 1–3; SWAMY, Proc. Nat. Inst. Sc. India 19 (1953) 127–142, f. 1–38; METCALFE, Reinwardtia 4 (1956) 99.—**Fig. 1.**

Erect, glabrous, dioecious shrub or small tree. Twigs 4-angular, rhomboid in section, more or less zigzag, pithy; pith in young twigs ± terete, in older ones cross-like in section; medullary rays very regular, finely radial-parallel. *Leaves* simple, alternate, bifarious, flat in flush, shortly petioled, crenulate-dentate, nigrescent, penninerved, veins transversal, ultimate veins partly blind in the intervenal areoles. Stipules small, acute, their lower part persistent and hardened. *Inflorescences* terminal, in their lower part leafy, bracteate, consisting of a raceme of peduncled, spike-like racemes with telescoped tubular bracts sustained at the base by 1 bract and 2 stipules. Bracts persistent, accrescent, truncate, veined lengthwise, the uncovered part thicker, each 1-flowered except the terminal one which is 2-flowered. *Flowers* in each raceme developing from the base upwards, on a flattened, persistent pedicel. *Perianth* connate, rather fleshy, corollar, consisting of 6 lobes, imbricate in bud, 3 inner and 3 outer ones, in the ♀ about equal, in the ♂ the inner ones smallest. ♂ *Flowers:* perianth segments shorter than the tube, inner ones spaced, spathulate; extrastaminal disk glands 3, blunt, oblong, fleshy at the base of the sulcate filaments; filaments connate in a column opposite the inner tepals; anthers 2-celled, dehiscing lengthwise, extrorse; connective produced above the anthers, rounded; pollen grains 3-colpate. ♀ *Flowers:* perianth ± persistent, perianth-lobes longer than the tube, about equal; disk glands absent (but possibly disk-like tissue of receptacular origin participating in the ovarial wall); ovary urceolate, thickened fleshy at the mouth and with recurved margin, 9–12-sulcate, the apical part possibly representing a glandular-stigmatic surface depressed in the centre and through a distinct (?style-)canal giving free entrance to the ovarial cavity. Ovules ∞, crowded on the flat base of the ovary, linear, erect, on a minute funicle, anatropous. *Fruiting receptacle* ± globose to broad-cylindric, fleshy, accrescent, 9–12-ribbed or -sulcate, breaking up at the mouth. *Seeds* ∞, densely packed, their needle-like bases surrounded by and partly connate with a spongy tissue of scarious lamellae of placental origin; seeds terete, narrow oblanceolate, with a blunt, obliquely cut, concave apex, shortly erect-patent pubescent over its whole surface; testa black, brittle-chartaceous; endosperm attached at the apex of the testa, cylindric, outer cell layer brown, enveloping the embryo. Embryo straight in the basal part of the seed the rootlet pointing downward, rootlet slightly compressed, cotyledons oblong, flat, thin-foliaceous, somewhat longer than the rootlet.

Distr. Monotypic, in *Malaysia* (Borneo).

Notes. All recent authors agree that the genus represents a distinct family. Difficulties in settling its taxonomic position have partly been due to some inadequate observations in the past which led to unsatisfactory interpretation. Originally described as scandent, it appears to be an erect shrub or treelet. Hitherto all authors agree on the absence of stipules which I find are distinctly present on innovations, leaving knob-like traces on the mature twigs.

In addition the morphological interpretation of the floral parts, specially in the ♀ has varied. The gland-like appendages in the ♂ flowers (fig. 1f) have been accepted by BAEHNI (*l.c.* p. 23–24) as representing a corolla which should then be homologous with the corona-like or diaphragm-like outgrowth in the ♀ flower (fig. 1g).

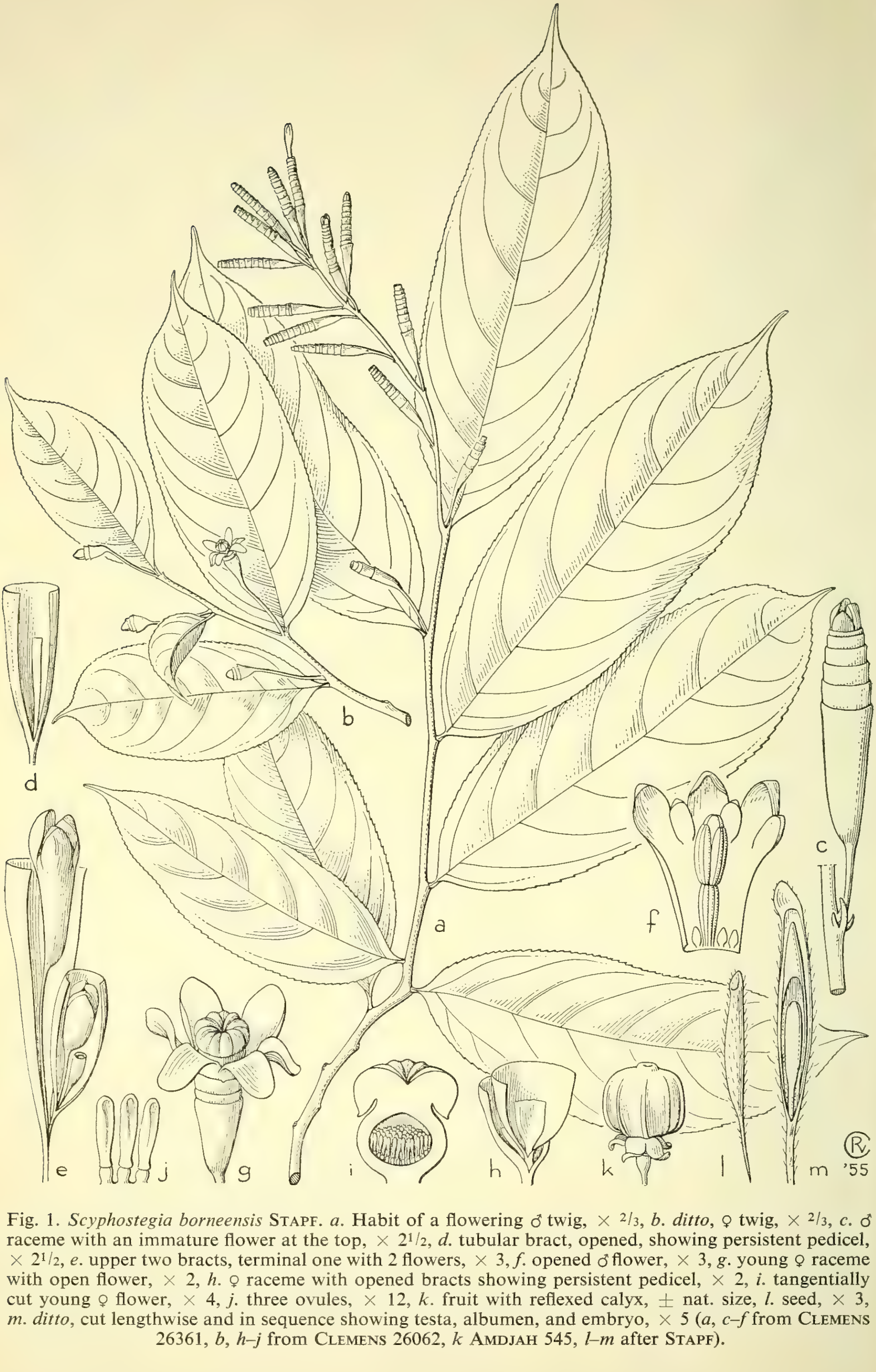

Fig. 1. *Scyphostegia borneensis* Stapf. *a.* Habit of a flowering ♂ twig, × 2/3, *b. ditto*, ♀ twig, × 2/3, *c.* ♂ raceme with an immature flower at the top, × 2 1/2, *d.* tubular bract, opened, showing persistent pedicel, × 2 1/2, *e.* upper two bracts, terminal one with 2 flowers, × 3, *f.* opened ♂ flower, × 3, *g.* young ♀ raceme with open flower, × 2, *h.* ♀ raceme with opened bracts showing persistent pedicel, × 2, *i.* tangentially cut young ♀ flower, × 4, *j.* three ovules, × 12, *k.* fruit with reflexed calyx, ± nat. size, *l.* seed, × 3, *m. ditto*, cut lengthwise and in sequence showing testa, albumen, and embryo, × 5 (*a*, *c–f* from Clemens 26361, *b*, *h–j* from Clemens 26062, *k* Amdjah 545, *l–m* after Stapf).

The scarious, scale-like outgrowths surrounding the stipes of the achenes were too schematically drawn by STAPF as 3 distinct lobes (in contrast with what he says in his text). HUTCHINSON accepted them to represent a floral perianth. On this basis, he interpreted the ♀ flower as an inflorescence not homologous with the ♂ flower, taking the thick outer lobes and corona of the ♀ flower together as a receptacular outgrowth comparable to that of the inflorescence in *Ficus*. This presentation is rightly disputed; BAEHNI has definitely shown (*l.c.* p. 25) that the scarious, connate, bract-like outgrowths on the ♀ receptacle have the nature of trichomes and not of a perianth, an opinion already advanced by STAPF. The exact homology of ♂ and ♀ flowers is also shown in the exactly comparable insertion of the ♀ flowers on a single, flattened, persistent pedicel inside each of the remarkable tubular bracts.

STAPF referred the genus to the *Monimiaceae*. This was disputed by PERKINS & GILG (Pfl. R. Heft 4, 1901, p. 117) and later by PERKINS (Gatt. Monim. 1925, p. 55). MONEY, BAILEY & SWAMY (J. Arn. Arb. 31, 1950, 373, 395) also reject this view, partly on account of the absence of the secretory pellucid dots in the leaves containing essential oil. They say that the 3-colpate pollen structure excludes the genus from relationship with most woody ranalian families, but they did not offer much of a positive alternative. A distinct difference against *Monimiaceae* is further the presence of stipules and of bifarious alternate leaves.

HUTCHINSON's opinion of affinity with *Moraceae* has to be abandoned definitely; ERDTMAN (Pollen Morph. & Tax. 1952, 405) says that it cannot belong to that affinity on account of the 3-colpate pollen. The apocarpy and absence of latex also does not point to *Moraceae*.

Recently SWAMY gave an entirely new interpretation of the structure of the ♀ flower in accepting the urceolate structure of the ♀ flower to represent an ovary with numerous basal ovules. His drawing of the ovule during anthesis is very convincing (*l.c.* p. 129, fig. 6): anatropous, with a pedestal funicle and 2 integuments. Though I have accepted this interpretation, the occurrence of analogous structures in *Monimiaceae* is remarkable: 1) trichome or hair-like outgrowths of the receptacle in many *spp.*, 2) seed with stiff erect-patent hairs (*e.g.* in *Glossocalyx*), 3) sulcate rim of receptacle in many *spp.*, 4) inclusion of ovaries and achenes within a receptacle identical in shape (in *Hennecartia*, *cf.* PERKINS, Gatt. Monim. 1925, fig. 35H).

Ochrea-like bracts showing a superficial resemblance to those in *Scyphostegia* are found in *Garryaceae* which are certainly not related.

In trying to find a satisfactory relationship of *Scyphostegia* I have asked the help of Dr C. R. METCALFE, of the Jodrell Laboratory, Kew, who has studied the anatomical features on freshly preserved material from the living trees present in the Botanic Garden, Penang, and obtained through the courtesy of the curator Mr H. RITCHINGS. He confirmed (Nov. 1955) 'that there is little anatomical evidence for a relationship with either *Moraceae* or *Monimiaceae*, but that it exhibits a combination of characters that are also to be found in a number of genera and species that are well established as members of the *Flacourtiaceae*. Dr HUTCHINSON can well agree with this relationship and had come quite independently to a similar conclusion'. This again shows the remarkable strength of anatomical evidence. Also morphologically the combination: distichous, crenate leaves with stipules, dioecious 3-merous flowers with a deepened receptacle in ♀, a unilocular ovary with parietal ovules and a sessile stigma, connate stamens and extrastaminal disk glands (epipetalous in *Homalium!*) fits excellently with *Flacourtiaceae*.

1. Scyphostegia borneensis STAPF, Trans. Linn. Soc. Bot. 4 (1894) 218, t. 17; MERR. En. Born. (1921) 272; BAEHNI, Ber. Schweiz. Bot. Ges. 48 (1938) 22, f. 1–3.—**Fig. 1.**

Shrub or small tree, 3–10 m. *Leaves* oblong, to narrow-oblong or obovate-oblong, membranaceous to chartaceous, rather equal-sided, acute-acuminate (acumen often falcate), *c.* $2^1/_2$–4 times as long as broad, 9–18 by 3–$6^3/_4$ cm, smaller in the flowering part; nerves 6–11 pairs, petiole almost absent by the contracted decurrent blade under the rounded base to distinct and $^3/_4$ cm. Stipules acute, triangular, *c.* 1 mm. ♂ *Inflorescence* green or yellow-green, up to 30 cm, laxly set with racemes 1–2 cm, excl. peduncle $^1/_4$–$1^1/_4$ cm. Tubular bracts up to *c.* 12, *c.* 5–10 by 2–3 mm, dark green. Pedicels scarious, lengthwise 2-veined, 4–6 by 1 mm. ♂ *Flowers:* perianth-tube *c.* 4–5 mm high; lobes oblong-rounded or more spathulate, distinctly thickened at the apex, the outer *c.* 3 by 2 mm, the inner 2 by $1^1/_2$ mm; disk glands $^3/_4$ by $^2/_5$ mm. Staminal column *c.* 2–3 mm, anthers *c.* 2 mm, connective $^1/_2$ mm high. ♀ *Inflorescences* with fewer racemes than the ♂. Racemes 5–8 by 2–3 mm, $1^1/_2$–$3^1/_2$ cm peduncled. Tubular bracts fewer and somewhat shorter than in ♂. ♀ *Flowers* pale greenish yellow, or bright green with yellowish margins. Pedicel 2 mm broad, shorter than in the ♂. Perianth-tube 2 mm high, lobes about equal, broad-elliptic, *c.* 6 by 4 mm, under the fruit recurved. Ovary in flower *c.* 4 by 4 mm, dark green at the base, apical grooved part pale green, in fruit accrescent to $1^1/_4$ by $1^1/_2$ cm, 9–12-sulcate or ribbed, green. *Seeds c.* 3 mm stipitate, *c.* 5–6 by $^4/_5$–1 mm.

Distr. *Malaysia:* Borneo, not yet recorded from the southern third part of the island.

Ecol. Rain-forest substage and low jungles, hill-sides and steep river-banks, also in secondary forest, 450–900 m, by RICHARDS (*no* 1603) recorded below 300 m on Dulit Range. *Fl.* March-Nov., *fr.* Sept.

Vern. *Kata manok*, *tarukakang*, Sg (N. Born.), *sangkurat*, Kedayan, *tulau*, Idahan, *loboh*, Tengara.

Notes. Two specimens are cultivated in the Bot. Gardens, Penang. Introduction in the Singapore Botanic Gardens has failed, possibly on account of badly aerated soil.

BASELLACEAE (C. G. G. J. van Steenis, Leyden)

Perennial, glabrous, herbaceous vines, twining to the right, often with a rhizome or tuberous roots. *Leaves* spiral, sessile or petioled, entire, penninerved, often rather fleshy, exstipulate. *Flowers* bisexual (or unisexual), actinomorphous, in axillary (and/or terminal) spikes, racemes or panicles, each subtended by a small bract. Bracteoles 2 or 4, in the latter case in 2 decussate pairs, below the flower, sometimes accrescent and connate at the base, the upper pair often tepaloid. *Perianth* segments 5, often coloured, connate at the base in a shorter or longer tube, imbricate, persistent, often accrescent. Stamens 5, epitepalous; filaments inserted on the perianth; anthers 2-celled, dorsifixed, dehiscing lengthwise, rarely (in *non*-Mal. *spp.*) with an oblique apical slit. *Ovary* superior, 1-celled; styles simple or 3-armed, or 3 free styles; ovule 1, basal, campylotropous. *Fruit* indehiscent, surrounded by the persistent often fleshy-accrescent calyx (and eventually bracteoles). *Seed* globular; testa membranous; endosperm copious, surrounded by the spirally twisted or semi-circular to horseshoe-shaped embryo.

Distr. Four genera with *c.* 15 *spp.*, almost confined to the warmer parts of the New World, from Texas and the West Indies to Peru, Uruguay, and the Argentine, some *spp.* of *Basella* in E. Africa and Madagascar, in *Malaysia* cultivated and locally naturalizing.

Notes. VOLKENS (1893) in the first edition of the 'Pflanzenfamilien' interpreted what has been here called the upper two bracteoles as a calyx and the perianth as a corolla. I agree with BENTHAM & HOOKER (1880), HUTCHINSON (1926), and ULBRICH (1934) in the second edition of the 'Pflanzenfamilien' in accepting a single perianth (called 'calyx' by H. on account of the epitepalous stamens suggesting apetaly) sustained by one or two pairs of bracteoles.

BENTHAM & HOOKER (Gen. Pl. 3, 1880, 76–77) merged *Basellaceae* with *Chenopodiaceae* and some authors have accepted this opinion or referred them to *Amaranthaceae*. MOROT (Bull. Soc. Bot. Fr. 31, 1884, 104–107) found the anatomy distinctly different from that of *Chenopodiaceae* and accepts them as a distinct family.

EICHLER (Blütendiagr. 2, 1878, 125, 128) merged them with *Portulacaceae* and a close affinity with that family was accepted by VOLKENS (1893) and ULBRICH (1934) in the 'Pflanzenfamilien'.

KEY TO THE GENERA

1. Flowers sessile, fleshy, hardly open at anthesis. Perianth very fleshy, enclosing the fruit. Filaments erect in bud. Embryo spirally twisted . . . . **1. Basella**
1. Flowers (in Mal. *spp.*) pedicelled, not fleshy, patent at anthesis. Perianth not berry-like. Filaments reflexed in bud. Embryo semi-circular or horseshoe-shaped . . . . **2. Anredera**

1. BASELLA

LINNÉ, Sp. Pl. (1753) 272; Gen. Pl. ed. 5 (1754) 133.—**Fig. 1.**

Succulent rhizomatous herbs. *Flowers* bisexual, in simple or occasionally branched spikes. Bracts minute, caducous. Bracteoles and urceolate *perianth* connate, fleshy, accrescent, ovoid, very little opening in anthesis, after flowering very fleshy and enclosing the fruit, forming a pseudoberry. Stamens included, filaments very short, inserted near the top of the corolla-tube, erect in bud; stamens dorsifixed, versatile. Perianth segments short, blunt. Styles 3, stigmas linear. Embryo spiral; cotyledons large, thin.

Distr. About 5 *spp.*, apparently native of tropical Africa and Asia, one *sp.* in E. Africa, 3 *spp.* described as endemic in Madagascar (differing by a dry, hard pericarp!), in *Malaysia* only one species of early introduction.

1. Basella alba LINNÉ, Sp. Pl. (1753) 272; BURM. *f.* Fl. Ind. (1768) 76; BLUME, Bijdr. (1825) 537; GRAH. Cat. Bomb. (1839) 170; WIGHT, Ic. 3 (1845) t. 896; MOQ. in DC. Prod. 13, 2 (1849) 222; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1023; Dalz. & GIBS. Bomb. Fl. Suppl. (1861) 73; F.-VILL. Nov. App. (1880) 171; VOLK. in E. & P. Pfl. Fam. 3, 1a (1893) 126; MERR. Govt. Lab. Publ. Philip. *no* 27 (1905) 71; MACBRIDE, Field Mus. Nat. Hist. bot. ser. 13 (1937) 574; HAUMAN, Fl. Cong. Belg. 2 (1951) 129. —*Basella* RHEEDE, Hort. Mal. 7 (1688) 45, t. 24. —*Gandola alba et rubra* RUMPH. Herb. Amb. 5 (1747) 417, t. 154 f. 2.—*B. rubra* LINNÉ, Sp. Pl. (1753) 272; BURM. *f.* Fl. Ind. (1768) 76; LAMK, Ill. (?1792) t. 215 f. 1; Gaertn. Fruct. 2 (1791) 200, t. 126 f. 8; Blume, Bijdr. (1825) 537; Roxb. Fl. Ind. ed. Carey 2 (1832) 104; Blanco, Fl. Filip. (1837) 215, ed. 2 (1845) 151, ed. 3, 1 (1877) 272, t. 74; Moq. in DC. Prod. 13, 2 (1849) 222; Miq. Fl. Ind. Bat. 1, 1 (1858) 1023; F.-Vill. Nov. App. (1880) 171; Bissch. Grev. Pl. Ned. Ind. (1883) 261; Hook. *f.* Fl. Br. Ind. 5 (1886) 20; Trimen, Fl. Ceyl. 3 (1895) 410; Courchet, Fl. Gén. I.-C. 5 (1910) 11, f. 2 (1–3); Koord. Exk. Fl. Java 2 (1912) 209, Atl. f. 951; Merr. Fl. Manila (1912) 200; Int. Rumph. (1917) 218; Sp. Blanc. (1918) 142; Kirtikar & Basu, Ind. Med. Pl. 2 (1918) 1070, t. 802; Brown, Minor Prod. Philip. For. 2 (1921) 278, *ibid.* 3 (1921) 185; Gamble, Fl. Madr. (1925) 1185; Heyne, Nutt. Pl. (1927) 613; Ochse & Bakh. Ind. Groenten (1931) 75, f. 45; Wilson, N. Am. Fl. 21 (1932) 339; Merr. Comm. Lour. (1935) 152; Burk. Dict. (1935) 307; Backer, Bekn. Fl. Java (em. ed.) 4a (1942) fam. 64, p. 1; Steen. Fl. Schol. Indon. (1949) 178; Brown, Usef. Pl. Philip. 1 (1950) 521–525, f. 219; Quis. Med. Pl. Philip. (1951) 285.—*B. lucida* Linné, Syst. ed. 10 (1759) 966; Burm. *f.* Fl. Ind. (1768) 76; Blanco, Fl. Filip. (1837) 216, ed. 2 (1845) 151, ed. 3, 1 (1877) 273; Moq. in DC. Prod. 13, 2 (1849) 224; Miq. Fl. Ind. Bat. 1, 1 (1858) 1024; F.-Vill. Nov. App. (1880) 171.—*B. japonica* Burm. *f.* Fl. Ind. (1768) 76, t. 39 f. 4.—*B. cordifolia* Lamk, Enc. 1 (1783) 382; F.-Vill. Nov. App. (1880) 171; Miq. Fl. Ind. Bat. 1, 1 (1858) 1023; Kurz, Nat. Tijd. Ned. Ind. 27 (1864) 173.—*B. nigra* Lour. Fl. Coch. (1790) 183; ed. Willd. (1793) 229.—**Fig. 1.**

Winding or creeping, 2–10 m long, up to 1 cm diam. Stems and petioles red (*var. rubra*), more rarely green (*var. alba*). *Leaves* broad-ovate to oblong, base shallow-cordate to acute, apex blunt to acute, somewhat succulent, green or purplish, 2–12 by $1^{1}/_{4}$–9 cm; petiole 1–3 cm. *Spikes* incl. the peduncle 3–25 cm, (in Mal. specim.) unbranched, with thick, red or green rhachis, flowers initially close together, gradually more spaced. Bracts ovate-triangular, acute, much shorter than the flower; bracteoles broad-elliptic, blunt, shorter than the bract. Flower with pale base and white, rose or purple, blunt apex, 3–4 mm long. Pseudoberry depressed-globose, shallowly lobed, 4–7 mm high, 5–10 mm wide, shining black, containing a violet juice.

Distr. According to Burkill probably native in the Old World both in Africa and trop. SE. Asia; in the latter country apparently exhibiting the greatest variability, but exact native country not known with certainty and obviously of ancient introduction in *Malaysia* and China; at present pantropic.

Ecol. Frequently planted by the people up to *c.* 500 m (in Africa up to 2500, in the Andes up to 3000 m), locally naturalized in the settled areas, preferably the drier areas, in grass-wildernesses and thickets, in young secondary forest, both under everwet and seasonal climatic conditions, but always scattered and likely to disappear. The cultivated specimens belong mostly to cultigens. Propagated easily by seed and by cuttings which produce shoots within few weeks; it can be best grown on a low trellis. Van Helten (Teysmannia 1915, 213) gave some indications for its cultivation.

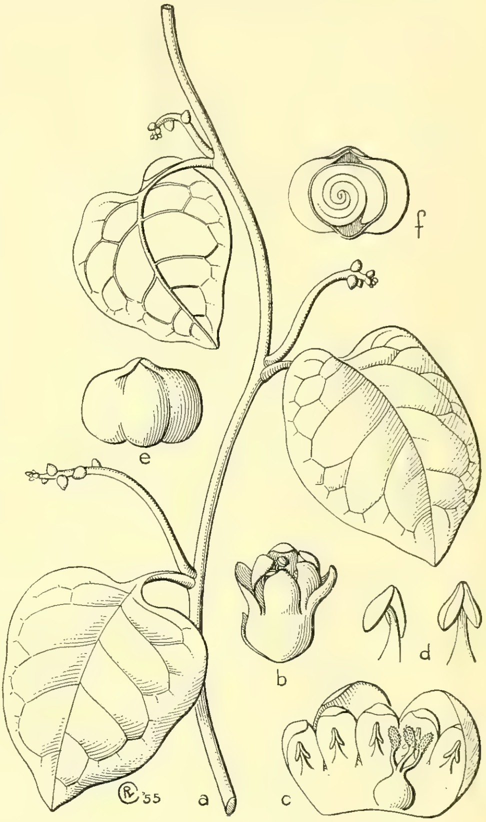

Fig. 1. *Basella alba* L. *a.* Habit, × $^1/_2$, *b.* flower connate in an urceolate tube, × 4, *c.* opened flower showing the sexual organs, × 5, *d.* anthers, × 10, *e.* pseudoberry, × $2^1/_2$, *f. ditto*, in section, with the twisted embryo, × $2^1/_2$ (after a young living specimen in the Leyden Hortus).

ESTEEMED ?

Uses. A plant of many uses. An estimated substitute for spinach or purslane and when boiled mucilaginous, used for food as a pot herb and in leafy vegetable stews. This was with *Amaranthus spp.* and *Talinum triangulare* Willd. one of the most valued vegetables grown in war prison camps in Indo-Malaysia. According to W. H. Brown it is a good food containing several vitamins and relatively rich in calcium and iron compounds.

Pulped and bruised leaves are used in India and Malaya to poultice sores. They are also a mild laxative. In the Philippines the roots are employed as a rubefacient. The sap is used to anoint any part of the body affected by acne in order to diminish the irritation produced by that malady.

The harmless colouring substance of the berries (*djingga*, J) is generally in use for colouring eatables, jellies, pastry, and preserves. Dried it is sold as powder (*gintju*, S) in W. Java.

Vern. *Brède d'Angole, épinard d'Amérique*, Fr, *Malabar nightshade, Ceylon spinach*, E, *gĕndola* (the common name), M, *rĕmajong*, Mal. P., *lĕmbajung*, Sum., *gandola, g. bodas, g. beureum*, S, *gĕndjĕrot, gĕndulak, gĕdrĕk, utji-utji*, J, *kandula*, Md, *gĕndola*, Bali, *tatabuwé, poïloö, duju numuno*, N. Cel., *rinutu*, Ambon; Philippines: *libáto*, common name, *grana*, Tag., *alugbáti*, Bis., *ilaibákir*, Iloko, *arogbáti*, Bik., *dundula*, Sulu.

Notes. Several cultigens are known and have been distinguished as different species in former time, but they differ by very minor characters. BAILEY still distinguishes the two species *B. alba* and *B. rubra* on which LINNAEUS based the genus, the first of which should have relatively narrower leaves besides its white flowers.

Through the rule prescribing that the correct epithet should be the one used by the first author who united the synonyms there is no definite certainty about this name. BAILLON (Hist. Pl. 1888) said that there was one species which he accepted as *B. rubra*, but GRAHAM united them as *B. alba* in 1839. According to RHEEDE seeds from Ceylon were successfully grown in 1685 in the Amsterdam Hortus Medicus.

2. ANREDERA

JUSSIEU, Gen. (1789) 84; J. F. GMEL. Syst. Nat. 2 (1791) 454, *nom. conserv. prop.*, *cf.* Taxon 5, 1956, 198.—*Fallopia* ADANS. Fam. Pl. 2 (1763) 277, 557, *nom. rejic. prop.*—*Boussingaultia* H.B.K. Nov. Gen. Sp. 7 (1825) 194, t. 465*bis*; HAUMAN, An. Mus. Nac. Buenos Aires 33 (1925) 347–359.—*Tandonia* MOQ. TAND. in DC. Prod. 13, 2 (1849) 226; *pro sect. sub Boussingaultia* VOLKENS in E. & P. Pfl. Fam. 3, 1a (1891) 128.—**Fig. 2.**

Branched vines with annual shoots from a fleshy rhizome. *Leaves* slightly fleshy, sessile or petioled. *Racemes* or spikes axillary, simple or branched. Bracts persistent or caducous; pedicels (if any) persistent, articulate below the perianth. Apex of the pedicels with two pairs of decussate bracteoles appressed to the perianth; lower pair small, connate and persistent forming a cuplet, or free and caducous; upper pair tepaloid, convex or boat-shaped, often keeled on the back, sometimes narrowly winged, rarely broadly winged. *Flowers* bisexual (or unisexual). *Tepals* connate at the base, forming a hollow concealing the ovary, segments patent in anthesis, thin, later ± thickened and enclosing the fruit. *Filaments* filiform broadened towards the base. *Style* 1 with 3-lobed stigma or split to various degree into arms, eventually into 3 free styles each with a globular to oblong or club-shaped, papillose stigma; arms sometimes forked, each with a linear stigma. *Fruit* globose, enclosed by the perianth; pericarp fleshy or pergamentaceous. *Seed* lens-shaped.

Distr. About 5–10 *spp.* in the warmer parts of America, from Mexico to Peru, the Argentine and Uruguay, also in the Galapagos Isl. (?native).

Notes. As BAILLON rightly remarked (Hist. Pl. 9, 1887, 148) *Boussingaultia* in the strict sense differs from the monotypic *Anredera* only by the conspicuously winged two upper bracteoles. This winged structure is a matter of degree, however, as KUNTH described them in the type species of *Boussingaultia* as '*carinatae concavae dorso inferne membranaceo-subalatae*' and HAUMAN distinguishes (*l.c. in clav.* p. 358) three other species with the same character. It seems therefore unavoidable to merge the two genera into one, *Anredera* having priority.

In subdividing *Anredera* I assume it is not advisable to use the style-character as is done by VOLKENS and HAUMAN in *Boussingaultia*; I have dissected flowers from many specimens of one species and have found the pistil variable as to length of style, length of style-arms, and shape of stigmas, as demonstrated in fig. 2, even in one specimen. I think a fitting character can be found in the nature of the lower pair of bracteoles:

1. *Sect. Anredera.* Lower bracteoles free, caducous. Type species: *A. scandens* (L.) MOQ.. Syn.: *sect. Moquiniella* HAUMAN *l.c.* 355. Other species belonging here *e.g. A. leptostachys* (MOQ.) STEEN. *comb. nov.* (*Boussingaultia leptostachys* MOQ. in DC. Prod. 13, 2, 1849, 229), fig. 2k. Both species dry light green in the herbarium unlike those I have seen of the following section.

2. *Sect. Tandonia* (MOQ.) VOLK. in E. & P. Pfl. Fam. 3, 1a (1891) 128. Lower bracteoles connate at the base forming a persistent cuplet on top of the pedicel. Type species: *A. baselloides* (H.B.K.) BAILL.. Syn.: *Tandonia* MOQ. *l.c.* 226. Other species *e.g. A. cordifolia* (TENORE) STEEN.

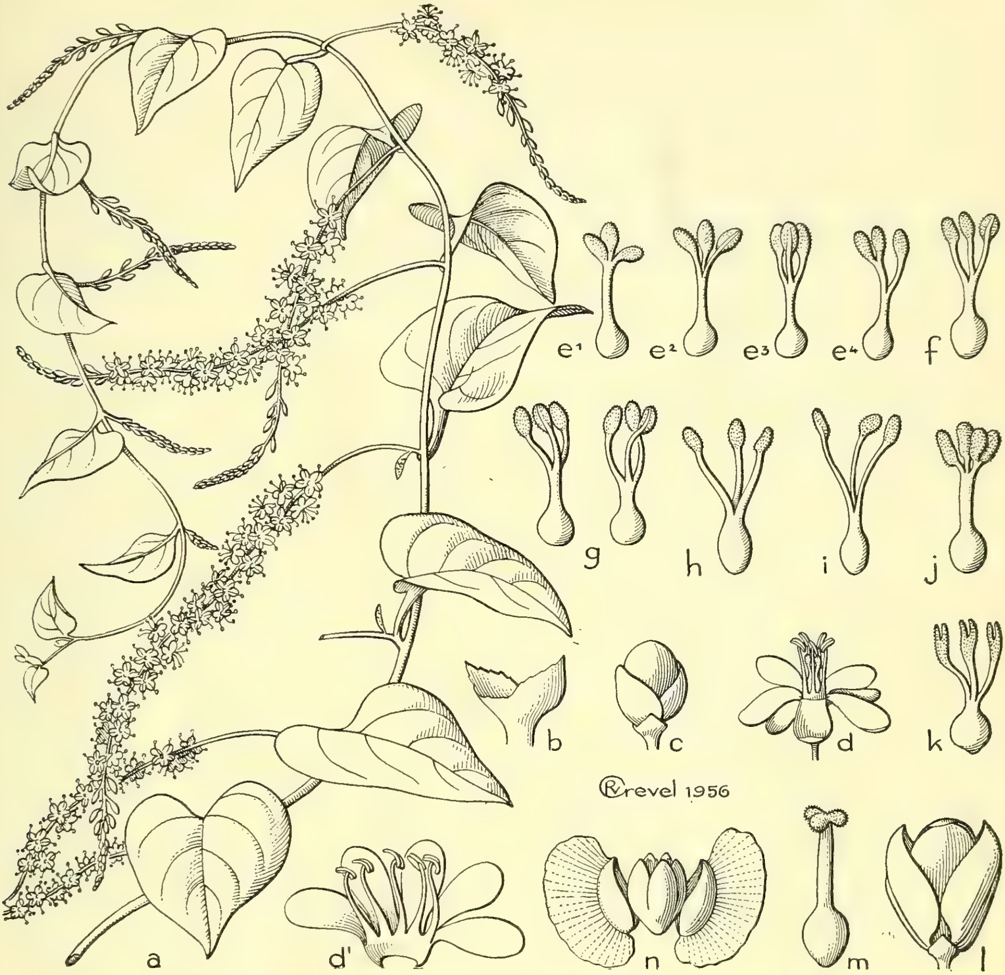

Fig. 2. *Anredera cordifolia* (Tenore) Steen. *a.* Habit, × 2/3, *b.* cuplet on top of pedicel, formed by conn at lower pair of bracteoles, *c.* bud, *d.* flower, *d'.* perianth and stamens from inside, *e–j.* variation in pistil. —*A. leptostachys* (Moq.) Steen. *k.* pistil.—*A. baselloides* (H.B.K.) Baill. *l.* bud (perianth surrounded by 2 boat-shaped bracteoles with narrowly winged keel and pedicel with apical cuplet of lower pair of bracteoles), *m.* pistil.—*A. scandens* (L.) Moq. *n.* flower, two winged upper bracteoles (detached) surrounding the perianth (*a.* from Bot. Mag. t. 3620, *b–c.* Backer 36502, *d–d'.* from J. Bot. 2, t. 18, e^{1-4} Backer 36502, *f.* Glaziou 8008, *g.* Herzog 2016, *h.* Gaudichaud 359, *i.* Bonpland 534, *j.* Boom 20485, *k.* Sintenis 2361, *l–m.* coll. Humboldt & Bonpland 3390, *n.* after Volkens).

As a revision of the genus falls without the scope of my task I have intentionally refrained from making other transfers than the above, which I accept as good species. A new key to the species will have to be framed as that of Hauman (*l.c.* p. 358) is unsatisfactory, *B. gracilis* being placed in the wrong section and *B. baselloides* belonging close to *B. ramosa.*

KEY TO THE SPECIES

1. Upper bracteoles flattened in flower, orbicular to broad-elliptic, not keeled . . . **1. A. cordifolia**
1. Upper bracteoles boat-shaped with a conspicuously winged keel . . . . **2. A. scandens**

1. Anredera cordifolia (Tenore) Steen. *comb. nov.—Boussingaultia cordifolia* Tenore, Ann. Sc. Nat. III, 19 (1853) 355, *non B. cordifolia* (Moq.) Volk. 1893, *quae est B. volkensii* Ulbr.; MacBride, Field Mus. Nat. Hist. bot. ser. 13^2 (1936) 577.—*Boussingaultia gracilis* Miers, J. Bot. 2 (1864) 161, t. 18; Hauman, An. Mus. Nac. Buenos Aires 33 (1925) 355, *incl. f. pseudo-basel-*

loides HAUMAN; BAILEY, Man. Cult. Pl. (1949) 368, incl. *Boussingaultia gracilis var. pseudobaselloides* (HAUM.) BAILEY.—*Boussingaultia baselloides* (*non* H.B.K.) HOOK. Bot. Mag. 64 (1837) t. 3620; MOQ. in DC. Prod. 13, 2 (1849) *p.p. excl. typ.*; BEILLE, Act. Soc. Linn. Bord. 56 (1901) clvi; KOORD. Exk. Fl. Java 2 (1912) 209; WILSON, N. Am. Fl. 21 (1932) 338; BACKER, Bekn. Fl. Java (em. ed.) 4a (1942) fam. 64, p. 2 *et auct. plurim.*—*A. baselloides* BAILL. Hist. Pl. 9 (1887) 147, f. 208–210, excl. *bason. Boussingaultia baselloides* H.B.K. —**Fig. 2a-j.**

Annual shoots up to 6 m; rhizome thick and hardy. *Leaves* short-petioled, ovate, subcordate, acute or blunt, thin-fleshy, 1–11 by 3/4–8 cm, producing small axillary tubercles (BAILEY). Racemes simple or split into 2–4 branches with a thin, rich-flowered rhachis, incl. the peduncle 4–30 cm. Bracts narrow, at most as long as the pedicels, persistent. Pedicels 1 1/2–2 mm, receptacular tip cup-shaped by 2 persistent, broad-triangular, acute, hyaline lower bracteoles. Upper pair of bracteoles greenish-white, shorter than the perianth, convex in bud, later flattening, broad-elliptic to suborbicular, *c.* 1 1/4–2 by 1–1 1/2 mm. *Perianth* fragrant, white, nigrescent, patent in anthesis, *c.* 3 1/2–6 mm diam., segments ovate-oblong to elliptic, blunt, 1 1/3–3 by 1–2 mm, hardly longer than the stamens and pistil. *Stamens* white, filaments in bud sharply reflexed at the apex, in anthesis spreading. *Style* white, but split to various degree into 3 stigmatic arms, each with 1 (rarely 2) club-shaped or broad-elliptic stigmas. *Fruit* unknown.

Distr. Native of tropical S. America, introduced as an ornamental plant in many countries, in *Malaysia* in the plains: Java.

Ecol. According to BAILEY the underground parts are hardy. No fruit has ever been found and it can be propagated vegetatively by small tubercles found in the axils of the leaves. In Guatamala reported up to 2300 m.

Vern. *Madeira vine, mignonette vine*, Am.

Notes. Specimens from Java agree in detail with HOOKER's plate and that of BAILLON; there is no reason to believe that HOOKER's plate is erroneous, as suggested by HAUMAN (*l.c.* p. 350). *Cf.* fig. 2 l–m.

This species represents, as HAUMAN has rightly remarked, the commonly cultivated plant which has been generally confused with *B. baselloides* H.B.K. Nov. Gen. Sp. 7 (1825) 196, t. 645*bis* (type: coll. HUMBOLDT & BONPLAND 3390, P). For this reason TENORE described it as a new species which apparently contains the oldest epithet.

From the Paris Herbarium I could study the type of *B. baselloides* which I found to agree in all details with KUNTH's plate: the boat-shaped upper bracteoles bear a narrow wing on the lower keel-halves and they slightly exceed the tepals in length. The flowers in the type appear to me female with small barren anthers.

Originally the plant described by HOOKER and that by MIERS appeared to differ in the pistil but the latter's structure is rather variable as is shown in fig. 2 e–j.

2. Anredera scandens (L.) MOQ. in DC. Prod. 13, 2 (1849) 230; F.-VILL. Nov. App. (1880) 172; VIDAL, Phan. Cuming. Philip. (1885) 137; Rev. Pl. Vasc. Filip. (1886) 217; MERR. Fl. Man. (1912) 201; FAWC. & RENDLE, Fl. Jam. 3, 1 (1914) 174, f. 66; MERR. Sp. Blanc. (1918) 142; En. Philip. 2 (1923) 137; MACBRIDE, Field Mus. Nat. Hist. bot. ser. 13 (1937) 578; BACKER, Bekn. Fl. Java (em. ed.) 4a (1942) fam. 64, p. 2; QUIS. Med. Pl. Philip. (1951) 285.—*Polygonum scandens* LINNÉ, Sp. Pl. (1753) 364, *excl. syn.*—*Basella vesicaria* LAMK, Enc. 1 (1785) 382.—*A. spicata* GMEL. Syst. Nat. 2 (1791) 454; PERS. Syn. 1 (1805) 297; MERR. Govt Lab. Publ. Philip. *no* 6 (1904) 24.—*A. vesicaria* GAERTN. Fruct. 3 (1807) 176, t. 213; WILSON, N. Am. Fl. 21 (1932) 337.—*Boussingaultia baselloides* (*non* H.B.K.) F.-VILL. Nov. App. (1880) 172; MERR. Govt Lab. Publ. Philip. *no* 6 (1904) 24.—*Gomphrena volubilis* BLANCO, Fl. Filip. (1837) 199, ed. 2 (1845) 140, ed. 3, 1 (1877) 252.—*A. cumingii* HASSK. Flora 48 (1865) 401. —**Fig. 2n.**

Stems slender, green or purplish, 1–5 m; with large tuberous roots. *Leaves* ovate to ovate-oblong, obtuse to short-acuminate, thin-fleshy, shining, 1 1/2–8 1/2 by 1–6 cm. *Racemes* rich-flowered, usually simple or with 2–3 branches, 5–50 cm, erect or hanging with ascending apex, rhachis rather strong. Bracts ovate-lanceolate, very acute, 3–5 mm, caducous. Pedicels persistent, 1 1/2–2 mm, with thickened apex. Lower pair of bracteoles ovate-triangular, acute, caducous. Upper pair of bracteoles boat-shaped, broadly winged on the back, greenish-white, incl. the wings in anthesis 2–2 1/2 mm, accrescent to 3–3 1/2 mm, with semi-cordate wing-bases, enclosing the corolla and later the fruit. *Perianth* greenish-white, 2 1/4–2 1/2 mm long, thin, hyaline, little opening in anthesis, not accrescent. Styles 3, white, connate at the base. Utricle ovoid to globose. *Seed* not seen.

Distr. Native of tropical America from Texas to Peru, in *Malaysia* an early introduction by the Spaniards and thoroughly naturalized previous to 1837, as BLANCO notes that it was then common in Parañaque, now common about Manila (Laguña, Cavite, Nueva Ecija, Rizal, Pasay, Batañgas), in 1922 imported from Manila to Pasuruan (E. Java) as an ornamental but not yet naturalized; *fl.* Aug.–Nov.. In Malaysia it does not produce seed.

Ecol. A lowland ornamental which apparently needs a dry season for its maintenance, badly growing in the everwet climate of Bogor; in Guatamala reported between 400 and 1300 m.

Uses. In the Tagalog regions the tuberous roots are used as topicals to hasten ripening of boils.

Vern. *Malabató, olibato*, Tag.

Notes. LINNAEUS added a number of early references to his description of *Polygonum scandens* which belong in part to a *Polygonum*; the species was typified by FAWCETT & RENDLE with the type in the Linnean Herbarium.

DICHAPETALACEAE (P. W. Leenhouts, Leyden)

1. DICHAPETALUM

THOU. Gen. Nov. Madagasc. (1808) 23; LEENH. Reinwardtia 4 (1956) 75.—*Chailletia* DC. Ann. Mus. Hist. Nat. Paris 17 (1811) 153.—*Moacurra* ROXB. [Hort. Beng. (1814) 21, *nomen*] Fl. Ind. 2 (1832) 69.—*Quilesia* BLANCO, Fl. Filip. (1837) 177.—*Pentastira* RIDL. Trans. Linn. Soc. Bot. II, 9 (1916) 27.—**Fig. 1–3.**

Monoecious or dioecious trees, (often scrambling) shrubs, or lianas. Twigs and bark rather tough; medullary rays in twigs many, distinct; pith rather small, usually dark-coloured and often disappearing early; wood rather hard. *Stipules* narrowly triangular to subulate, sometimes rather early caducous. *Leaves* spirally arranged but usually pseudo-distichous, short-petioled, pinnatinerved; margin entire, thickened by a nerve; orbicular flat glands nearly always present on the surface of the leaf, mostly beneath in the basal part; base not rarely slightly inequilateral. Growth mode: apparently mostly in flushes. *Inflorescences* axillary (sometimes pseudo-terminal on leafless axillary shoots), dichotomously branched or glomerulous, sometimes reduced to 2 or 1 flower(s); lower forks with 1 transverse bractlet. *Pedicels* articulated near the apex. *Flowers* small, 5-merous, bi- or unisexual, in Mal. *spp.* hypo- or only slightly epigynous. *Sepals* ovate, imbricate, slightly confluent at the base, usually pubescent on either side. *Petals* (in Mal. *spp.*) free, more or less spathulate, bifid to emarginate, creamy to white when fresh, dark when dried. *Stamens* 5, episepalous, (in Mal. *spp.*) free; anthers introrse, opening by a longitudinal slit; connective strongly thickened. *Disk* consisting of 5 intrastaminal, epipetalous lobes. *Pistil* 2- or 3-merous; styles free or more or less connate; ovules 2 per cell, apical, pendent, anatropous, only one developing into a seed. *Drupe* usually tomentose, more or less lobed, in Mal. *spp.* orange or yellow when fresh; pericarp thin, fleshy, the angles usually with distinct sutures apparently indehiscent; endocarp crustaceous; stones 1–3, 1-seeded, often faintly united. *Seeds* exalbuminous; cotyledons fleshy, planoconvex.

Distribution. The family *Dichapetalaceae* comprises 4 nearly exclusively tropical genera. Three of them, with *c.* 20 *spp.* are confined to South America & Africa. *Dichapetalum* itself is much larger and is distributed throughout the tropical zone (Polynesia and Micronesia excepted). Its main centre of speciation is Africa, to which three of its four sections are confined.

All Malaysian *spp.* belong to the fourth *sect. Dichapetalum* (*sect. Eu-Dichapetalum* ENGL. Bot. Jahrb. 23, 1896, 133).

About 200 *spp.* have been described in the genus, most of them local endemics in Africa; it has appeared that in the past specific limits have frequently been drawn too narrow and that a considerable number will have to be reduced. In this I have come to a similar conclusion for Malaysia as suggested by HAUMAN for Africa (Bull. Jard. Bot. Brux. 25, 1955, 339).

Ecology. The Malaysian species are mostly confined to the substage of the rain-forest, ascending to *c.* 1800 m altitude. Only one species (*D. timoriense*) is growing in part of its area under semi-arid (seasonal) climatic conditions in SE. Java and the Lesser Sunda Islands.

None of the species plays a predominant role in the forest vegetation and as a matter of fact the genus is on the whole inconspicuous and scarce. No data worthy of note are available on pollination or dispersal.

In most species the 'lobes' of the drupes show a marked marginal lengthwise 'suture' suggesting a line of dehiscence; however, no dehiscence has been observed.

Wood anatomy. See under Taxonomy.

Uses. No useful plants of any repute are among Malaysian *Dichapetalum*. In Africa some species are very poisonous by a most remarkable toxic compound (acetic fluor, $CH_2F\,COOH$), unique in the plant kingdom. See R. PETERS (Endeavour 13, 1954, 147).

Taxonomy. There is no unanimity of opinion about the taxonomic place of the family. Numerous authors (BENTHAM & HOOKER, VAN TIEGHEM, HALLIER *f.*, and HUTCHINSON) arrange it in the affinity of *Rosaceae*. ENGLER, BAILLON, and VON WETTSTEIN plead for its affinity with the *Euphorbiaceae* which is also accepted here.

This opinion is strengthened by the pollen structure which ERDTMAN 'finds rather similar for instance with that in several *Euphorbiaceae*' (Pollenmorph. & Tax. 1950, 146).

HEIMSCH (Lilloa 8, 1942, 186) considers that the wood anatomy indicates a position either near to the *Tremandraceae*, *Polygalaceae* and *Trigoniaceae*, or near to the *Euphorbiaceae*. CHALK in Metcalfe and Chalk (1950) refrains from expressing an opinion because of the scanty anatomical evidence available. The affinities of the family probably could be better established by studying the elements of the ground tissue with respect to their identification as fibre tracheids or libriform fibres (*cf.* REINDERS, Handl. 1951, 142–147; English ed. in preparation).—C.A.R.-G.

Specific delimitation has in some cases appeared to be difficult through a few rather common and widely distributed species (specially *D. gelonioides* and *D. timoriense*), which have produced a number of more or less distinct, local partial populations which differ rather conspicuously in vegetative characters. Besides, some important characters as uni- or bisexual flowers and 2- or 3-merous pistil appear not to be constant specific characters in all species and not even in one homogeneous partial population. Another difficulty with the Malaysian material is that of several dioecious species only material of one sex has hitherto been collected.

The most reliable taxonomic characters have been found in the size and shape of the inflorescences and in the structure of the fruit; the nervation is in several species characteristic but difficult to circumscribe. In several species vegetative characters have proved very variable. Except in a few cases the flowers have not yielded valuable features.

The construction of the key to the species has been particularly difficult. It has been found unsatisfactory to base a key on flowering and one on fruiting material. The key offered here has been framed in making use of both flowering and fruiting and of vegetative characters. It will not be found possible to find with it at once a name for any random flowering or incomplete specimen.

Notes. In the herbaria specially sterile material has often preliminarily been referred to *Euphorbiaceae* and there appears also to be a likeness with *Flacourtiaceae* and *Connaraceae*. Collectors are urgently requested to collect in the field as complete material as possible; it is desirable to have ♂ and ♀ flowers and fruits; the latter are specially important.

Thanks are due to Dr J. G. B. BEUMÉE, Wageningen, who has put MS notes on Malaysian *Dichapetalum* at my disposal.

KEY TO THE SPECIES

1. At least the young branches, petiole, and base of the leaf beneath shaggy pilose.

  2. Monoecious. Branches dark-coloured. Nerves 9–16 pairs. Fruits $3^{1}/_{2}$–4 cm long, shaggy ferrugineous-pilose . . . . **8. D. griffithii**

  2. Dioecious. Branches often light-coloured. Nerves 5–11 pairs. Fruits up to 2 cm long, fulvous velvety pubescent.

    3. Branches purple-brown. Leaves up to *c.* 12 cm long, dark-brown when dry (*D. ciliatum*). **6. D. tricapsulare**

    3. Branches greyish- or yellowish-brown, very rarely dark-brown. Leaves 10–20 cm long, green when dry.

      4. Leaves narrowly elliptic ($2^{1}/_{2}$–3 times as long as wide). Inflorescences glomerulous. Disk-lobes nail-shaped, the upper part thickened and tuberculate. Pistil 2–3-merous. Fruits $1^{1}/_{4}$ by $1^{1}/_{2}$ cm, faintly emarginate at the apex . . . . **10. D. steenisii**

      4. Leaves broad-elliptic (*c.* 2 times as long as wide). Inflorescences short-stalked. Disk-lobes quadrangular. Pistil 2-merous. Fruits $1^{3}/_{4}$–2 by 2–$2^{1}/_{2}$ cm, deeply emarginate at the apex. **9. D. setosum**

1. Branches sericeous, tomentose, velutinous or (sub) glabrous.

  5. Leaves 16–22 cm, very thin, in the living state the parenchyma convex between the main nerves, in the dry state irregularly corrugated with the nerves shallowly sunken. Plant ± glabrous. **7. D. tenuifolium**

  5. Leaves otherwise.

    6. Leaves elliptic-lanceolate, *c.* 4 times as long as wide, up to 14 cm long (rarely some of the leaves slightly broader). Fruits more or less pubescent, sutures distinct . . . . **6. D. tricapsulare**

    6. Leaves usually 2–3 times as long as wide (if *c.* 4 times as long as wide, then leaves often more than 14 cm long, and either fruits otherwise, or inflorescences distinctly branched and stalked).

      7. Branches fully glabrous, even when young, black. Receptacle of the flowers slightly hollowed. Leaves (dark) brown or dark olive-green when dry; nerves rather inconspicuous, distinctly interarching . . . . **13. D. laurocerasus**

      7. Branches more or less pubescent, at least when young. Receptacle of the flowers not hollowed. (In some specimens of *D. papuanum* the branches are fully glabrous; then the leaves are greyish green, and only the apical nerves are distinctly interarching.)

        8. Inflorescences glomerulous, (sub) sessile (sometimes short-stalked or together on leafless axillary shoots with scale-like bracts!) or flowers solitary; fruits usually solitary on a short pedicel.

          9. Flowers 1 or 2 in one leaf-axil.

            10. Pedicel rather long; flowers solitary. Pistil 2-merous. Fruits 2-lobed, 1–$1^{1}/_{4}$ cm long, with distinct sutures . . . . **15. D. tenerum**

10. Flowers subsessile, 1–2 in one leaf-axil. Pistil 3-merous. Fruits suborbicular, rounded or blunt-triangular in section, 3 cm long, without sutures . . . . **14. D. sessiliflorum**
9. Flowers together in few- to many-flowered inflorescences (fruits often solitary!).
11. Glands usually on the upper side of the leaf; lower side shining dark purple-brown when dry, the nerves ferrugineous-tomentose. Flowers without disk . . . . . . **2. D. sordidum**
11. Glands exclusively on the lower side of the leaf. Flowers with disk.
12. Monoecious. Petals twice as long as sepals. Branches often blunt-quadrangular. Fruits 1½–2½ cm, smooth, suture not distinct . . . . **11. D. longipetalum**
12. Dioecious. Petals as long as the sepals or only slightly longer. Branches terete. Fruits up to 1½ cm long, always with distinct sutures . . . . **5. D. gelonioides**
8. Inflorescences distinctly branched, stalked (peduncle, or, if peduncle very short, the two main branches, at least half as long as the total inflorescence); infructescences usually branched and with some to many fruits.
13. Fruits globular, tomentose, without sutures. Inflorescences usually 5–7 cm long, repeatedly branched, many-flowered, densely tomentose . . . . **1. D. timoriense**
13. Fruits lobed, with distinct sutures.
14. Fruits glabrous with the exception of very few appressed hairs, sutures narrow. **3. D. papuanum**
14. Fruits tomentose, sutures conspicuous.
15. Pistil 2-merous.
16. Style 1, more or less deeply cleft. Nervation very conspicuous . . **5. D. gelonioides**
16. Styles 2. Nervation rather inconspicuous . . . . **12. D. helferianum**
15. Pistil 3-merous (if fruits 1- or 2-celled, remains of a 2nd and/or 3rd cell are always present).
17. Branches early glabrescent, greyish-brown. Leaves glabrous above, nearly glabrous beneath, rather large (15–22 by 5–11 cm) . . . . **4. D. platyphyllum**
17. Branches minutely tomentose, gradually glabrescent, dark (purple-)brown. Leaves tomentose on midrib and nerves above, on midrib, nerves, and veins beneath, rather small (6–12 by 3–5 cm) . . . . **2. D. sordidum**

1. Dichapetalum timoriense (DC.) BOERL. Handl. 1 (1890) 199; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 348; HOCHR. Pl. Bog. Exs. (1904) 17; BACK. Schoolfl. (1911) 219; KOORD. Exk. Fl. Java 2 (1912) 454; MERR. En. Philip. 2 (1923) 389; HEYNE, Nutt. Pl. (1927) 902; MEEUSE in BACK. Bekn. Fl. Java (em. ed.) 4c (1943) fam. 117, p. 1; LEENHOUTS, Reinw. 6 (1954) 78.—*Scrotum cussi* RUMPH. Herb. Amb., Auct. (1755) 59, t. 26, f. 2; MERR. Int. Rumph. (1917) 510; HEYNE, Nutt. Pl. (1927) 902; *cf.* STEEN. Bull. Jard. Bot. Btzg 18 (1950) 458. —*Chailletia timoriensis* DC. Prod. 2 (1825) 57; DECNE, Nouv. Ann. Mus. Hist. Nat. 3 (1834) 478; MIQ. Fl. Ind. Bat. 1, 1 (1855) 637; BECC. Malesia 1 (1877) 176.—*Quilesia sericea* BLANCO, Fl. Filip. (1837) 177; ed. 2 (1845) 125; ed. 3, 1 (1877) 224; MIQ. Fl. Ind. Bat. 1, 1 (1857) 788.—*Villaresia scandens* HASSK. Nat. Tijd. N.I. 10 (1856) 152; WALP. Ann. 4 (1857) 431; MIQ. Fl. Ind. Bat. 1, 2 (1859) 595.—*Chailletia benthamiana* TURCZ. Bull. Soc. Nat. Mosc. 36, 1 (1863) 610.—*Chailletia deflexifolia* TURCZ. Bull. Soc. Nat. Mosc. 36, 1 (1863) 611; HOOK. *f.* Fl. Br. Ind. 1 (1875) 571, *incl. var. tomentosa*; KING, J. As. Soc. Beng. 64, ii (1895) 94; RIDL. Fl. Mal. Pen. 1 (1922) 418. —*Chailletia griffithii* (*non* HOOK. *f.*) F.-VILL. Nov. App. (1880) 45 (*cf.* MERR. En. Philip. 2, 1923, 388, *sub. D. sericeum*).—*D. deflexifolium* BOERL. Handl. 1 (1890) 199; KOORD. Exk. Fl. Java 2 (1912) 454; BURK. Dict. 1 (1935) 803.—*D. scandens* BOERL. Handl. 1 (1890) 199, *non* JOHNSTON, J. Arn. Arb. 16 (1935) 44 *quae est D. vestitum* BAILL. *var. scandens* BAILL.—? *Chailletia hookeri* KING, J. As. Soc. Beng. 64, ii (1895) 91; RIDL. Fl. Mal. Pen. 1 (1922) 418.—*D. benthamianum* (TURCZ.) ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 348, *non D. benthamianum* (F. DIEDR.) ENGL. (1896), *sphalm.* = *Chailletia benthamii* F. DIEDR. = *D. benthamii* DE WILD., 1919.—*D. malaccense* ENGL. Bot. Jahrb. 23 (1896) 143.—*Chailletia beccariana* STAPF *ex* KING, J. As. Soc. Beng. 65, ii (1896) 516.—?*Chailletia tesselata* KING, J. As. Soc. Beng. 65, ii (1896) 515; RIDL. Fl. Mal. Pen. 1 (1922) 416; CRAIB, Fl. Siam. En. 1 (1931) 268.—*D. tesselatum* F. N. WILLIAMS, Bull. Herb. Boiss. II, 5 (1905) 219.—*D. luzoniense* MERR. & ROLFE, Philip. J. Sc. 3 (1908) Bot. 106; MERR. En. Philip. 2 (1923) 388.—*D. submaritimum* ELM. Leafl. Philip. Bot. 4 (1912) 1493; MERR. En. Philip. 2 (1923) 389.—*D. schlechteri* KRAUSE, Bot. Jahrb. 49 (1912) 168.—*D. novo-guineense* KRAUSE, Bot. Jahrb. 49 (1912) 169.—*D. robinsonii* MERR. Philip. J. Sc. 7 (1912) Bot. 280; En. Philip. 2 (1923) 388.—*D. olivaceum* ELM. Leafl. Philip. Bot. 5 (1913) 1769.—*D. sericeum* MERR. Sp. Blanc. (1918) 215; En. Philip. 2 (1923) 388.—*D. nitidum* MERR. Philip. J. Sc. 17 (1921) 270; En. Philip. 2 (1923) 388.—*D. longistipulaceum* KRAUSE, Bot. Jahrb. 62 (1929) 342.—?*D. peekelii* KRAUSE, Bot. Jahrb. 62 (1929) 342.—*D. missionum* KRAUSE, Bot. Jahrb. 62 (1929) 344.—*D. validum* KRAUSE, Bot. Jahrb. 62 (1929) 344.—*D. maluense* KRAUSE, Bot. Jahrb. 62 (1929) 345.—*D. venulosum* C. T. WHITE, J. Arn. Arb. 10 (1929) 229.—*D. beccarianum* STAPF *ex* RIDL. Kew Bull. (1930) 372.—**Fig. 1.**

Monoecious or dioecious climbing or creeping shrub, sometimes a small and slender tree up to 10 m; stem 3–5 cm diam. *Branchlets* glabrous or long remaining fulvous- or ferrugineous-tomentose, afterwards purple-brown to greyish. *Leaves* (oblong to) ovate to obovate, 7–18 by 3–10 cm, herbaceous to chartaceous (rarely subcoriaceous), pubescence variable, usually tomentose on midrib and nerves above, lower surface all over more or less densely pubescent, rarely fully glabrous;

glands (absent or) near the base, usually on the upper, sometimes on the lower surface of the leaf, rarely on both sides; base equilateral or oblique, acute to rounded, sometimes decurrent; margin revolute; apex usually abruptly acuminate, acumen short, cuneate, subacute, sometimes mucronate; nerves (5–)6–8(–12) pairs, usually rather distant, strongly curved, often distinctly interarching at some distance from the margin. *Inflorescences* repeatedly dichotomously branched, usually rather

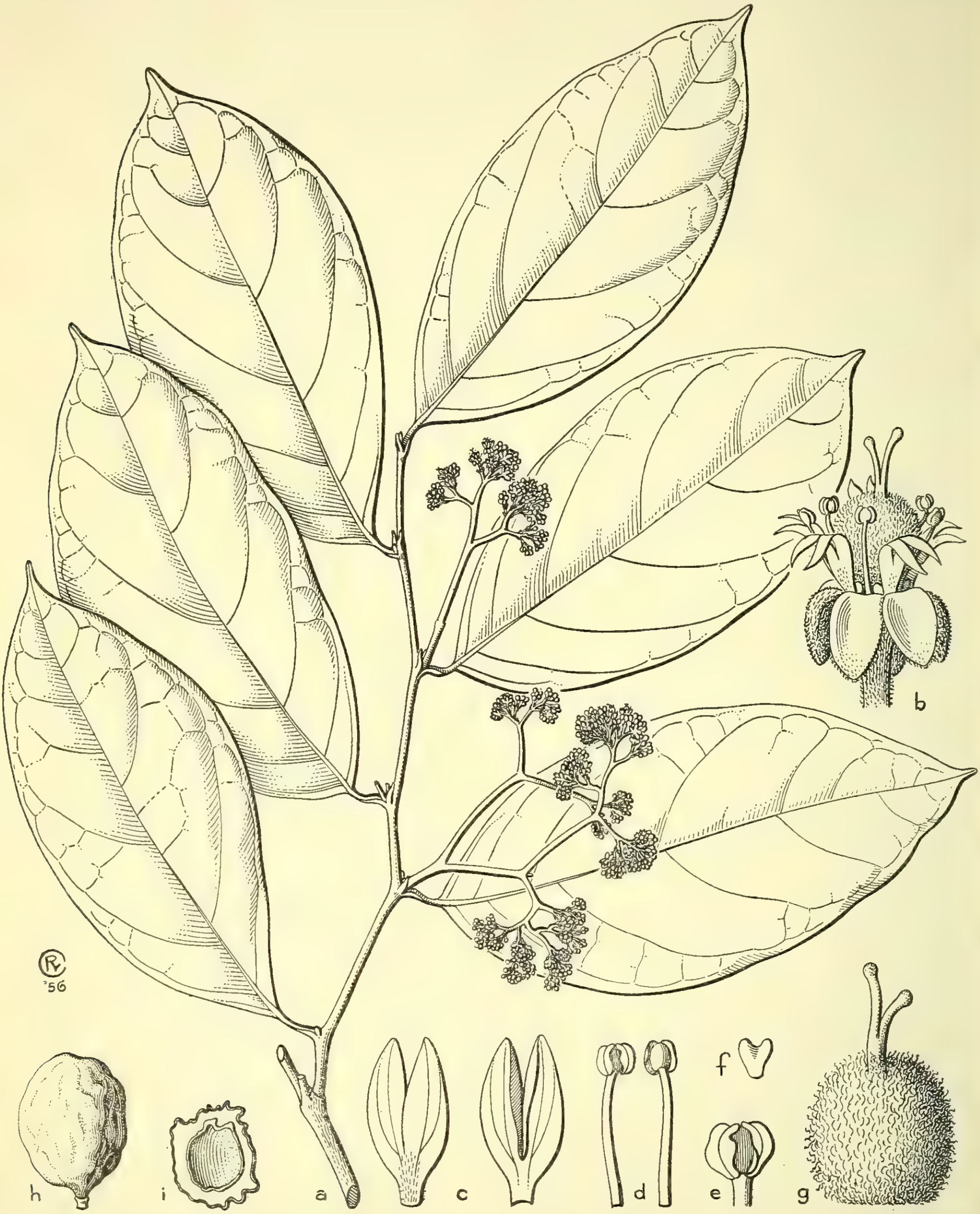

Fig. 1. *Dichapetalum timoriense* (DC.) BOERL.—*a*. Flowering twig, *b*. flower, *c*. petal from outside and inside respectively, *d*. stamen from inside and outside respectively, *e*. opened anther from inside, *f*. disk-lobe, *g*. pistil, *h*. fruit, *i*. *ditto*, cross-section (*a* × 2/3, *b* × 7, *c–d*, *f–g* × 10, *e* × 16, *h–i* nat. size; after VAN HASSELT *s.n.*, *h–i* HB 6701).

long-stalked, sometimes subsessile with 2 collateral small inflorescences in one axil, (1–)5–7(–10) cm long, many-flowered, densely tomentose. *Flowers* 2½–4 mm long, uni- or bisexual. *Petals* spathulate (to rhomboid), slightly to more than halfway incised, glabrous or more or less densely pilose outside, sometimes rather caducous. *Disk-lobes* usually *c.* ⅓ mm, 2-lobed, glabrous (rarely with some hairs), sometimes spathulate and up to 1 mm, not rarely absent. *Ovary* densely woolly pubescent, 2–3-celled; styles usually nearly entirely connate. *Fruits* 1–6, globular to ovoid or more or less pear-shaped or cordate, *c.* 1½–2½ cm diam., densely fulvous velvety pubescent, (golden-)brown when fresh; pericarp apparently thick and fleshy, without sutures; seeds 1–3.

Distr. Throughout *Malaysia* (the mainland of Sumatra excepted), dubious from Melanesia (New Britain and New Ireland).

Ecol. In primary and secondary forests, apparently preferably along the edges, on river-banks, *etc.*, 0–1800 m. *Fl.* Jan.–Dec. (in the Philippines mainly April–June); *fr.* Jan.–Dec.

Uses. In the Moluccas the fruits and young leaves are eaten and the young branches are used as ropes.

Vern. *Akar kachang-kachang, a. pah kudah, a. sarang punai, tugor pontianak akar*, Mal. Pen., *děrang dang* (or *das*) *aroi*, S, *loloikith*, Sumba, *akar lara*, E. Borneo; Philippines: *alibot-bot*, P. Bis., *ariskis*, Tagb., *dekdek*, Ilk.; *torang*, Ceram, *popolèr kussu*, Ambon, *buwah mulo*, Aru Isl., *daralac, wohota*, New Guinea (Morobe Distr.).

Notes. Extremely variable species, comprising a number of more or less distinct local races. Most distinctive are the relatively large, many-flowered, densely tomentose inflorescences, which are usually rather long-stalked; furthermore the mostly relatively broad and rather hairy leaves, and the relatively large, velvety pubescent fruits.

The identity of *D. tesselatum* and *D. hookeri* is not quite certain. The flowers of both and the inflorescences of *D. hookeri* are identical with those of *D. timoriense*; the former mainly differs by its small, dense clustered inflorescences and in its stiff-chartaceous, fully glabrous leaves, the latter by its oblong, stiff-chartaceous, nearly glabrous leaves with 10–12 pairs of nerves transverse to the midrib, faintly curved, and distinctly interarching.

According to the description, *D. peekelii*, from New Ireland, is very close or possibly identical. Unfortunately the type has been lost; a specimen (FLOYD NGF 6699 from New Britain) is very probably identical with *D. peekelii* but its conspecifity with *D. timoriense* is, however, not beyond all doubt.

The interpretation of RUMPHIUS's *Scrotum cussi* has been uncertain for a long time. HASSKARL (Abh. Naturf. Ges. Halle 9, 1866, 334) assumed it to be apocynaceous; MERR. *l.c.* cites it among the doubtful species; VAN STEENIS *l.c.* erroneously referred it to *Poikilospermum* (*Morac.*). I agree with (BACKER in) HEYNE that it represents *D. timoriense.*

2. Dichapetalum sordidum (RIDL.) LEENH. Reinw. 4 1956) 80.—*Chailletia deflexifolia* TURCZ. *var. sordida* HOOK. *f.* Fl. Br. Ind. 1 (1875) 571.—*Chailletia sordida* RIDL. Fl. Mal. Pen. 1 (1922) 418. —**Fig. 2i.**

Dioecious (possibly sometimes monoecious) shrub or small tree. *Branchlets* minutely fulvous-pubescent at the tips, afterwards glabrous, purple-(to greyish-)brown. *Leaves* (subobovate or) elliptic to oblong, 6–12 by 3–5 cm, chartaceous, dark purple-brown when dry, at least at the lower side, minutely yellowish-tomentose on midrib and nerves above, on midrib, nerves, and larger veins beneath; glands few, small, usually on the upper surface; base usually slightly oblique, acute to rounded; apex acute to shortly acute-acuminate; nervation slightly sunken above, prominent beneath, nerves 5–8 pairs, strongly curved, usually distinctly interarching. *Inflorescences* axillary, not rarely pseudo-terminal on leafless axillary shoots (sometimes truly terminal?), laxly glomerulous, densely ferrugineous-tomentose, many-flowered. *Flowers* 3 mm long. *Petals* oblong, rather abruptly rhomboid in the upper part, 3 mm long, ⅔ mm incised, the outer side with some long median hairs. *Disk* absent. *Ovary* woolly pubescent, 3-celled; style 1, 3-parted at the tip. *Fruits* 1(–2), broadly obovate, flattened, 2–1-lobed, 1½ by 2 cm, with a distinct suture on the margin, slightly warty, shortly velvety golden-brown pubescent, 2–1-seeded.

Distr. *Malaysia:* Malay Peninsula (Malacca, Johore, Singapore), Riouw Arch.

Ecol. Forest-edges at low altitudes. *Fl.* Sept.–Dec.; *fr.* Sept.–Jan.

Note. Related to *D. timoriense*; especially different in its fruit, by the flower-clusters, and by the shape of the petals. Best characterized by its rather small, elliptic leaves, which are dark purple-brown when dry, with the nerves yellowish tomentose.

3. Dichapetalum papuanum (BECC.) BOERL. Handl. 1 (1890) 199; ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 348; LEENH. Reinw. 4 (1956) 80.—?*Funis butonicus* RUMPH. Herb. Amb. 5 (1747) 77, t. 41, f. 1.—*Chailletia papuana* BECC. Malesia 1 (1877) 176.—*Pentastira flava* RIDL. Trans. Linn. Soc. Bot. 9 (1916) 27; SCHELLENBERG, Bot. Jahrb. 58 (1923) 158; SLEUM. in E. & P. Pfl. Fam. ed. 2, 20 b (1942) 392.—*Pentastira nitida* RIDL. *l.c.* 28; SCHELLENBERG, *l.c.*; SLEUM. *l.c.*—*D. moluccanum* MERR. Int. Rumph. (1917) 312.—*D. glabratum* KRAUSE, Bot. Jahrb. 62 (1929) 346.—*D. pullei* KRAUSE, Bot. Jahrb. 62 (1929) 346.—*D. grandifolium* RIDL. Kew Bull. (1930) 373.—*D. australianum* C. T. WHITE, Proc. R. Soc. Queensl. 53 (1942) 211.—**Fig. 2c.**

ssp. **papuanum.**—All synonyms except *D. grandifolium.*

Dioecious climbing shrub, sometimes treelet up to *c.* 8–10 m, or the basal part treelike, 2–3 m high, 3–4 cm diam. *Branchlets* (minutely pubescent to) glabrous, purple-brown. *Petioles* ¼–¾ cm, scattered-pilose, glabrescent. *Leaves* elliptic (sometimes slightly inequilateral), 9–17 by $3^{1}/_{2}$–$6^{1}/_{2}$ cm, stiff-herbaceous, glabrous (young leaves often scattered pilose on the nerves beneath); glands conspicuous, on the lower surface mainly near the base; base acute, slightly decurrent; apex gradually acuminate, acumen short, blunt; nerves 4–8 pairs, at distances (along the midrib) of $1^{1}/_{2}$–3 cm, strongly curved, only the apical ones distinctly interarching. *Inflorescences* $1^{1}/_{2}$–$2^{1}/_{2}$ cm long, short-stalked (sometimes dichotomously branched from the very base), rather laxly branched and many-flowered. *Flowers* 1 (♂)–2 (♀) mm long. *Petals* obovate, apex truncate to slightly emarginate, glabrous or the outer surface with some hairs near the base. *Disk-lobes* minute, 2-lobed, minutely tomentose. *Pistil* densely tomentose, in ♀ flowers the ovary 3-celled; styles 3, confluent at the base, or stigma subsessile, 3-lobed. *Fruits* 1–2, 3(–2)-lobed, obovate, $^{3}/_{4}$–$1^{3}/_{4}$ by 1–$1^{3}/_{4}$ cm, slightly warty and with a few scattered, short, appressed hairs; suture narrow.

Distr. N. Queensland, Solomon Isl., and *Malaysia:* New Guinea and Moluccas (Aru Isl., Ceram, Ambon).

Ecol. Primary and secondary rain- and monsoon-forests, from sea-level up to 1600 m. *Fl.* mainly Sept.–Jan., *fr.* mainly Nov.–March.

Notes. The identity of RUMPHIUS's *Funis butonicus* remains doubtful; especially the fruits are rather different from those of the present species. It is even possible that it belongs to quite another family.

This species is best characterized by its obovate, nearly glabrous fruits.

RIDLEY, in describing *Pentastira*, recorded the ovary as 1-celled; he had only ♂ flowers in hand in which the pistilloid is often hollow.

ssp. **borneense** LEENH. Reinw. 4 (1956) 81.—*D. grandifolium* RIDL.

Leaves 13–22 by $5^{1}/_{2}$–11 cm; nerves 7–10 pairs. Petioles $^{3}/_{4}$–$1^{1}/_{2}$ cm. Inflorescences 1–4 cm long, usually distinctly stalked. Flowers (♀ unknown) $5^{1}/_{2}$ mm; petals halfway incised. Infructescences and fruits unknown.

Distr. *Malaysia:* North Borneo.

Note. The taxonomical position of *D. grandifolium* remains somewhat uncertain. Vegetatively it is very close to *D. papuanum*; the inflorescences are only slightly coarser, the flowers are much larger, but otherwise similar. Fruiting material is desirable to settle its status.

4. Dichapetalum platyphyllum MERR. Philip. J. Sc. 30 (1926) 401; LEENH. Reinw. 4 (1956) 81.

?Dioecious, erect shrub, *c.* 1 m. *Branches* glabrous, greyish. *Leaves* (broad-)elliptic, 15–22 by 5–11 cm, thin-coriaceous, glabrous above, subglabrous beneath; glands few, very small, on the lower surface; base acute, decurrent; apex subabruptly acuminate, acumen short, broad, blunt to acute; nerves *c.* 7 pairs, straight to faintly curved, more or less distinctly interarching near the margin. *Inflorescences* 1–4 cm long, shortly stalked, densely fulvous tomentose, with *c.* 10–20 flowers. *Flowers* known only in bud and from remains under the fruit. *Calyx c.* 3 mm, densely fulvous-tomentose outside. *Petals* slightly emarginate, glabrous. *Infructescences c.* $1^{1}/_{2}$ cm, sparsely pilose, with up to 4 fruits. *Fruits* (young) (2–)3-lobed, 1 by 1 cm, the lobes obovate, more or less densely fulvous-tomentose, probably more or less glabrescent; sutures distinct.

Distr. *Malaysia:* Philippines (Leyte, Sulu Isl.).

Ecol. Damp forests at low altitude. *Fl.* July–Aug.

Note. Apparently close to *D. gelonioides* from which it differs, however, by its 3-merous fruits.

5. Dichapetalum gelonioides (ROXB.) ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 348; RIDL. Kew Bull. (1930) 372; LEENH. Reinw. 4 (1956) 81.—*Moacurra gelonioides* ROXB. [Hort. Beng. (1814) 21, *nomen*] Fl. Ind. 2 (1832) 69; LINDLEY, Veg. Kingdom (1846) f. 345^{1-8}; BAILL. Étud. Euphorb. (1858) 587; DALZ. & GIBS. Bombay Fl. (1861) 52; THWAITES, Enum. (1864) 79, *incl.* also *var.* β; MUELL. ARG. in DC. Prod. 15, 2 (1866) 227.—*Celastrus ?acuminatus* WALL. Cat. (1831) *no* 4342, *nomen, pro min. part., part. alt.* = *Drypetes sp.* (G), *non* LINNÉ *f.* 1781, *nec* RAFIN. 1838.—?*Elaeocarpus ?integrifolius* (*non* LAMK) BLANCO, Fl. Filip. ed. 2 (1845) 306; ed. 3, 2 (1878) 202.—*Chailletia sumatrana* MIQ. Sum. (1861) 328; TRIM. Fl. Ceyl. 1 (1893) 254.—*Chailletia gelonioides* BEDD. Fl. Sylv. 3 (1871) 59, t. 9 f. 1; HOOK. *f.* Fl. Br. Ind. 1 (1875) 570; KURZ, Fl. Burm. 1 (1877) 230; F.-VILL. Nov. App. (1880) 45; BRANDIS, Ind. Trees (1906) 146; TALBOT, Fl. Bombay 1 (1909) 253.—*D. sumatranum* BOERL. Handl. 1 (1890) 199.—*Chailletia andamanica* KING, J. As. Soc. Beng. 64, ii (1895) 93.—*D. andamanicum* ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 348.—*Ellipanthus scortechinii* KING, J. As. Soc. Beng. 66, ii (1897) 8; RIDL. Fl. Mal. Pen. 1 (1922) 548.—*D. monospermum* MERR. Govt Lab. Publ. *no* 35 (1906) 34; PELLEGRIN in Fl. Gén .I.-C. 1 (1911) 798; MERR. En. Philip. 2 (1923) 388.—*D. holopetalum* MERR. Philip. J. Sc. 17 (1921) 271, *non* RUHL. (1904); En. Philip. 2 (1923) 388.—*D. euphlebium* MERR. Philip. J. Sc. 20 (1922) 394; En. Philip. 2 (1923) 388.—*D. kerrii* CRAIB, Kew Bull. (1926) 346.—*D. borneense* MERR. Pl. Elm. Born. (1929) 138.—*D. ciliatum* (*non* MERR.) MERR. Pl. Elm. Born. (1929) 138. —*D. howii* MERR. & CHUN, Sunyatsenia 2 (1935) 256, f. 28; LEENH. Reinw. 4 (1956) 87.—*D. tenuifolium* (*non* ENGL.) SCHELLENB. Pfl. R. Heft 103 (1938) 189.—*D. gagnepainii* PELLEGRIN, Bull. Soc. Bot. France 91 (1945) 180; in Fl. Gén. I.-C. Suppl. 1 (1948) 729.—**Fig. 2g–g′.**

Dioecious tree up to 20–25 m by 20 cm, or (climbing or creeping) shrub or liana. *Branchlets* scattered shortly pubescent, soon glabrescent, grey to purple-brown, usually with many small, orbicular, white lenticels. *Leaves* rather variable in size and shape, elliptic, 6–16 by 2–6 cm, (herbaceous to) thin-chartaceous, (sub)glabrous (only in *ssp. pilosum* slightly more hairy); glands few, usually only beneath near the base; base slightly oblique, acute (to rounded), usually decurrent; apex gradually long-acuminate, acumen blunt to acute, often mucronulate; nervation often slightly sunken above, distinctly prominent beneath; nerves 6–10 pairs, distant, angle acute, strongly curved, more or less distinctly interarching near the margin. *Inflorescences* axillary (sometimes some to many on axillary shoots with early caducous leaves and then pseudo-paniculate), glomerulous, $\frac{3}{4}$–1 cm (rarely more lax and $1\frac{1}{2}$–2 cm long), *c.* 7–10-flowered, minutely pubescent. *Flowers* $2\frac{1}{2}$–3 mm. *Petals* broadly spathulate, slightly emarginate (up to $\frac{1}{4}$ of their length) to nearly entire. *Disk-lobes* $\frac{1}{4}$–$\frac{3}{4}$ mm, rounded to cordate, glabrous to minutely pubescent. *Ovary* in ♀ flowers densely fulvous-velvety pubescent, 2-celled (very rarely 3-celled), in ♂ flowers densely white woolly pubescent; style 1, more or less deeply cleft. *Fruits* usually 1 (in *ssp. pilosum* often 5–6, glomerulous), 1(–2)-lobed, lobes bean-shaped, 1–$1\frac{1}{2}$ cm long, usually densely shortly fulvous-tomentose, suture broad very distinct; stone tuberculate.

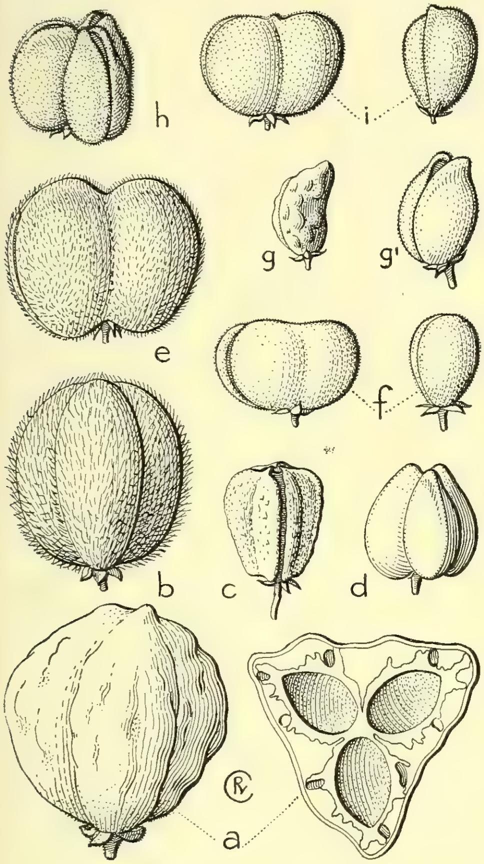

Fig. 2. Different fruit forms in Malaysian *Dichapetalum.—a. D. sessiliflorum* Leenh., with cross-section, *b. D. griffithii* (Hook. *f.*) Engl., *c. D. papuanum* (Becc.) Boerl. *ssp. papuanum, d. D. tenuifolium* (King) Engl., *e. D. setosum* Leenh., *f. D. helferianum* (Kurz) Pierre, left with 2, right with 1 cell developed, *g. D. gelonioides* (Roxb.) Engl. *ssp. tuberculatum* Leenh., *g'. ditto ssp. sumatranum* (Miq.) Leenh., *h. D. steenisii* Leenh. *ssp. celebicum* Leenh., *i. D. sordidum* (Hook. *f.*) Leenh., left with 2, right with 1 developed cell (all natural size; *a* Carr 13487, *b* Kep 7419, *c* Carr 14938, *d* Wray 3304, *e* Clemens 21803, *f* Curtis 1687, *g* Pierre 4000, *g'* Kostermans 5472, *h* Elbert 3215, *i* Teysmann HB 6702).

Distr. From the Deccan & Ceylon to Yunnan, Hainan, and the Andamans, in *Malaysia:* Sumatra, Malay Peninsula, Borneo, and the Philippines.

Ecol. In primary and secondary forests at low to medium altitudes (up to 1500 m). *Fl.* and *fr.* probably Jan.–Dec.

KEY TO THE SUBSPECIES

1. Leaves distinctly obovate. *ssp.* **andamanicum**
1. Leaves elliptic (sometimes ovate).
  2. Leaves scattered soft-hairy, especially on the nerves beneath . . . . . *ssp.* **pilosum**
  2. Leaves (nearly)glabrous.
    3. Leaves small, up to 9 by $3\frac{1}{2}$ cm; nervation sunken above, strongly prominent beneath. Inflorescences often slightly more lax. *ssp.* **sumatranum**
    3. Leaves larger, usually 12 by 3 cm or more; nervation not or very slightly sunken above, less prominent beneath. Inflorescences glomerulous.
      4. Fruits tuberculate, subglabrescent. *ssp.* **tuberculatum**
      4. Fruits smooth, densely pilose. *ssp.* **gelonioides**

ssp. **gelonioides.**—*Celastrus ?acuminatus* Wall. —*D. kerrii* Craib.

Small tree, up to 10 m high, or shrub. Leaves elliptic, acute at base, apex caudate; dull greyish-green when dry. Fruits usually 1-lobed, smooth, densely fulvous-tomentose.

Distr. S. Deccan, Ceylon, Bengal, Assam, Burma, Yunnan, Upper Siam, and *Malaysia:* Sumatra (Simalur and E. coast).

Vern. *Tutun awang buluk*, Simalur, *bolon doctan, kaju si lambok*, Sum. E. coast.

ssp. **tuberculatum** Leenh. Reinw. 4 (1956) 82.—*?Elaeocarpus ?integrifolius* (*non* Lamk) Blanco. —*Ellipanthis scortechinii* King.—*D. monospermum* Merr.—*D. tenuifolium* (*non* Engl.) Schellenb. —*D. gagnepainii* Pellegrin.—**Fig. 2g.**

(Shrub-like) tree. Leaves as in *ssp. gelonioides*, greyish-green (Philippine & Bornean specimens) to brown (Malayan specimens) when dry. Fruits 1-(very rarely 2-)lobed, tuberculate, subglabrous.

Distr. Indo-China (S. Annam and Cochin-China), Lower Siam, and *Malaysia:* Malay Peninsula, North Borneo, and the Philippines (Mindanao excluded).

Vern. Philippines: *bagakolon, makahaboy*, P. Bis., *buta-buta, porotpot*, Tagb.

Note. In the other subspecies the endocarp is also tuberculate, but in *ssp. tuberculatum* the pericarp is apparently much thinner and distinctly less hairy.

ssp. **andamanicum** (KING) LEENH. Reinw. 4 (1956) 83.—*Chailletia andamanica* KING.

Leaves very shortly petioled, rather small (up to *c.* 10 by 4 cm), distinctly obovate, yellowish-green when dry; apex short and blunt; nerves more transverse. Fruits usually 2-lobed, otherwise as in *ssp. gelonioides.*

Distr. S. Andaman.

ssp. **sumatranum** (MIQ.) LEENH. Reinw. 4 (1956) 82.—*Chailletia sumatrana* MIQ.—*D. borneense* MERR.—**Fig. 2g′.**

Tree, erect or climbing shrub, or liana. *Leaves* rather small (*c.* 6–7 by 2–3 cm), long-petioled, greyish-green (Sumatra) to brown (Borneo) when dry; nerves 5–8 pairs, distinctly sunken above, strongly prominent beneath. Inflorescences often slightly more lax, 1–2 cm. Fruits 1(–2)-lobed, otherwise as in *ssp. gelonioides.*

Distr. *Malaysia:* Sumatra, Borneo, Mindanao.

Vern. *Akar-barak,* Sum., *vingol,* N. Born.

Note. The specimens from Sum. E. Coast are slightly different; the leaves are larger, and pubescent on the nerves, the inflorescences are more lax and up to 2 cm long.

ssp. **pilosum** LEENH. Reinw. 4 (1956) 82.—*D. holopetalum* MERR.—*D. euphlebium* MERR.—*D. ciliatum* (*non* MERR.) MERR.

Liana, not rarely tree or shrub. Leaves herbaceous, bright-green when dry, scattered pilose on the base of the midrib above, along the margin, and on the nerves and veins beneath; venation more conspicuous than in the other subspecies. Fruits in glomerules, 1–2-lobed, more globular than in the other subspecies, faintly tuberculate, densely minutely fulvous pubescent, more or less glabrescent.

Distr. *Malaysia:* N. and E. Borneo, Mindanao.

Vern. *Angar-angar, anjaruba ambok, sari panggil,* Borneo.

Notes. The species as a whole is much less variable than is *D. timoriense*; in contradistinction to the latter species, however, the boundaries between the local races are more clear.

The identity of *Elaeocarpus ?integrifolius* (*non* LAMK) BLANCO is not entirely certain. The present reduction was proposed already by F.-VILLAR, *l.c.*; MERRILL (Sp. Blanc. 1918, 237) was convinced of the identity of this species with *Urandra luzoniensis* (*Icac.*). BLANCO's description of the flowers is very imperfect indeed; the description of the leaves holds better for *Dichapetalum* than for *Urandra* (especially as BLANCO says 'folia brevissimèque petiolata', which does not hold at all for *Urandra,* but fits very well for *Dichapetalum*).

Specially in *ssp. gelonioides* the inflorescences are sometimes inserted on axillary shoots with very caducous leaves; such inflorescences make at first sight the impression of being narrowly paniculate.

The species as a whole is best characterized by its fruits, which are either densely, minutely fulvous-tomentose and with very conspicuous suture, or subglabrous and strongly warty; moreover, especially in *ssp. gelonioides, tuberculatum,* and *sumatranum,* by its leaves, which are rather slender and tapering at both ends; the few, strongly curved and rather conspicuous nerves are also characteristic.

6. Dichapetalum tricapsulare (BLANCO) MERR. Publ. Gov.Lab. Philip. *no* 35 (1906) 35; Sp. Blanc. (1918) 215; En. Philip. 2 (1923) 389; LEENH. Reinw. 4 (1956) 83.—*Riana tricapsularis* BLANCO, Fl. Filip. (1837) 850; ed. 2 (1845) 126; ed. 3, 1 (1877) 225.—*Chailletia helferiana* (*non* KURZ) F.-VILL. Nov. App. (1880) 45.—*D. glabrum* ELM. Leafl. Philip. Bot. 2 (1908) 483; MERR. En. Philip. 2 (1923) 388.—*D. ciliatum* MERR. Philip. J. Sc. 7 (1912) Bot. 279; En. Philip. 2 (1923) 387; *non* Pl. Elm. Born. (1929) 138 (= *D. gelonioides ssp. pilosum*).—*D. oblongifolium* MERR. Philip. J. Sc. 17 (1921) 271; En. Philip. 2 (1923) 388.

Dioecious small tree (4–5 m by 4–5 cm), lax shrub (up to 3 m) or liana. *Branchlets* densely fulvous-tomentose (sometimes rather shaggy) to glabrous, purple-brown. *Leaves* (elliptic to) lanceolate, (8–)10–14 by 1½–3(–5) cm, pubescent on both sides, especially beneath, and along the margin; glands few, small, on the lower surface near the base; base slightly oblique, acute to rounded; apex usually long tapering, blunt, mucronate; nerves 6–10 pairs, strongly curved, the apical ones distinctly interarching; intermediate veins distinctly developed. *Inflorescences* glomerulous, ½–1 cm long, with *c.* 5 flowers, shaggy pilose. *Flowers* (♀ unknown) 4 mm. *Petals* obovate, 3 mm long, ½ mm incised, outside with some long hairs near the base (on margin and midrib). *Disk-lobes* ¼ mm high, slightly cordate, glabrous. *Pistilloid* densely woolly pubescent. *Fruits* usually solitary, short-stalked, (1–)3-lobed, broad-obovate, *c.* 1½ by 1½ cm, densely minutely fulvous pubescent, more or less glabrescent, sutures distinct.

Distr. *Malaysia:* Philippines (Luzon, Leyte, Bohol, Bucas Grande Isl., Mindanao).

Ecol. In forests and brushwood, up to 1000 m. *Fl.* March–Aug.; *fr.* Oct.–Jan.

Uses. The timber is used as construction-material.

Vern. *Kayotcot,* Mbo.

Notes. The specimens from Leyte are slightly different: Leaves are (sub)glabrous, inflorescences more lax and up to 3 cm long, flowers 2½ mm long, petals fully glabrous. *D. ciliatum* is only slightly different in being more shaggy pilose and having somewhat broader leaves.

Closely related to *D. gelonioides*; different by its narrow, usually hairy leaves, and its 3-celled fruits.

7. Dichapetalum tenuifolium (KING) ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 348; *non* SCHELLENB. Pfl. R. Heft 103 (1938) 189 (= *D. gelonioides*); LEENH. Reinw. 4 (1956) 83.—*Chailletia tenuifolia* KING, J. As. Soc. Beng. 64, ii (1895) 91; RIDL. Fl. Mal. Pen. 1 (1922) 416.—**Fig. 2d.**

Dioecious small tree (up to 5 m by 5 cm) or shrub. *Branchlets* early glabrescent, reddish brown to black. *Leaves* elliptic-oblong, 16–22 by $4^{1}/_{2}$–6 cm, papyraceous, irregularly corrugated, glabrous; glands, if present, few, on the lower side, mainly near the base; base acute; apex tapering, blunt to acute; nervation sunken above, prominent beneath; nerves 7–9 pairs, curved, usually distinctly interarching. *Inflorescences* glomerulous, $^{1}/_{2}$–1 cm, scattered pilose, with 10–12 flowers. *Flowers* $2^{1}/_{2}$ mm long. *Petals* broadly spathulate, slightly emarginate. *Disk-lobes* $^{1}/_{4}$ mm, cordate, glabrous. *Pistil* densely woolly pubescent; ovary 3-celled; style 1, tripartite at the tip. *Fruits* solitary, short-stalked, 3-lobed (one lobe much smaller), obcordate, $1^{1}/_{4}$ by $1^{1}/_{2}$ cm, not distinctly grooved, faintly tuberculate, subglabrous.

Distr. *Malaysia:* Malay Peninsula (Perak).

Ecol. Dense jungle, up to *c.* 600 m. *Fl.* May–Oct.; *fr.* Oct.

Note. Closely related to *D. gelonioides*; distinctly different by its thin leaves and fruit characters.

8. Dichapetalum griffithii (HOOK. *f.*) ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 348; BURK. Dict. 1 (1935) 803; LEENH. Reinw. 4 (1956) 83.—*Chailletia griffithii* HOOK. *f.* Fl. Br. Ind. 1 (1875) 571; KING, J. As. Soc. Beng. 64, ii (1895) 92; RIDL. Fl. Mal. Pen. 1 (1922) 419; *non* F.-VILL. Nov. App. (1880) 45 (= *D. timoriense*).—*Chailletia setosa* KING, J. As. Soc. Beng. 65, ii (1896) 515; RIDL. Fl. Mal. Pen. 1 (1922) 419.—**Fig. 2b.**

Monoecious climbing or creeping shrub, sometimes erect shrub or up to 4 m high treelet. *Branchlets* ferrugineous shaggy pilose. *Leaves* subsessile, lanceolate to elliptic, 12–18–22 by 4–6–11 cm, herbaceous, pubescence variable, usually shaggy pilose on the midrib above, on midrib and nerves beneath; glands on the lower side of the leaf, especially near the base, not rarely absent; base cordate; apex gradually acuminate, acumen cuneate, acute (rarely blunt); nervation prominent beneath, nerves 10–16 pairs, straight to rather strongly curved, distinctly interarching at some distance from the margin. *Glòmerules* axillary, many-flowered, $^{3}/_{4}$–1 cm long, shaggy pilose. *Flowers* $3^{1}/_{2}$–4 mm, bisexual. *Petals* spathulate, $3^{1}/_{2}$ mm long, 1 mm incised, glabrous. *Disk-lobes c.* $^{1}/_{4}$ mm high, quadrangular to faintly 2-lobed, glabrous. *Ovary* woolly pubescent, 3-celled; style 1, ± tripartite at the tip. *Fruits* solitary, 1 cm long stalked, obovoid, 2(–3)-lobed, $3^{1}/_{2}$–4 by 2–$2^{1}/_{2}$ cm, shaggy ferrugineous-pilose; stones rugose; 1–2(–3) seeded.

Distr. *Malaysia:* Malay Peninsula.

Ecol. In mixed primary & secondary, and in bamboo forests, up to *c.* 200 m. *Fl.* mainly May–July; *fr.* mainly Sept.–Febr.

Uses. The fruits are edible. The Sakais drink a decoction of the roots during 3 days after childbirth.

Vern. *Akar,* (*a.*) *kĕrutot, a. pĕleh angin,* (*a.*) *pĕlir* (or *pulêh*) *kambing, kĕdondong bulan, kĕrupok bukit* (or *kurupô butrit*), (*mĕroyan*) *kabut.*

Notes. Characterized by its pubescence and by the rather large, densely shaggy-pilose fruits.

9. Dichapetalum setosum LEENH. Reinwardtia 4 (1956) 84.—*non Chailletia setosa* KING *quae est D. griffithii* ENGL.—**Fig. 2e.**

Dioecious scandent shrub. *Branches* shaggy pilose, glabrescent, light-coloured. *Leaves* elliptic, 10–20 by 6–10 cm, stiff herbaceous to subcoriaceous, scattered to densely pubescent above, specially on midrib and nerves, along the margin, and beneath, hairs patent, rather long, stiff, bulbous-based; glands rather many beneath; base rounded to broadly cuneate; apex gradually acuminate, acumen up to $1^{1}/_{2}$ cm long, slender, acute; nervation sunken above, rather strongly prominent beneath; nerves 5–11 pairs, curved, distinctly interarching at some distance from the margin. *Inflorescences* lax, $2^{1}/_{2}$ cm long, 1 cm long stalked, shaggy pilose, few- to many-flowered. *Flowers* (♀ unknown) 5 mm. *Petals* narrowly spathulate, $4^{1}/_{2}$ mm long, $^{1}/_{3}$ mm incised, glabrous. *Disk-lobes* quadrangular, $^{1}/_{2}$ mm, glabrous. *Pistilloid* densely woolly pubescent. *Fruits c.* 2, 2-lobed, $1^{3}/_{4}$–2 by 2–$2^{1}/_{2}$ cm, rather densely patently pilose, with very distinct sutures; stone thin-walled, hard, 2-celled.

Distr. *Malaysia:* Borneo (3 collections only).

Ecol. In thickets. *Fl.* in Aug., *fr.* in July.

Note. A very characteristic species, possibly related to *D. gelonioides.*

10. Dichapetalum steenisii LEENH. Reinwardtia 4 (1956) 84.

Dioecious liana. *Branches* scattered shaggy pilose when young, gradually glabrescent, finally greyish brown. *Leaves* elliptic to lanceolate, 13–19 by 4–7 cm, herbaceous, sparsely, shaggy pilose, especially on the nerves beneath; glands rather many, scattered all over the lower surface; base acute; apex tapering acute-acuminate; midrib and nerves slightly sunken above, prominent beneath; nerves 8–10 pairs, curved, distinctly interarching. *Inflorescences* glomerulous, *c.* 1 cm long, many-flowered, shaggy pilose. *Flowers* (♀ unknown) 3 mm. *Calyx* shaggy fulvous pilose. *Petals* spathulate, slightly incised at the apex, glabrous. *Disk-lobes* nail-shaped, $^{1}/_{4}$ mm, thickened and tuberculate in the broadened upper part, glabrous. *Pistilloid* woolly pubescent. *Fruits* 1–3, subsessile, 2–3-lobed, ovate, *c.* 13 by 16 mm, densely fulvous-tomentose, with distinct sutures.

Distr. *Malaysia:* Natuna Isl. (Bunguran), SE. Celebes.

Ecol. Primary forest, up to *c.* 500 m.

ssp. **steenisii.**

Nerves *c.* 8 pairs. *Fruits* 2-lobed (no remains of a 3rd one).

Distr.: Natuna Isl. (Bunguran: Mt Ranai). *Fl.* and *fr.* April.

Vern. *Bulu* (Mal.).

ssp. **celebicum** LEENH. Reinwardtia 4 (1956) 84. —**Fig. 2h.**

Nerves *c.* 10 pairs. Fruits 3-lobed. Flowers unknown.

Distr. SE. Celebes, twice collected. *Fr.* Sept.

11. Dichapetalum longipetalum (TURCZ.) ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 348; CRAIB, Fl. Siam. En. 1 (1931) 268; LEENH. Reinw. 4 (1956) 84. —*Chailletia longipetala* TURCZ. Bull. Soc. Nat. Mosc. 36, 1 (1863) 611; HOOK. *f.* Fl. Br. Ind. 1 (1875) 571; KURZ, Fl. Burm. 1 (1877) 231 (*sphalm.* '*macropetala*').—*D. baillonii* PIERRE, Fl. Coch. 1 (1882) t. 47; PELLEGRIN in Fl. Gén. I.-C. 1 (1911) 800.—*Chailletia hainanensis* HANCE, J. Bot. 23 (1885) 322.—*D. tonkinense* ENGL. Bot. Jahrb. 23 (1896) 143; PELLEGRIN in Fl. Gén. I.-C. 1 (1911) 799, f. 88^{1-7}; Suppl. 1 (1948) 730.—*D. hainanense* ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 348; PELLEGRIN in Fl. Gén. I.-C. Suppl. 1 (1948) 730. —**Fig. 3.**

Monoecious liana, shrub, or small tree (up to 10 m by 15 cm). *Branchlets* bluntly quadrangular in cross-section, densely ferrugineously tomentose when young, older ones glabrous, lenticellate, grey to purple-brown. *Leaves* ovate- to obovate-elliptic, 10–17 by 3¹/₂–9 cm, thin-chartaceous, shining dark-brown above when dry, minutely pilose on

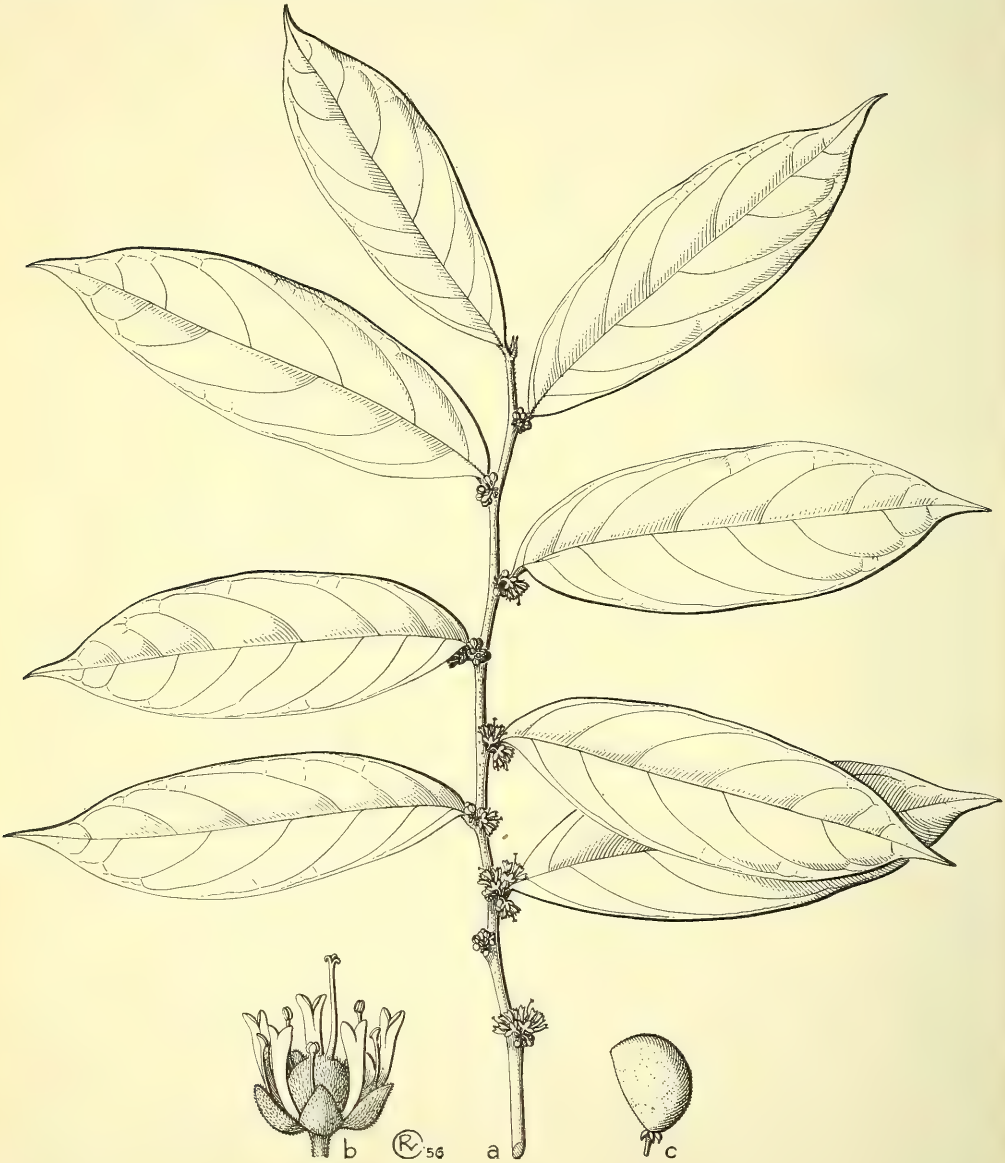

Fig. 3. *Dichapetalum longipetalum* (TURCZ.) ENGL.—*a*. Flowering twig, *b*. flower, *c*. fruit. (*a* × ¹/₂, *b* × 3¹/₂, *c* × ¹/₂; *a–b* after LEI 100, *c* BALANSA 3852).

midrib and nerves above, densely to very sparsely velutinous beneath, without glands; base acute to subcordate; apex gradually to subabruptly acuminate, acumen cuneate, acute (to blunt); nervation sometimes slightly sunken above, midrib and nerves distinctly prominent beneath; nerves 7–9 pairs, faintly curved, slightly interarching. *Inflorescences* glomerulous, ¾–1 cm, sessile, many-flowered. *Flowers* 5 mm, bisexual. *Petals* oblanceolate, 4½–5 mm, twice as long as the calyx, 1–1½ mm incised, glabrous. *Disk-lobes* quadrangular, faintly 2-lobed, ½ mm, glabrous. *Ovary* densely velvety pubescent, (2–)3-celled; style 1, filiformous, 4 mm long, its tip slit up into (2–)3 recurved parts. *Fruits* solitary, short-stalked, 1(–2)-lobed, bean-shaped, 1½–2½ by 1–1½ cm, densely minutely fulvous-tomentose, more or less glabrescent, suture indistinct; endocarp *c.* 1 mm thick, hard.

Distr. S. Burma, Cambodja, Annam, Tonkin, Hainan, and *Malaysia:* Malay Peninsula.

Ecol. In forests, bamboo forests, and thickets, up to *c.* 500 m. *Fl.* mainly Oct.–March; *fr.* mainly May–June.

Notes. Best characterized by the very long petals and strongly oblique fruits, moreover by the often quadrangular branchlets. The ovary is usually 3-celled, but on the same specimen often some flowers with a 2-merous ovary are to be found.

HOOKER *f.*, *l.c.*, and all authors afterwards, described the flowers of this species as being unisexual, though ♂ and ♀ inflorescences were to be found on the same plant. The ♂ inflorescences were said to be more lax and larger than the ♀ ones, the ♂ flowers smaller, their petals not exceeding the calyx, and more than halfway slit up. The source of this error is the specimen HELFER (Kew distr.) 2171 in HOOKER's herbarium, in which a loose ♂ inflorescence of *D. cf. timoriense* is mounted over one of the branches, which itself is also in full flower.

12. Dichapetalum helferianum (KURZ) PIERRE, Fl. Coch. 1 (1881) t. 48; PELLEGRIN in Fl. Gén. I.-C. 1 (1911) 797, f. 88$^{8-9}$; LEENH. Reinw. 4 (1956) 85.—*Chailletia helferiana* KURZ, J. As. Soc. Beng. 41, ii (1872) 297; HOOK. *f.* Fl. Br. Ind. 1 (1875) 570; KURZ, Fl. Burm. 1 (1877) 230; KING, J. As. Soc. Beng. 64, ii (1895) 92; RIDL. Fl. Mal. Pen. 1 (1922) 417; *non* F.-VILL. Nov. App. (1880) 45 *quae est D. tricapsulare.*—**Fig. 2f.**

Dioecious scandent shrub, rarely a tree (up to 8 m high). *Branchlets* minutely pubescent when young, greyish- to yellowish-brown. *Leaves* elliptic to oblong, 8–14 by 2½–5½ cm, thin-coriaceous, dull-brown when dry, glabrous except stipules, petiole, and midrib beneath; glands 2–3, on the lower surface near the base; base equilateral, acute; apex subabruptly acuminate, acumen ½–1 cm long, acute; nervation inconspicuous; nerves 7–8 pairs, curved, distinctly interarching, some intermediate veins well-developed. *Inflorescences* axillary, 1–2 cm, minutely tomentose, 7–11-flowered. *Flowers* 2½ mm long. *Petals* obovate-spathulate, 2 mm long, ⅓ mm incised, glabrous. *Disk-lobes* quadrangular, ¼ mm, glabrous. *Ovary* densely woolly pubescent, 2-celled; styles 2. *Infructescences* ½–2 cm, with 1–2 fruits. *Fruits* 1–2(–3)-lobed, ovate, *c.* 1 by 1½ cm, minutely fulvous-tomentose; suture distinct; stone slightly rugose.

Distr. S. Burma (from Moulmein southwards), S. Siam, and *Malaysia:* Malay Peninsula (Perlis, Langkawi Isl.). According to PELLEGRIN *l.c.* also in Cambodia; I did not see the specimen, but I doubt its identity.

Ecol. Low altitude. *Fl.* March–April, July; *fr.* June–Jan.

Vern. *Gunda mahmot*, Mal. Pen.

Notes. KURZ, apparently erroneously, mentions the petals as being 'silky pubescent outside.'

At first sight this species looks rather like *D. laurocerasus*; apart from the important differences in flower and fruit, it mainly differs in its vegetative parts by light-coloured branches (black in *laurocerasus*) and its leaves being not fully glabrous.

13. Dichapetalum laurocerasus (HOOK. *f.*) ENGL. in E. & P. Pfl. Fam. 3, 4 (1896) 348; LEENH. Reinw. 4 (1956) 85.—*Chailletia laurocerasus* PLANCH. *ex* HOOK. *f.* Fl. Br. Ind. 1 (1875) 572; KING, J. As. Soc. Beng. 64, ii (1895) 93; RIDL. Fl. Mal. Pen. 1 (1922) 417, f. 41.

Monoecious woody climber or creeper, sometimes shrub or small tree. *Branchlets* glabrous, black. *Leaves* elliptic (rarely ovate), 8–12 by 4–6½ cm, thin-coriaceous, glabrous (except sometimes a few hairs on stipules and petiole), usually yellowish- to reddish-brown when dry; glands beneath few, mainly near the base; base slightly oblique, broadly cuneate to subrotundate; apex more or less acuminate, acumen small, broad, and blunt; nervation inconspicuous, nerves (6–)8–10 pairs, straight, curved and distinctly interarching towards the margin. *Inflorescences* axillary, dichotomous, 1–1½ cm long, stalked or not, with *c.* 15 flowers, scattered-pilose. *Flowers* 5 mm, bisexual, receptacle slightly hollowed. *Petals* narrowly spathulate, 4½ mm long, 1 mm incised, glabrous. *Disk-lobes* ½ mm, glabrous to minutely tomentose, sometimes more or less mutually connate. *Ovary* densely patently stiff-pilose, 3-celled; style long and slender, nearly glabrous, stigma 3-lobed. *Fruits* solitary, on a thick 1 cm long stalk, 1(–2) lobed, usually oblique, 2½ by 2–3 cm, densely minutely fulvous-tomentose; sutures absent.

Distr. *Malaysia:* Malay Peninsula (mainly P. Penang, once in Perak).

Ecol. Dense jungle, up to about 600 m. *Fl.* Febr.–March(–May); *fr.* June–Aug.

Vern. *Bua akar larak kuching*, *tahi ulat*, Mal. Pen.

Note. Very distinct, especially in its flowers differing from all other Malaysian species, in vegetative parts showing some superficial resemblance to *D. helferianum.*

14. Dichapetalum sessiliflorum LEENH. Reinwardtia 4 (1956) 85.—**Fig. 2a.**

Dioecious liana. *Branches* densely fulvous-tomentose when young, glabrescent, greyish brown. *Leaves* elliptic to lanceolate, 9–15 by 3–5 cm, chartaceous, (sub)glabrous above, faintly appressedly pilose on midrib and nerves beneath; glands few, beneath, near the base; base acute; margin minutely crenulate; apex acuminate, acumen usually long, slender, and acute; nerves 7–10 pairs, usually strongly curved, distinctly interarching. *Flowers* (only ♂ buds known) 1–2, subsessile, axillary. *Calyx* densely ferrugineous-tomentose. *Petals* ovate, slightly emarginate, outside (margin excepted) and inside at the base long-pilose. *Disk* absent(?). *Pistilloid* patently stiff-pilose. *Fruits* solitary, short-stalked, triangular-ovoid, *c.* 3 by 2½–3 cm, smooth, densely shortly ferrugineous-tomentose, glabrescent, 3(–1)-celled; stones free, woody, strongly corrugated.

Distr. *Malaysia:* SE. New Guinea.

Ecol. In forests, 1200–1500 m. *Fl.* and *fr.* Oct.–Nov.

Notes. Characterized by the large, rounded fruits and the very small inflorescences; moreover the only species with petals which are even inside pubescent.

15. Dichapetalum tenerum LEENH. Reinwardtia 4 (1956) 86.

Dioecious ?liana, sometimes treelet. *Branches* velvety fulvous-pubescent, gradually glabrescent, purple-brown. *Leaves* elliptic, 6–10 by 2½–4 cm, herbaceous, pilose along the margin, on the midrib above, and on midrib, nerves, and part of the veins beneath; some small glands scattered over the lower surface; base acute (to rounded); apex gradually acuminate, acumen usually long, blunt, mucronate; nerves 8–10 pairs, curved (rarely nearly straight), not or indistinctly interarching. *Inflorescences* ¾ cm long, 1(–2)-flowered. *Flowers* (probably only ♀ seen) 2½ mm. *Petals* broad-spathulate, 1–1¼ mm long, *c.* ¼ mm incised. *Disk-lobes* ⅕ mm high, 2-lobed, glabrous. *Ovary* woolly pubescent, 2-celled; styles 2, stigmas 2-lobed. *Fruits* 2(–1)-lobed, emarginate, 1¼ by 1¼ cm, with distinct sutures, densely velvety ferrugineous pubescent, slightly warty; seeds dark orange.

Distr. *Malaysia:* West New Guinea (one doubtful specimen from Papua, Central Div.).

Ecol. Rain-forest, up to 50 m. *Fl.* Oct.–April.

Doubtful

Dichapetalum ledermannii KRAUSE, Bot. Jahrb. 62 (1929) 343.

NE. New Guinea (Lordberg).

Possibly related to *D. tenerum* from which it differs by rather long petioles (1 cm), narrow leaves (*c.* 9 by 2½ cm), and *c.* 5-flowered inflorescences. The only specimen still in existence, as far as I know, is a male one (LEDERMANN 10179,L). Its flowers possess stamens with a very broad filament pilose outside; there is no disk; the pistilloid is rather large and possibly points to a 3-merous pistil.

This specimen belongs to a small group of New Guinean ones, all apparently related to *D. tenerum* or *D. timoriense*. They are either each representing a distinct species or, what is more probable, belong to one variable species. As the material of this assemblage of sheets is still quite insufficient, I think it preferable for the present to leave all material, not belonging to the only well circumscribed *D. tenerum*, undetermined, even with the inclusion of *D. ledermannii*.

Excluded

Chailletia bojeri TUL. Ann. Sc. Nat. Bot. IV, 8 (1857) 85, has erroneously been mentioned (Ind. Kew. 1, 1895, 501) as being described from 'Malacca'; this should be Madagascar.

Dichapetalum obovatum ELM. Leafl. Philip. Bot. 2 (1908) 483 = *Oncocarpus obovatus* (ELM.) MERR. (*Anac.*).

Dichapetalum spicatum ELM. Leafl. Philip. Bot. 1 (1908) 299 = *Osmelia philippina* (TURCZ.) BENTH. (*Flacourt.*).

Dichapetalum tetramerum RIDL. Kew Bull. (1938) 234 = *Ellipanthus beccarii* PIERRE (*Connar.*).

Digaster MIQ. Sum. (1861) 329, originally described as possibly belonging to *Chailletiaceae*, has been reduced to *Pygeum* GAERTN. (*Rosac.*).

ALISMATACEAE (C. den Hartog, Amsterdam)

Annual or perennial aquatics and marsh plants, sometimes laticiferous. *Leaves* basal and erect, sometimes floating, rarely all submerged, sometimes some reduced to phyllodes, lanceolate to sagittate, rarely broad-elliptic to ovate, entire, with a hydathode on the apex, curvinerved, nerves more or less parallel and gradually joining the marginal nerve, connected by ascending cross-veins; petiole sheathing, mostly with air-channels, often septated. *Inflorescences* mostly erect, racemose or paniculate; peduncle sometimes hollow, mostly with air-channels. Bracts 3(–2) per whorl of flowers or branches. *Flowers* actinomorphous, bisexual or unisexual (and then rarely with rudiments of the other sex). *Sepals* 3, imbricate, green, parallel-nerved, convex, persistent. *Petals* 3, imbricate, white or faintly coloured, marcescent. *Stamens* 3–∞, free, in a whorl; filaments filiform or dilated; anthers 2-celled, basifix, sometimes versatile, latrorsely lengthwise dehiscent. *Carpels* 2–∞, free, in the Mal. *spp.* spirally arranged on the receptacle (in extra-Mal. *Alisma* in a whorl); style 1, ventrally or terminally inserted on each carpel, persistent. *Ovule* 1 (in extra-Mal. *Damasonium* 2 or more), basal, campylotropous, rarely anatropous (*Damasonium*), micropyle extrorse, rarely introrse (*Luronium*). *Achenes* in a head (or whorl in *Alisma*), free, rarely connate at the base. *Seeds* oblong or horseshoe-shaped; testa membranous; embryo horseshoe-shaped; albumen 0; radicula extrorse, rarely introrse (*Luronium*).

Distribution. About 10 genera with *c.* 70 *spp.*, all over the temperate and tropical zones except in the Pacific area (Micronesia, Melanesia, and Polynesia). The largest genera are *Sagittaria* and *Echinodorus* both centering in the New World.

Ecology. Malaysian representatives are confined to low altitudes, *Sagittaria sagittifolia ssp. leucopetala* ascending to *c.* 1000 m. Habitats are marshes and pools, swamps and wet rice-fields, and other stagnant shallow waters.

Most representatives are rare or very rare in Malaysia, though their general distribution can be very wide. The reason of this is obscure. It can neither be ascribed to scarcity of collections, at least not in Java, or of collectors interested in water plants, nor can it be correlated with a scarcity of swamps and swampy areas in Malaysia.

This phenomenon of rarity combined with a wide distribution is certainly not unique among water plants but has been found in many other cases, in Malaysia both species and genera, for example: *Aldrovanda, Aponogeton, Blyxa § Caulescentes, Brasenia, Ceratophyllum submersum, Eriocaulon setaceum, Hydrocharis dubia, Myriophyllum, Najas marina, Nymphoides moonii* and other *spp., Potamogeton spp., Sparganium, Tenagocharis*, and *Trapa.*

It is true that some of these species require apparently special mineral waters (calcium for *Aldrovanda*, other minerals for *Najas marina*, as far as is known from their localities). It is also true that a number of species are only found in ancient swamps in which man has not interfered with drainage or otherwise polluted the waters. It could also be understood that dispersal capabilities are scarce in Malaysia, but there is little reason for this assumption in relation to what is known about means of dispersal.

Save the record by VAN WELSEM (Trop. Natuur 4, 1915, 174) that the fruits of *Sagittaria* possess buoyancy by virtue of air-containing exocarpellary tissue, no observations made in Malaysia have come to my knowledge. However, many extra-Malaysian data on means of dispersal in *Alismataceae* have been recorded in RIDLEY's invaluable 'Dispersal' (1930).

Vegetative dispersal can take place by tubers and rhizomes transported by water in rivers (*Sagittaria*); floating seedlings derived from seeds germinated under water have been observed in *Echinodorus ranunculoides.* Furthermore in two *Caldesias* vegetative 'buds' ('turions') are produced in the inflorescence giving rise to new plants which can be transported by water.

Seed disperal by water has been proved for various species in which achenes possess buoyancy capacity; those of *Alisma plantago* have subepidermal air-tissue and may float for many months; after decay of this tissue the seed sinks. The wings of the achenes in *Sagittaria* contain light air-tissue as well as a large-celled, light epidermis. The achenes of *Limnophyton obtusifolium* are well adapted to floating by two lateral air-chambers between endo- and exocarp.

Exozoic dispersal has been observed in *Alisma* and will doubtless take place in other species; achenes have been found on breast and feet of various birds, and as the light, often winged, flat achenes float on the surface of the water they get easily attached to the feathers merely by the wet. Achenes have also been found in bird's nests.

Endozoic dispersal: HOCHREUTINER fed roaches (*Leuciscus rutilus*) with achenes of *Alisma plantago*; after the stomachal passage seed was found partly viable (Bull. Herb. Boiss. 1899, 450). It is quite likely that fish feed on species of the family. HOLMBOE found achenes of *Alisma* in the stomach of dippers (*Cinclus aquaticus*) and the same has been observed with the mallard, a duck (*Anas platyrhyncha*), with achenes of *Alisma, Sagittaria, etc.*, in which these readily pass the stomach with the seed unharmed, and with wood ducks (*Aix sponsa*).

The above-mentioned data point to a well-stacked array of favourable dispersal methods and one would expect that in regions where water is abundant in marshes, pools, ditches, ponds, and swamps, *Alismataceae* would not be rare. Furthermore, archipelagic conditions would not hamper their dispersal as aquatic birds are known to cover large distances and are able to bridge seas and straits separating islands, although the absence of *Alismataceae* from Micronesia, Melanesia, and Polynesia is most remarkable!

As dispersal by water birds will generally be rather random one would expect wide distributional areas with each an irregular pattern of localities, but with few wide disjunctions. This is found indeed as mentioned above under the ecology. But disjunctions are in many cases—and that not only in *Alismataceae* but in many other water plants—so wide and species so exceedingly rare in large areas, that one can hardly suppose this to be due to random dispersal alone.

It is a matter of fact that *Alismataceae* are exceedingly rare in Malaysia and this concerns all Malaysian species except *Sagittaria guayanensis* which is relatively frequent in its area. The *Sagittarias* introduced in Malaysia also show hardly any sign of rapid extension of their area which stands in sharp contrast to the aggressiveness of for example *Eichhornia* and *Elodea* which fulfilled their napoleonic ambitions merely by vegetative dispersal.

Therefore, there must be other factors underlying the curious distribution of so many water and marsh plants and this will probably be found in their narrow tolerance for edaphic conditions taken in the widest sense. Experiments are needed to elucidate the nature of these factors.

Morphology. The exceedingly thin 'squamulae intravaginales' have been recorded in *Caldesia* by BUCHENAU. ARBER (Ann. Bot. 39, 1925, 169, f. 1–3) found them in very young stages of *Sagittaria* (dorsally on the leaf-base), so that their occurrence in *Alismataceae* seems certain.

Taxonomy. Formerly *Butomaceae* and *Alismataceae* have been treated as two tribes of one family by BENTHAM & HOOKER (Gen. Pl. 3, 1883, 1003), a position in which they are still maintained by RENDLE (Class. Fl. Pl. ed. 2, 1, 1953, 213). On the other hand HUTCHINSON (Fam. Fl. Pl. 2, 1934, 26, 32) arranges them under two distinct families belonging to two different orders, *Butomales* and *Alismatales*.

PICHON (Not. Syst. 12, 1946, 170–183) after having compared a number of anatomical structures (laticiferous ducts, leaves, hydathodes, ovules) accepted a close relationship and merged *Butomaceae* with *Alismataceae* except for *Butomus*.

A similar close relationship was suggested by JOHRI (Proc. Ind. Ac. Sc. B 4, 1936, 128–162) on the basis of comparative embryology and he is of opinion that the separation of *Alismataceae* and *Butomaceae* into two different orders is unnecessary.

Alismataceae are distinguished from *Butomaceae* by the basal solitary ovule (or in *Damasonium* 2 or more in the inner angle); in *Butomaceae* ovules are numerous, scattered, and parietal.

They are more rapidly distinguished from *Hydrocharitaceae* in which the carpels are connate and the ovary inferior with many scattered parietal ovules in each cell.

Uses. The family does not contain many economic plants. Some introduced species of *Sagittaria* are used as ornamentals in pools and ponds. An important cultigen of *Sagittaria sagittifolia* is cultivated by the Chinese, partly as fodder for pigs (the whole plant), but mostly for the edible tubers (see p. 333).

Note. In collecting *Alismataceae* it is to be noted that both flowers and fruits should be collected and that flowers should be measured and dried immediately after the collecting in the field, as by their marcescent structure they cannot be accurately measured and drawn from herbarium specimens. Further, ecological data on precise soil conditions, water composition, pollination, and seed dispersal are very valuable as hardly anything is known in these aspects.

KEY TO THE GENERA

1. Carpels crowded on a minute receptacle. Achenes swollen, round in cross-section.
    2. Leaves ovate to elliptic. Flowers bisexual. Achenes without air-chambers . . . **1. Caldesia**
    2. Leaves broadly sagittate. Flowers male and bisexual. Achene with 2 lateral air-chambers. **2. Limnophyton**
1. Carpels inserted on a large, easily observable, globular or oblong receptacle. Achenes more or less compressed.
    3. Bracts (in Mal. *spp.*) 2. All flowers bisexual. Receptacle globular to oblong. Achenes not, slightly, or strongly compressed. Seeds broad-elliptic, testa connate at the incision and wholly enclosing the hippocrepiformous embryo . . . . **3. Echinodorus**
    3. Bracts under each whorl 3. Flowers unisexual, or on the lower part of the inflorescence sometimes bisexual. Receptacle globular. Achenes strongly laterally compressed. Seeds hippocrepiformous. **4. Sagittaria**

1. CALDESIA

Parlatore, Fl. Ital. 3 (1858) 599; Buch. Pfl. R. Heft 16^2 (1903) 15.—*Alisma sect. Caldesia* B. & H. Gen. Pl. 3 (1883) 1005.—**Fig. 1–2.**

Leaves broad-elliptic to broad-ovate, apex blunt, base cordate (rarely truncate outside Mal.). *Panicle* pyramidal; branches and pedicels on the branches in whorls of 3, each branch and each pedicel sustained by an oblong-lanceolate bract. *Flowers* bisexual. *Petals* white. *Stamens* 6(–11); filaments filiform. *Carpels* 2–9(–20) crowded, not in a whorl; style ventrally inserted, slender; *achene* swollen, without lateral air-chambers; endocarp formed by large, radially arranged sclerenchymatic cells (colouring red with phloroglucin); exocarp spongy or membranous. *Seed* oblong.

Distr. 3 *spp.* from Africa & Madagascar and South and Central Europe through South and East Asia, and Malaysia to Australia.

Notes. Closely allied to *Alisma* which differs in having the carpels in a whorl and a non-sclerenchymatic endocarp. In *Alisma* the cell-walls of the endocarp contain lignin and colour red with phloroglucin but are not typically sclerenchymatic, consequently the achene is softer than in *Caldesia.*

The revision of the Malaysian species necessitated to revise the extra-Malaysian species as well and they have consequently been incorporated here for general use in a key to all the species of the genus.

KEY TO THE SPECIES

1. Leaves not pellucid-punctate. Veins connecting the nerves paralle land ascending at an angle of 60° and $^1/_3$–$^1/_2$ mm spaced. Bracts scarious. Sepals erect after flowering. Achenes elliptic, dorsally with 3–5 longitudinal smooth ribs.
  2. Leaves broad-elliptic, apex acute, base deeply cordate. Lowest bracts up to 1 cm long. Stamens 6. Carpels 5–8 . . . . **1. C. parnassifolia**
  2. Leaves reniform, apex emarginate, base truncate. Lowest bracts up to 2 cm long. Stamens 9(–11). Carpels 12–20. All parts coarser or larger than in the preceding species . . . **2. C. grandis**
1. Leaves pellucid-punctate. Veins connecting the nerves parallel and perpendicular to the nerves, at least 1 mm spaced. Bracts herbaceous. Sepals reflexed and revolute after flowering. Achenes reniform, dorsally provided with 4 more or less warty or spiny ribs . . . . **3. C. oligococca**

1. Caldesia parnassifolia (Bassi *ex* L.) Parl. Fl. Ital. 3 (1858) 599; *incl. var. majus* Micheli in DC. Mon. Phan. 3 (1881) 35; *incl. major & nilotica* Buch. Pfl. R. Heft 16^2 (1903) 16, f. 6 A–C; Samuelsson, Svensk Bot. Tidskr. 24 (1930) 113–116; Perrier de la Bâthie, Fl. Mad. fam. 25 (1946) 6, f. II 1–3; Steen. Nova Guinea n.s. 7 (1956) 7. —*Alisma parnassifolium* Bassi *ex* Linné, Syst. Nat. ed. 12, 3 (1768) 230; Mant. 2 (1771) 371; Bassi, Comm. Bonon. 6 (1783) 33; F.v.M. Fragm. 8 (1874) 214.—Thiselton-Dyer, Fl. Trop. Afr. 8 (1901) 208.—*Alisma reniforme* D. Don, Prod. Fl. Nepal. (1825) 22; Wight, Ic. (1840) t. 322; Bth. Fl. Austr. 7 (1878) 186; Hook. *f.* Fl. Br. Ind. 6 (1893) 560; Bailey, Queensl. Fl. 6 (1902) 1703; Gagnep. Fl. Gén. I.-C. 6 (1942) 1205.—*Alisma calophyllum* Wall. Cat. (1832) 4997, *nomen nudum.*—*Caldesia reniformis* Makino, Bot. Mag. Tokyo 20 (1906) 34; Holthuis, Blumea 5 (1942) 161.

Glabrous. *Leaves* floating, broad-ovate to broad-elliptic or suborbicular, $2^1/_2$–6 cm long measured along the midrib, base deeply cordate with broadly rounded basal lobes, apex obtuse, in smaller specimens sometimes broad-acute; nerves 13–17, connected by very numerous, straight, parallel, fine crossbar-veins, $^1/_3$–$^1/_2$ mm spaced, ascending at 60°; petiole *c.* 25(–50) cm, with few lengthwise air-channels, prominently septate at distances of 4–8 mm when dry. *Inflorescences* few or one, peduncle hollow, with lengthwise air-channels, finely ribbed when dry, including the panicle *c.* 75 cm long. *Panicle* mostly shorter than the peduncle, pyramidal, branches and flowers on the branches regularly in subsequent whorls of 3, sometimes seemingly in whorls of 4–6 but then 1–3 pedicels represent really 1-flowered branches with each 3 bracts above the base of the 'pedicel'; each branch and pedicel sustained at the base by a membranous, acute, oblong-lanceolate bract, lower ones 1 cm long, subsequent ones gradually smaller. Pedicels $1^1/_2$–4 cm. *Sepals* elliptic, bluntly rounded, remaining erect, pale green with hyaline margin, *c.* $3^1/_2$–$4^1/_2$ by 2–$2^1/_2$ mm. *Petals* white, in bud elliptic, bluntly rounded, very thin, somewhat exceeding the sepals. *Stamens* 6, filaments white or pale yellow, broadened towards the base, persistent, 2–$2^1/_2$ mm; anthers bright yellow, compressed, 1 by $^1/_3$–$^1/_2$ mm. *Carpels* 5–8, not all developing into achenes, compressed, obovate, including the style 2-$2^1/_2$ mm; style subterminal, *c.* 1–$1^1/_2$ mm; stigma punctiform. *Achene* elliptic; laterally faintly compressed, dorsally with 3–5 longitudinal ribs, incl. style *c.* 3–4 mm long; exocarp spongy, brown, endocarp consisting of a layer of thick-walled sclerenchymatic, radial cells, each cell-wall inside provided with ribs. *Seed c.* 2 by 1 mm, pale brown.

Distr. From North and Central Africa & Madagascar to South & Central Europe, through Southeast Asia to China, Japan, and North Australia, in *Malaysia:* SW. Celebes (Lake Lura, SARASIN 1240, *non vidi*, SAMUELSSON *l.c.*), Moluccas (Talaud), and E. New Guinea (Cape Vogel Peninsula), only thrice found. Fig. 3.

Ecol. Permanent lowland swamps, rooting in shallow water, in Celebes at 650 m. *Fl., fr.* May, Sept.

In the axils of the bracts of the rhachis there are sometimes instead of flowers vegetative lateral branches 3/4–1 1/2 cm long: cigar-shaped turions consisting of many imbricate, acute, lanceolate bracts; they occur in European, Asiatic, and Malaysian specimens and have been described by BUCHENAU (Abh. Naturw. Ver. Bremen 2, 1871, 482) and BANERJI (J. Bomb. Nat. Hist. Soc. 50, 1952, 685–687).

According to BUCHENAU (Pfl.R. p. 2) along the northern frontier of the area of distribution in Central Europe 'winter buds' are formed on prostrate stolon-like stems at the close of the season, representing a way of vegetative reproduction.

Notes. MAKINO *l.c.* has not succeeded in adding much to the differences between the specimens of the European population and those from the tropical parts of the Old World. Malaysian specimens agree very well with luxuriant South European specimens which have never more than 13 nerves in the leaf; in tropical specimens there are 13–17 nerves. There is apparently a small racial difference, by some authors evaluated in the rank of *forma*, by others in the rank of variety. An experimental taxonomical study might show the precise value of the differences found.

2. **Caldesia grandis** SAMUELSSON, Svensk Bot. Tidskr. 24 (1930) 116 *cum ic.*

For the differences with *C. parnassifolia* see the key. *Leaves* broader than long, suborbicular, base truncate, apex emarginate, measured along the midrib 11 cm, width 14 cm; nerves 13–17; petiole septate. *Sepals* 4–5 by 2 1/2 mm. *Stamens* 9(–11, *cf.* SAMUELSSON). *Carpels* (12–)17(–20); style 2 1/2 mm; achenes not seen.

Distr. India (East Bengal, Khasia Hills: Jowai, Nonkreem, Nunklow, Nurtiung, Khalol), not yet found in Malaysia.

Ecol. Apparently a mountain species, 1000–1500 m. Turions occur between the flowers in the whorls of specimens examined by me.

Note. A closer morphological and cytological investigation of this local species is suggested to our Indian colleagues in order to increase present data.

3. **Caldesia oligococca** (F.v.M.) BUCH. Bot. Jahrb. 2 (1882) 479; Pfl. R. Heft 16^2 (1903) 16; BACKER, Handb. Fl. Java 1 (1925) 53; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 204, p. 2.—*Alisma oligococcum* F.v.M. Fragm. 1 (1858) 23; *ditto* 4 (1866) 169; *ditto* 8 (1874) 214; BTH. Fl. Austr. 7 (1878) 185; MICHELI in DC. Mon. Phan. 3 (1881) 37; HOOK. *f.* Fl. Br. Ind. 6 (1893) 560; in Trim. Fl. Ceyl. 4 (1898) 370; THISELTON-DYER, Fl. Trop. Afr. 8 (1901) 208; BAILEY, Queensl. Fl. 6 (1902) 1703; BACKER, Bull. Jard. Bot. Btzg II, *no* 12 (1913) 7; GAGNEP. Fl. Gén. I.-C. 6 (1942) 1206.—*Alisma apetalum* HAM. in Wall. Cat. (1832) 4996, *nomen.* —*Alisma acanthocarpum* F.v.M. Fragm. 1 (1858) 23; *ditto* 4 (1866) 169; *ditto* 8 (1874) 214; BTH. Fl. Austr. 7 (1878) 185; MICHELI in DC. Mon. Phan. 3 (1881) 38; BAILEY, Queensl. Fl. 6 (1902) 1702. —*Alisma glandulosum* THWAITES, En. Fl. Zeyl. (1864) 332.—*Caldesia acanthocarpa* BUCH. Bot. Jahrb. 2 (1882) 479; Pfl. R. Heft 16^2 (1903) 17, f. 6 F, G.—**Fig. 1–2.**

Glabrous. *Leaves* floating, sometimes also some submerged linear phyllodes (12 cm by 4 mm), ovate, base deeply cordate, lobes obtuse, incision narrow, apex blunt, pellucid-dotted, 6–10 cm long measured along the midrib; nerves 9–17; crossbar veins 1–5 mm spaced, straight and parallel, at 90° with the nerves, in their turn again connected by small reticular veinlets; petiole 35–70 cm, ribbed, when dry with more or less prominent septations 2–8 mm spaced. *Panicles* 1–3, pyramidal, 1/4–1/2 as long as the strongly ribbed, angular, hollow peduncle, including the latter 50–115 cm. Bracts connate at the base, oblong-lanceolate, apex attenuate, herbaceous, pellucid-dotted, the lower ones (1 1/2–)3–11 1/2 by (2/3–)1–1 2/3 cm, upwards rapidly decreasing in size, upper ones only 1–1 1/2 cm; nerves linear, prominent at the undersurface. Pedicels 1–3 1/2 cm. *Sepals* elliptic, bluntly rounded, green with scarious margin, 1 1/2–4 by 1–2 1/2 mm, after anthesis reflexed and revolute, more or less lengthwise grooved. *Petals* white, elliptic, acute, very thin, shortly unguiculate, 2 1/2–6 mm. *Stamens* 6; filaments very thin, dilated towards the base, persistent, 2/3–2 mm; anthers versatile, 1/3–1 mm long. *Carpels* 2–10, suborbicular to obovate, compressed, not all developing; style inserted ventrally halfway down, 3/4–1 1/2 mm; stigma punctiform. *Achenes* laterally compressed, kidney-shaped, 1 1/2–5 mm long, dorsally with 4 longitudinal ribs densely set with blunt spiny warts, which are interconnected by scarious membranes; sometimes the 2 outer ribs nearly smooth and only the inner ones provided with blunt, more or less conspicuous warts; exocarp membranous; endocarp consisting of a layer of large sclerenchymatic radial cells, without ribs on the inner cell-walls. *Seeds* 1 1/2–2 by 1/4–1/2 mm, reddish brown.

Distr. W. Africa (Nigeria), Southeast Asia (India, Ceylon, and Indo-China) to North and East Australia, in *Malaysia*: W. and E. Java (between Djakarta and Tg. Priok, and Djatiroto); Lesser Sunda Islands (Timor: near Niki Niki, MONOD DE FROIDEVILLE 1725). Fig. 3.

Ecol. In pools and ditches, and along riverbanks; emerged in the dry season; from sea-level to 600 m. By rise of the water during the flowering period the panicle is transformed into an umbel-like inflorescence by development of branches and pedicels keeping the flowers above the surface of the water. *Fl.* Febr.–May, in Australia also found in June–Oct.

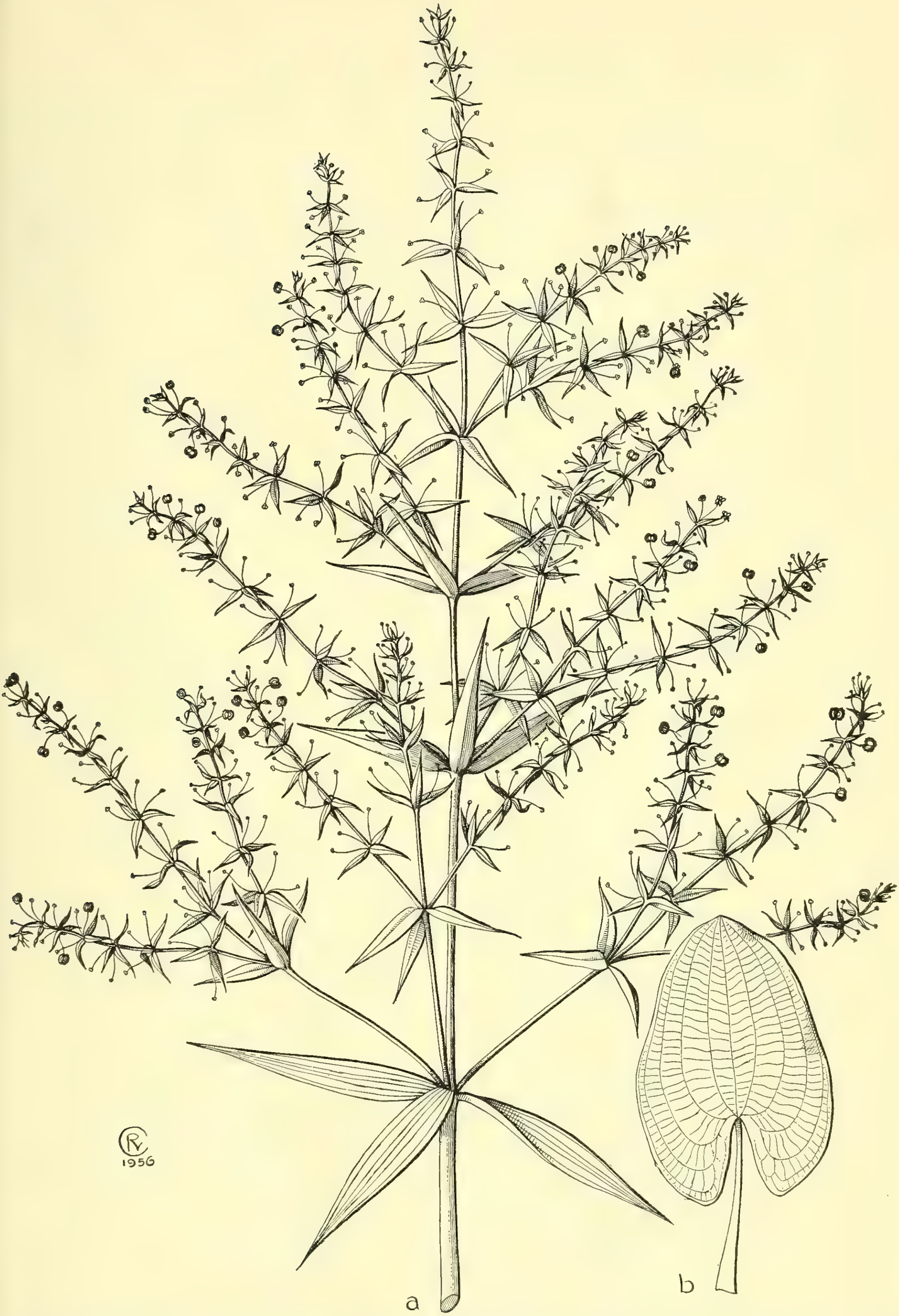

Fig. 1. *Caldesia oligococca* (F.v.M.) Buch. *var. echinata* Hartog. *a*. Habit, × 2/5, *b*. floating radical leaf × 2/5 (Java).

Note. The species is very variable in the size of the bracts, size of the flowers, size and form of the achenes, the striation of the sepals, and the distances between the crossbar veins in the leaf-blades.

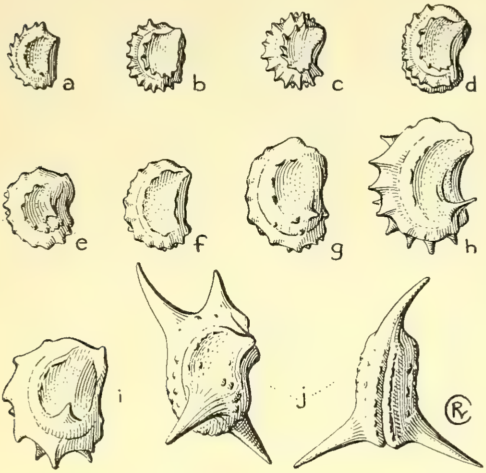

Fig. 2. *Caldesia oligococca* (F.v.M.) BUCH. Fruits of the three varieties: *a–d. var. echinata* HARTOG, *e–i. var. oligococca*, *j. var. acanthocarpa* (F.v.M.) HARTOG (*a* from Indo-China, *b* from W. Java, *c* from Djatiroto (E. Java), *d* from Ceylon, *e* from Timor, *f* Tower Hill, Queensland, *g* Daintree R., *ditto*, *h* Mt Ellis, *ditto*, *i* Kelsey Creek, *ditto*, *j* Normanton, *ditto*. All × 3).

This caused F. v. MUELLER to distinguish two species in Australia (1858, *l.c.*); BENTHAM already suggested that these might be reduced to varietal rank. It appears to me that they represent extremes within one specific population.

In view of the very few specimens available it seems convenient for the present to distinguish three varieties; it should be added that additional material may show, however, that they are connected by intermediates and do not represent sharply delimited infraspecific taxa.

var. **oligococca.—Fig. 2e–i.**

Crossbar veins 1–2 mm spaced. Lowermost bracts 1½–6 cm long. Sepals 2–4 by 1½–2½ mm, strongly striated. Petals 3–6 mm long. Filaments 1½–2 mm, anthers ½–¾ mm. Achenes kidney-shaped, laterally compressed, 3–6 mm, dorsally with 4 longitudinal ribs; inner ribs provided with more or less conspicuous warts, rarely nearly smooth; outer ribs nearly smooth, often with a small wart near the apex or faintly tubercled.

Distr. N. Australia, Queensland, in *Malaysia:* Lesser Sunda Islands (Timor).

var. **echinata** HARTOG, *nov. var.*[1]—*Alisma glandulosum* THW. En. Fl. Zeyl. (1864) 332.—**Fig. 1,2 a–d.**

Crossbar veins 2–5 mm spaced. Lowermost bracts 5–11½ cm long. Sepals 1½–2 by 1 mm, not or hardly striated. Petals 2½ mm long. Achenes kidney-shaped, laterally compressed, 1½–3 mm long, dorsally with 4 longitudinal ribs densely set with blunt spiny warts, which are interconnected by scarious membranes.

Distr. W. Africa (Nigeria), S.E. Asia (India, Ceylon, and Indo-China), in *Malaysia:* Java.

var. **acanthocarpa** (F.v.M.) HARTOG, *nov. comb.* —*Alisma acanthocarpum* F.v.M. Fragm. 1 (1858) 23.—**Fig. 2j.**

Crossbar veins *c.* 1 mm spared. Lowermost bracts 2½–3½ cm long. Sepals 3½ by 2 mm, prominently striated. Petals 4–6 mm. Filaments 2 mm, anthers 1 by ½ mm. Achenes kidney-shaped, laterally compressed, 5–8 mm, dorsally with 4 longitudinal ribs which are faintly tubercled to nearly smooth; outer 2 ribs at the apex provided with a lateral, conical, acute spine 2–3½ mm long, base 1 mm thick, divergent under 60–90°; inner ribs producing together 1, occasionally 2, dorsal spines.

Distr. N. Australia and Queensland.

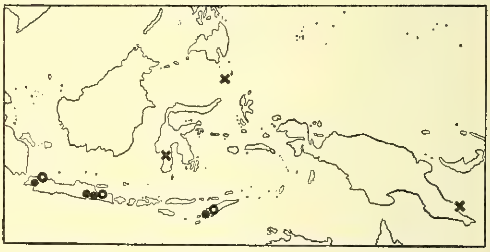

Fig. 3. Localities in Malaysia of *Caldesia parnassifolia* (**X**), *C. oligococca* (**O**), and *Limnophyton obtusifolium* (●).

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(1) Nervi transversales distantes 2–5 mm. Bracteae infimae 5–11½ cm longae. Sepali 1½–2 mm longi, 1 mm lati, non vel vix striati. Petali 2½ mm longi. Achenae reniformes, lateraliter compressae, 1½–3 mm longae, dorsaliter costis 4 longitudinalibus densissime verrucosis praeditae, verrucis obtusis spinulosis membranis scariosis conjunctis.

Fig. 4. *Limnophyton obtusifolium* (L.) MIQ. *a.* Habit of small specimen, × ½, *b.* bud (opened from herbarium specimen), × 5, *c.* fruit, × 5, *d.* large leaf from mature specimen, × ½ (*a* SHAIK MOKIM 851, *b* JUNGHUHN *s.n.*, *c* POSTHUMUS *s.n.*). →

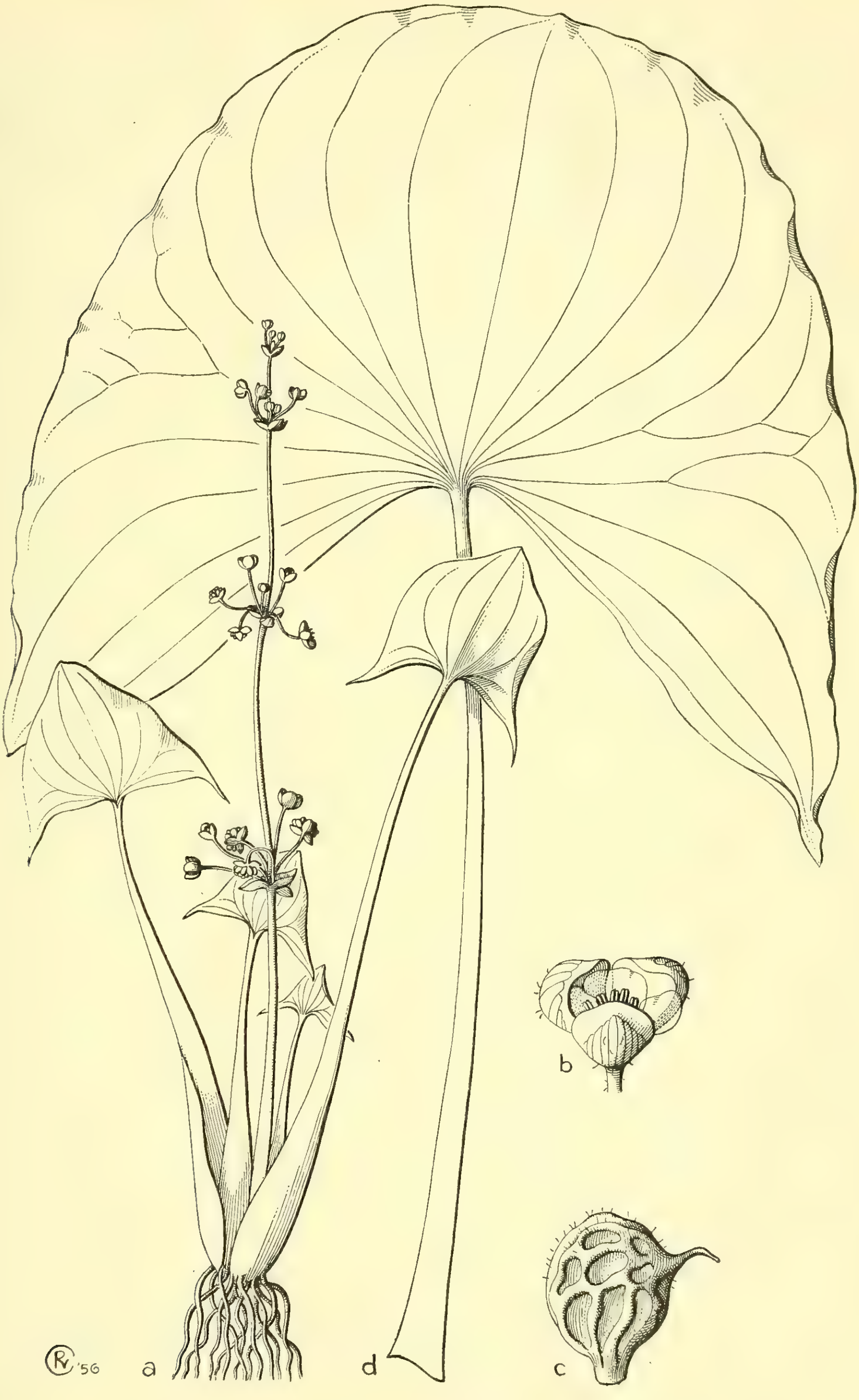

Fig. 4. *Limnophyton obtusifolium* (L.) MIQ. For legend see base of opposite page.

2. LIMNOPHYTON

MIQUEL, Fl. Ind. Bat. 3 (1855) 242; B. & H. Gen. Pl. 3 (1883) 1005; BUCHENAU, Pfl. R. Heft 16^2 (1903) 21.—**Fig. 4.**

Basal *leaves* sagittate. *Panicle* pyramidal with branches and flowers in ∞-merous, 3-bracteate whorls; lower whorls with bisexual flowers, upper ones ♂. *Sepals* reflexed after anthesis. *Petals* white. *Stamens* 6, in pairs opposite the sepals; filaments strongly broadened towards the base. *Carpels* 15-∞, crowded on a small receptacle. *Achene* swollen; exocarp spongy, endocarp hardly sclerenchymatic, with on both sides a lateral air-chamber between the endo- and exocarp. *Seed* horseshoe- shaped.

Distr. Possibly monospecific; palaeotropics, from Africa & Madagascar eastward as far as *Malaysia* (Timor).

Note. From Africa a few other species than the present one have been described which possibly represent only forms of the one treated here. *L. parviflorum* PETER matches *Caldesia sagittarioides* OSTENF. from Indo-China and apparently represents a juvenile flowering form. Such forms are well known to occur in water plants and have often been described as separate species, *cf.* under *Monochoria* (Fl. Mal. 4, p. 258) and *Tenagocharis* (*ibid.* 5, p. 118).

1. **Limnophyton obtusifolium** (L.) MIQ. Fl. Ind. Bat. 3 (1855) 242; MICHELI, in DC. Mon. Phan. 3 (1881) 39; HOOK. *f.* Fl. Br. Ind. 6 (1893) 560; in TRIM. Fl. Ceyl. 4 (1898) 370; THISELTON-DYER, Fl. Trop. Afr. 8 (1901) 209; BUCH. Pfl. R. Heft 16^2 (1903) 22, f. 10; BACKER, Handb. Fl. Jav. 1 (1925) 53; COERT, Trop. Natuur 23 (1934) 7; GAGNEP. Fl. Gén. I.-C. 6 (1942) 1207; PERRIER DE LA BÂTHIE, Fl. Mad. fam. 25 (1946) 9, f. I 7–13; BACKER, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 204, p. 3.—*Culi tamara* RHEEDE, Hort. Mal. 11, t. 45.—*Sagittaria obtusifolia* LINNÉ, Sp. Pl. (1753) 993.—*Alisma sagittifolium* WILLD. Sp. Pl. ed. 4, 2 (1799) 277; KUNTH, En. Pl. 3 (1841) 151.—*Alisma kotschyi* HOCHST. *ex* A. BRAUN in Flora 26 (1843) 499. —*Alisma obtusifolium* THWAITES, En. Pl. Zeyl. (1864) 332.—*Dipseudochorion sagittifolium* BUCH. Flora 48 (1865) 245.—*Caldesia sagittarioides* OSTENF. Philip. J. Sc. 9 (1914) Bot. 259; SAMUELSSON, Svensk Bot. Tidskr. 24 (1930) 113.—*L. parviflorum* PETER, Abh. Ges. Wiss. Göttingen 13 (1928) 41; in Fedde, Rep. Beih. 40 (1938) 119.—**Fig. 4.**

Robust, possibly annual. *Leaves* floating, pellucid-punctate, broadly sagittate, with blunt, rounded or emarginate apex (in extra-Mal. sometimes broad-acute or apiculate), basal lobes broad-triangular very acutely tipped, $12\frac{1}{2}$–13 cm (measured along midrib) by 20–23 cm (greatest width); nerves 17–19, upper ones directed towards the apex, the others radiating towards the basal lobes, the 4th and sometimes also the 5th pair branched, all connected by parallel veins under an angle of 60° and 3–6 mm spaced, again connected by reticulate veins 2nd order; petiole sparsely patent-short hairy, ribbed with longitudinal septate air-channels, septations distinct in dried young specimens. To 80 cm long. *Peduncle* erect, sparsely patent hairy, angular, strongly ribbed, with longitudinal air-channels. *Panicle* pyramidal, flowers in whorls of 13–18, the lowest whorl in addition with 3–4 lateral branches. Bracts up to 3 cm long, lanceolate acuminate, mostly reflexed. Pedicels 2–$4\frac{1}{2}$ cm, mostly reflexed after anthesis. *Sepals* elliptic, bluntly rounded, in the bisexual flowers $5\frac{1}{2}$–7 by $3\frac{1}{2}$–4 mm, in the ♂ flowers 4–$4\frac{1}{2}$ by $2\frac{1}{2}$ mm. *Petals* white, in bud orbicular to broad-elliptic, larger than the sepals, short-unguiculate, extremely delicate, in ☿ flowers larger than in the ♂ flowers. *Stamens* 6, in the ☿ flowers those of each pair spaced one before each margin of a petal, in the ♂ flowers the bases of the filaments touching; filaments 2 mm, broadened and thickened towards the base; anthers $1\frac{1}{3}$ by $\frac{3}{4}$ mm. *Carpels* 15–20, obovate, laterally compressed, provided with some reticulate, scarious ribs, $1\frac{1}{2}$–3 mm; style subterminal; stigma knob-shaped, feebly lobed, glandular-papillose. *Achenes* obovate with cuneate base, 4–5(–8) mm, with a fine reticulation of scarious ribs, short-beaked. *Seed* 4 mm long.

Distr. From tropical Africa & Madagascar through Southeast Asia (India, Ceylon, Annam) to *Malaysia:* W.-E. Java (Depok; Rawah Bening near Tulungagung, Kediri; Babad, W of Mt Lamongan), Lesser Sunda Islands (Timor: near Niki Niki). Fig. 3.

RIDLEY has recorded this species from the Malay Peninsula: 'a small pool, Pulau Tawar, Pahang' (Trans. Linn. Soc. Lond. II, 3 (1893) 385) but has in his subsequent revisions omitted this record which appeared to be a misidentification for *Sagittaria guayanensis.*

Ecol. In swamps and pools below 600 m, according to COERT *l.c.* only growing in a certain period of the year and terrestrial parts dying off in the other part of the year, in Timor found in a small lake drying up in the dry season, *fl. fr.* April–Aug.

Note. Under unfavourable circumstances growth in specimens is sometimes arrested; in these specimens the leaf-shape varies from broad-ovate with acute apex (2–3 by $1\frac{1}{2}$–$1\frac{3}{4}$ cm) to broad-sagittate with blunt or apiculate apex (2–3 by $1\frac{3}{4}$–2 cm). Such not full-grown depauperized specimens have sometimes been described as distinct species (*Caldesia sagittarioides* OSTENF., *Limnophyton parviflorum* PETER), but represent merely phenotypic forms.

3. ECHINODORUS

L. C. RICHARD, Mém. Mus. Hist. Nat. Paris 1 (1815) 365; ENGELMANN in A. Gray, Man. Bot. ed. 1 (1848) 460, *descr. emend.*; BUCHENAU, Pfl. R. Heft 16^2 (1903) 23; PICHON, Not. Syst. 12 (1946) 172; FASSETT, Rhodora 57 (1955) 133–156, 174–188, 202–212.—*Alisma sect. Echinodorus* SCHULTES, Syst. 7 (1830) 1605.—*Baldellia* PARL. Nuov. Gen. Sp. Monoc. (1854) 57.—*Sagittaria sect. Echinodorus* BAILL. Hist. Pl. 12 (1894) 84.—*Ranalisma* STAPF, in Hook. Ic. Pl. (1900) t. 2652; BUCH. Pfl. R. Heft 16^2 (1903) 11; HUTCHINSON, Fam. Fl. Pl. 2 (1934) 34; DALZIEL & HUTCHINSON, Fl. Trop. W. Afr. 2 (1936) 303.—**Fig. 5.**

Emerged *leaves* long-petioled, linear-lanceolate to ovate, base acuminate, blunt or cordate, submerged phyllodes (if present) linear. *Inflorescence* racemose or a panicle with whorls, sometimes an umbel which in some species is only 1–3-flowered. Bracts 2 or 3. *Flowers* ☿. *Sepals* green, dorsally striped or grooved. *Petals* delicate, often much exceeding the sepals. *Stamens* 6, 9, 12 or ∞; filaments filiform; anthers oblong. *Carpels* ∞, spirally arranged on a globular or oblong receptacle; style terminal. *Achenes* not, slightly, or strongly compressed, with lateral ribs or not, beaked. *Seeds* broad-elliptic, the testa following the hippocrepiformous seed but connate in the incision.

Distr. About 25–30 *spp.* mostly in tropical America, only 4 *spp.* in the Old World; two in Europe, one in tropical Africa [*E. humilis* (KUNTH) BUCH.], and one in tropical Southeast Asia and *Malaysia* (Malay Peninsula).

Notes. RICHARD segregated *Echinodorus* from *Alisma* in the briefest way possible '*Alismae polyandrae*' which was at that time sufficient. The 2 tropical Old World species are distinguished by strongly compressed, non-ribbed achenes and pauciflorous 1–3-flowered inflorescences with only 2 bracts; they belong to *subg. Ranalisma* (STAPF) HARTOG, *stat. nov.*, typified by the Asiatic-Malayan species.

Following PICHON (Not. Syst. 12, 1946, 173), in some recent European floras, for example that of CLAPHAM *c.s.*, the European *E. ranunculoides* (L.) ENGELM. has been distinguished as representing a monotypic, distinct genus *Baldellia* which is characterized by the occurrence of only 6 stamens; the other characters, mentioned by PICHON, cannot be maintained, because they simply do not exist. Its elevation to generic rank has been proposed without a revision of the genus as a whole and based on examination of too scant material. As a matter of fact the characters of this species can at most be classified in the subsectional level, if such a fine subdivision of the genus is deemed desirable. BUCHENAU did not give it and FASSETT, in his revision of the tropical American species, *l.c.*, has shown that among the American species there are far more important characters for sectional and subgeneric rank than can be advanced in favour of a separate generic status of the European species. Local florists should avoid such splitting as they are not in a position to judge its necessity and consequences and unduly set up nomenclature.

1. Echinodorus ridleyi STEEN. Arch. Hydrobiol. Suppl. 11 (1932) 240, footnote.—*Ranalisma rostrata* STAPF in HOOK. Ic. Pl. (1900) t. 2652; BUCH. Pfl. R. Heft 16^2 (1903) 11, f. 4; RIDLEY, Mat. Fl. Mal. Pen. (Monoc.) 2 (1907) 126; Fl. Mal. Pen. 4 (1924) 362, f. 206.—*E. rostratus* GAGNEP. Bull. Soc. Bot. Fr. 76 (1929) 274, *non* ENGELM. 1848; Fl. Gén. I.-C. 6 (1942) 1200, f. 114, 1–6.—**Fig. 5.**

Tender plant with creeping stolons (fruiting peduncles) producing new rosettes with intervals. Emerged *leaves* broad-elliptic to ovate, base rounded to slightly cordate, apex rounded blunt-apiculate, 1–3$^1/_2$ by $^2/_3$–2$^1/_2$ cm; nerves 3–5, connected by crossbar veins ascending at 60° and 1–3 mm spaced, in their turn connected by about parallel longitudinal secondary crossbar veinlets spaced $^1/_2$ mm; petiole thin, ribbed, hollow, with a basal membranous sheath, 4–20 cm long, with prominent septations spaced 4–6 mm. *Peduncle* solitary, 4–10 cm. *Umbel* 1–3-flowered, sometimes bearing turions in the place of the lateral flowers which develop 1 or 2 leaves, sustained by 2 membranous bracts, these lanceolate, slightly keeled, acutely tipped, connate at the base, both with a small dorsal rootlet at the base, 3–6 mm long. Pedicels 1–1$^3/_4$ cm. *Flowers c.* 1 cm diam. *Sepals* broad-elliptic, blunt, reflexed after anthesis, pale green, 4–6 mm long. *Petals* elliptic to obovate, white, 4–6 mm long. *Stamens* 9, in one whorl; filaments filiform, 2 mm; anthers oblong, $^1/_2$–$^3/_4$ mm. *Carpels* ∞, spirally arranged on prominent receptacle elongated after anthesis, obliquely elliptic, laterally compressed; style terminal, subulate, 1 mm. *Achenes* very obliquely obovate-orbicular, with many glands, strongly compressed laterally, broadly unequal-winged, 3–4 mm, terminal beak 2–3 mm. *Seed* elliptic, 2 mm, light brown.

Distr. Southeast Asia (Annam: Hue, SQUIRES 412) and *Malaysia:* Malay Peninsula (Selangor:

Gua Batu woods, RIDLEY 8464; SCORTECHINI 126 Herb. Mus. Perak), thrice found.

Ecol. Open muddy place in jungle (RIDLEY), in Annam collected with *Monochoria* which will have been probably in open swamps or rice-fields, *fl. fr.* July, in Annam Jan.–May.

Notes. Unfortunately I have had no material additional to the original sheets of STAPF and GAGNEPAIN, but it appeared that the morphology of this curious, obviously very rare plant has not been understood completely.

STAPF mentions mainly 1-flowered plants and

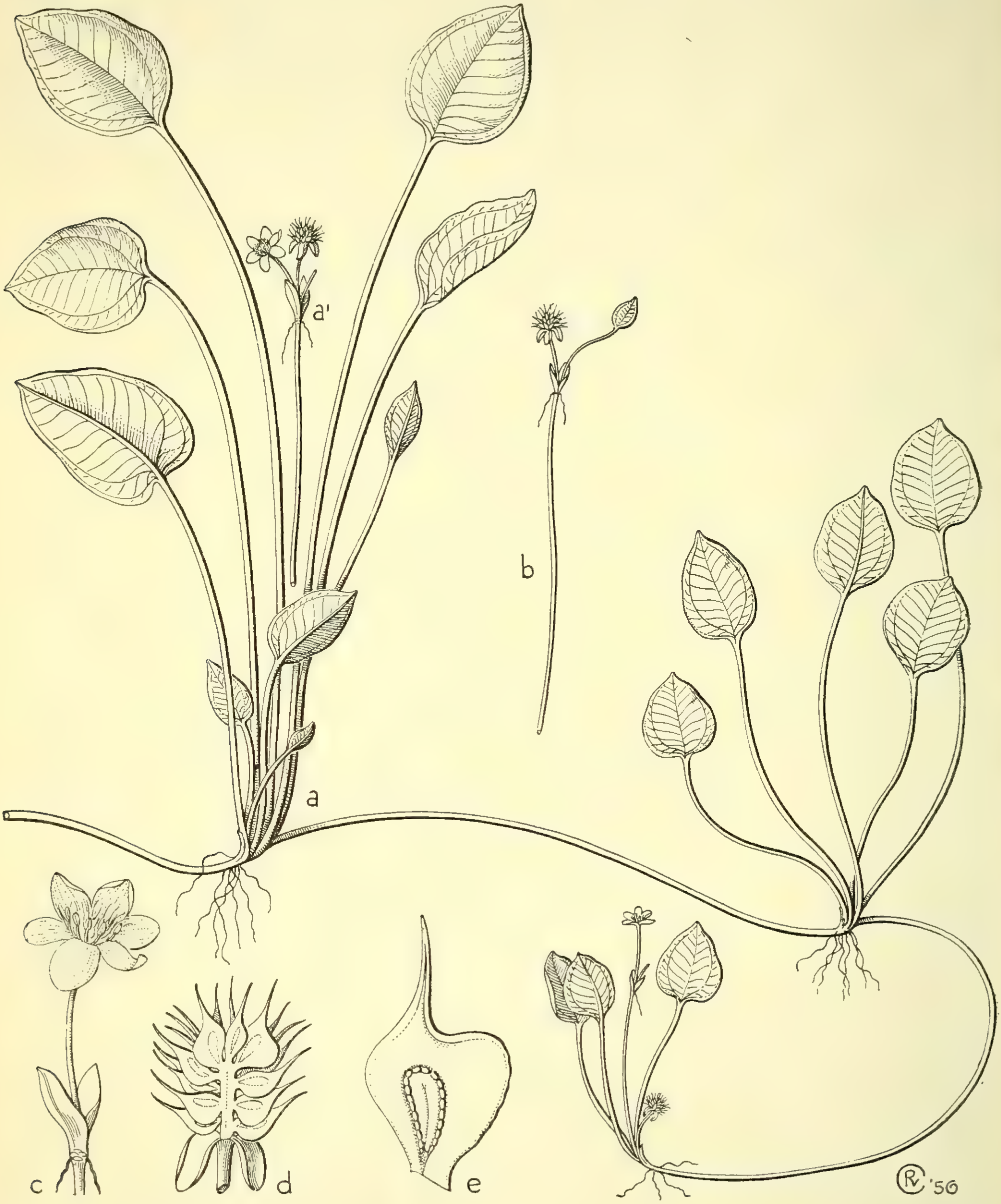

Fig. 5. *Echinodorus ridleyi* STEEN. *a*. Habit, with 2 rosettes on the pseudo-stolons, *a'*. inflorescence showing roots on bracts below two flowers (one beyond anthesis), *b. ditto*, with developing leaf, × 2/3, *c*. flower, × 2, *d*. fruiting flower, × 3, *e*. fruit, × 8 (*a–a'* partially after STAPF, partly after RIDLEY 8464, *b* SCORTECHINI 126, *c–d* after STAPF, *e* RIDLEY 8464).

GAGNEPAIN saw only 1-flowered specimens. In both cases, however, the other flowers were substituted by turions which already develop one or a few leaves (fig. 5b) while still in flower and the bracts of the umbel bear each a rootlet at the same time. Towards the fruiting stage the umbel is already transformed into a whole new plant which bends downward towards the mud. Consequently a young plant still attached to the mother rosette by the old peduncle may bear both a young peduncle and a non-peduncled, but only pedicelled fruithead (fig. 5a, end below).

From this structure it can be inferred that the peduncle after having flowered serves as a stolon forming a new plant on the place of the aging inflorescence. I have found a similar structure in the African *E. humilis*, the European *E. repens*, the American *E. radicans*, and in the European *Luronium natans*. Whether also true stolons occur in the genus is unknown and should be verified in the field.

4. SAGITTARIA

LINNÉ, Sp. Pl. 1 (1753) 993; Gen. Pl. ed. 5 (1754) 429; J. G. SMITH, Rep. Mo. Bot. Gard. 6 (1895) 27; BUCH. Pfl. R. Heft 16^2 (1903) 37; BOGIN, Mem. N.Y. Bot. Gard. 9 (1955) 188.—*Sagittaria sect. Lophiocarpus* KUNTH, En. Pl. 3 (1841) 161.—*Alisma sect. Lophiocarpus* SEUB. Fl. Bras. 3, 1 (1847) 106.—*Lophiocarpus* MIQ. Ill. Fl. Arch. Ind. (1870) 50, *non* TURCZ. 1843.—*Lophotocarpus* DURAND, Ind. Gen. Phan. (1888) 627.—**Fig. 6–12.**

Emerged *leaves* sagittate or lanceolate, floating ones mostly cordate, submerged phyllodes linear. *Inflorescence* mostly a raceme with 1–14 mostly 3-flowered whorls, each sustained by a whorl of 3, more or less connate bracts, sometimes a panicle. *Flowers* mostly unisexual: upper ones ♂, lower ones ♀ or ☿. Pedicels erect or ascending, those of ♀ flowers often thickened and reflexed after anthesis. *Sepals* reflexed in ♂ flowers, in ♀ flowers appressed, patent, or reflexed. *Petals* delicate, white or rarely pink, sometimes with purple spot at the base. *Stamens* 7–∞; filaments filiform, subulate, or dilated. *Carpels* ∞, spirally arranged in a head on a large, globular receptacle. Style terminal, erect or obliquely directed inward. *Achenes* laterally compressed, beaked, winged, mostly membranous. *Seed* horseshoe-shaped.

Distr. About 25 *spp.*, mainly in temperate and tropical America, in the Old World only 3 species native, absent from Australia and the Pacific, others introduced and partly naturalized.

Note. I agree with PICHON (Not. Syst. 12, 1946, 177) and BOGIN *l.c.* that the genus *Lophotocarpus* cannot be upheld and maintained separately from *Sagittaria*; the differences are small and only a single one holds; in my opinion they can at most be evaluated at sectional rank, as follows:

Sect. Sagittaria. Sepals in mature pistillate flowers reflexed. Pedicels mostly ascending, rarely recurved and thickening in fruit. Perfect flowers rarely present.

Sect. Lophiocarpus KUNTH, En. Pl. 3 (1841) 161.—Subg. *Lophotocarpus* BOGIN *l.c.*. Sepals in mature pistillate flowers appressed or spreading. Pedicels recurved and more or less thickened in fruit. Perfect flowers occasionally present.

KEY TO THE SPECIES

1. Mature ♀ flowers with appressed or patent sepals.
  2. Sepals of mature ♀ flowers closely appressed. Fruiting pedicels strongly thickened. Coarse plant.
    3. Water plant with floating cordate-ovate leaves. ♀ Flowers with a whorl of stamens. Achene much compressed, with broad, blunt-spiny wings, a more or less warty ridge on the lateral sides, and no prominent beak . . . . **1. S. guayanensis** *ssp.* **lappula**
    3. Emerged leaves sagittate. ♀ Flowers only exceptionally with stamens. Achene flattened, narrowly winged, without lateral ridges, but with a beak $^1/_2$–1 mm long . . . . . **2. S. montevidensis**
  2. Sepals of the mature ♀ flowers widely patent. Fruiting pedicels hardly thickened. Delicate water plant. **3. S. subulata**
1. Sepals of mature ♀ flowers with reflexed sepals.
  4. Emerged leaves linear to lanceolate. Filaments hairy.
    5. Nerves arising from the leaf-base. Bracts connate and scarious. Filaments dilated. Fruiting pedicels recurved and thickened . . . . **4. S. platyphylla**
    5. Nerves arising from the midrib. Bracts nearly free, thick and striped. Filaments filiform. Fruiting pedicels ascending, not thickened . . . . **5. S. lancifolia**
  4. Emerged leaves sagittate. Stamens glabrous . . . . **6. S. sagittifolia** *ssp.* **leucopetala**

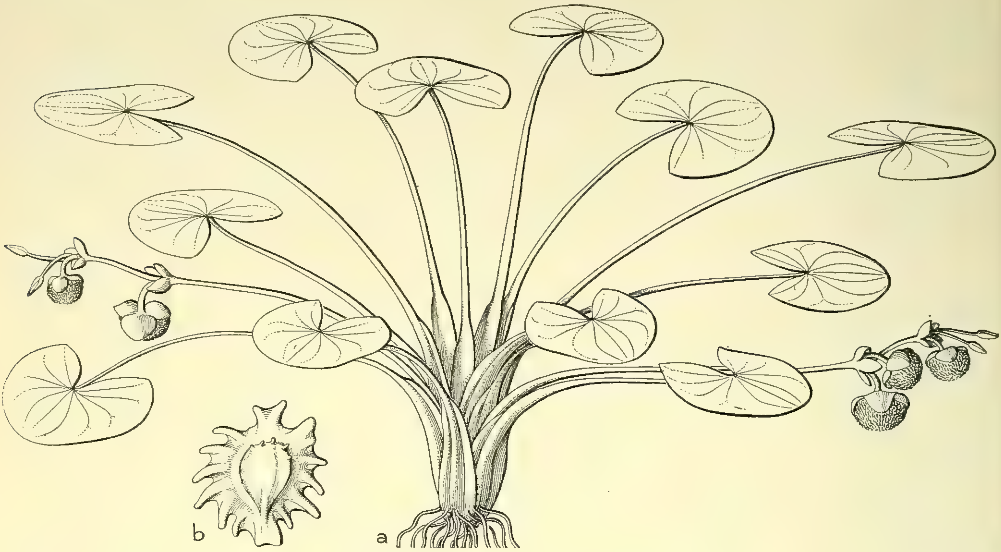

Fig. 6. *Sagittaria guayanensis* H.B.K. *ssp. lappula* (D. DON) BOGIN. *a.* Plant × $^2/_5$, *b.* fruit, × 4 (SCHIFFNER 1482).

1. Sagittaria guayanensis H.B.K. Nov. Gen. Sp. 1 (1816) 250.

I perfectly agree with BOGIN (*l.c.* 192) that only 2 subspecies can be distinguished, and not 4 as was proposed by BUCHENAU, *viz:*
ssp. guayanensis: Achenes plump, $1^1/_2$–$2^1/_2$ by $1^1/_4$–2 mm, wings shallowly crested, occasionally smooth, faces 1–3-winged, typically strongly echinate, occasionally smooth or unadorned. —Throughout tropical America.
ssp. lappula (D. DON) BOGIN, *l.c.:* Achenes compressed, $2^1/_2$–4 by $1^3/_4$–3 mm, wings typically deeply crested, rarely nearly smooth, their faces usually prominently 1-ribbed, the rib occasionally remotely echinate, rarely unadorned.—Tropics of Africa, Asia, and Malaysia, see below.

The original spelling *guayanensis* for the epithet has been retained here, though many recent authors have followed BUCHENAU who, for reasons of easy pronunciation, changed it into *guyanensis.*

ssp. **lappula** (D. DON) BOGIN, Mem. N.Y. Bot. Gard. 9 (1955) 192, f. 5.—*S. lappula* D. DON, Prod. Fl. Nep. (1825) 22.—*S. pusilla* BL. En. Pl. Jav. 1 (1827) 34, *non* NUTT. 1818; ZOLL. Syst. Verz. (1854) 65.—*S. cordifolia* ROXB. Fl. Ind. ed. CAREY 3 (1832) 647.—*S. blumei* KUNTH, En. Pl. 3 (1841) 158.—*S. obtusissima* HASSK. Cat. Pl. Hort. Bog. (1844) 26.—*Lophiocarpus cordifolius* MIQ. Illustr. (1870) 50; BUCH. Abh. Naturw. Ver. Bremen 7 (1880) 30, *incl. var. madagascariensis.—Lophiocarpus lappula* MIQ. *l.c.*.—*Lophiocarpus guayanensis* MICHELI, in DC. Mon. Phan. 3 (1881) 62; GAGN. Fl. Gén. I.-C. 6 (1942) 1201, f. 114, 7–12. —*S. guayanensis* H.B.K.; HOOK. *f.* Fl. Br. Ind. 6 (1893) 561; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 2 (1907) 127; Fl. Mal. Pen. 4 (1924) 363; HEND. Mal. Wild Fl. (Monoc.) (1954) 202, f. 120A.—*Lophotocarpus guayanensis* J. G. SMITH, Rep. Mo. Bot. Gard. 6 (1895) 61, *pro specim. geront.*; THISELTON-DYER, Fl. Trop. Afr. 8 (1901) 210; *pro var. lappula et var. madagascariensis* BUCH. Pfl. R. Heft 16^2 (1903) 36, f. 12 B-C; KOORDERS, Exk. Fl. Java 1 (1911) 92; BACKER, Handb. Fl. Java 1 (1925) 54; BACKER, Onkr. Suiker. (1928) 20, Atlas t. 26; PERRIER DE LA BÂTHIE, Fl. Mad. fam. 25 (1946) 4, f. II 4–5; BACKER, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 204, p. 3.—*Lophotocarpus formosanus* HAYATA, Ic. Pl. Form. 5 (1915) 249.—**Fig. 6.**

Laticiferous water plant. *Leaves* floating, ovate with rounded or emarginate apex, base deeply cordate, basal lobes obtuse, $1^1/_2$–$6^1/_2$ cm long measured along the midrib, greatest width $2^1/_2$–$10^1/_2$ cm; submerged phyllodes sometimes present, linear to lanceolate, shortly petioled, 5–11 by $^1/_3$–$^1/_2$ cm; nerves 15–17, prominent on the undersurface, the inner 6–8 directed apically, the others towards the lobes, on the undersurface connected by parallel cross-veins under an angle of *c.* 70° spaced 1–2 mm, upper surface with veins densely reticulate; petiole ribbed, *c.* 15–30 cm with air-channels and *in sicco* prominent septations spaced 2–4 mm; sheath with a broad scarious margin. *Peduncles* 1–7, rather flaccid, floating, ribbed, with wide air-channels, short-patent hairy towards the apex incl. the raceme 15–40 cm. *Racemes c.* $^1/_3$ as long as the peduncle, with 2–6 whorls of 2–3 flowers; 1–4 lower whorls with ☿ flowers, the upper ones ♂. Bracts 3 in each whorl, broad-elliptic, connate, rounded at the top, green with scarious margin, $^4/_5$–2 cm long. Pedicels up to 1 cm, after anthesis thickened and recurved. *Sepals* broadly triangular-ovate, blunt, keeled, 8–11 by 7–10 mm. *Petals* obovate to orbicular, very broadly rounded at the apex, delicate, white with sometimes a small purple spot above the yellowish base, 12–15(–18) mm. *Stamens* in the ☿ flowers 8–12, in an interrupted whorl grouped opposite to the sepals, in the ♂ flowers 6–10, in a whorl, exceeding the rudiments of the pistils, filaments 2–3 mm, much dilated and flattened towards the base, fine-papillose; anthers oblong, 1½ by ¾ mm. *Carpels* ∞, elliptic to suborbicular, with a dorsal and a ventral, undulate, membranous crest; style terminal directed inward, *c.* 1 mm; stigma punctiform. *Achenes* ∞, 3–4 mm, elliptic, short-stalked, with broad, blunt-spiny crest, spines connected by a thin membrane, *c.* 1 mm high; lateral ridges without or with minute warts; beak broadly scarious-margined; exocarp with a very fine reticulate relief. *Seed* brown, 1½ mm.

Distr. Tropics of Africa and Southeast to East Asia (also Formosa), in *Malaysia:* Sumatra, Malay Peninsula, Java & Madura Isl., Celebes.

Ecol. Ditches and wet rice-fields, 10–1000 m, often in great quantity, *fl.* Jan.–Dec. Flowers are closed in the morning, open at noon or somewhat later but never very widely, and close at dusk.

Vern. *Kĕladi ajer, kĕlipok padang*, Mal. Pen., *ètjèng, S.*

Note. The data on the colour of the flowers have been copied from BACKER; no field notes are available. It seems that the presence or absence of a basal, purple spot on the petals is not geographically (racially) defined as is the case in *S. sagittifolia* (see p. 332).

2. Sagittaria montevidensis CHAM. & SCHLECHTEND. Linnaea 2 (1827) 156; MICHELI in DC. Mon. Phan. 3 (1881) 75; J. G. SMITH, Rep. Mo. Bot. Gard. 6 (1895) 57, t. 29; BUCH. Pfl. R. Heft 16^2 (1903) 43; BACKER, Ann. Jard. Bot. Btzg Suppl. 3 (1909) 413; SMALL, N. Am. Fl. 17 (1909) 62; VAN WELSEM, Trop. Natuur 4 (1915) 174, f. 109–110; BACKER, Handb. Fl. Java 1 (1925) 55; BRUGGEMAN, Ind. Tuinb. (1939) 168, f. 181; BACKER, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 204, p. 4; BOGIN, Mem. N.Y. Bot. Gard. 9 (1955) 195, f. 2 e–f.

Robust, glabrous, with stolons ending in a tuberous thickened apex. *Leaves* emerged, erect, sagittate; terminal lobe very broad-ovate, apex broad-acute to acuminate, 4–20 cm long measured along the midrib, width near leaf-base 2–25 cm; basal lobes lanceolate to broad-ensiform, ending in very narrow ends, 4–25 cm long, about half as wide as the terminal lobe; nerves in the terminal lobe 9–15, in the basal lobes 6–8, connected by parallel cross-veins under an angle of 60°, spaced 2–5 mm, again connected by reticulate veinlets; petiole nearly terete, ribbed, with longitudinal air-channels, with septations 3–5 mm spaced. *Peduncles* robust, erect, blunt-angled to terete, ribbed, with longitudinal air-channels, septations 5–7 mm apart. *Raceme* 40–50 cm long, with 14 whorls of 3–6 flowers, the lowest whorl besides sometimes with 1–2 branches, lowest 2–4 whorls ♀, other ♂. Bracts connate, keeled, scarious, the free parts attenuate, lanceolate, 1–1½ cm long. Pedicels of the ♀ flowers recurved and thickened after anthesis 2–7 cm, those of the ♂ flowers obliquely erect, thin, *c.* 4 cm. *Sepals* elliptic to obovate, with scarious margin, 8–11 by 4–5 mm, appressed, accrescent to 15 mm. *Petals* transversely elliptic, faintly sinuate at the apex, campanulately bent together, 18–22 by 22–28 mm, white with a rather large, dark-red yellow-margined spot, the coloured part persistent after flowering. *Stamens* ∞; filaments 2–3 mm, filiform, often slightly dilated, faintly hairy; anthers 1½ by ½ mm, oblong. *Carpels* ∞, elliptic; style terminal ½–1 mm; stigma punctiform. *Achenes* obovate to elliptic, 2–3 by 1–1½ mm, dorsally and ventrally narrowly winged, with 1 dorsal resin duct; beak terminal, ½–1 mm, obliquely erect adaxially. *Seed* red-brown, 1½–2 mm.

Distr. Native of South America, in *Malaysia:* adventive along the bank of a canal near Djakarta, first found in 1903 (BACKER *l.c.*). According to BRUGGEMAN also cultivated in the botanic gardens at Tjibodas and Sibolangit; *fl.* Jan.–Dec.

Note. Several authors have recorded the occurrence of rudimentary carpels in ♂ flowers and a whorl of 9–12 stamens in ♀ flowers. I could not observe this in the Javan specimens. The latter belong to *ssp. montevidensis.*

3. Sagittaria subulata (L.) BUCH. Abh. Naturw. Ver. Bremen 2 (1871) 490; J. G. SMITH, Rep. Mo. Bot. Gard. 6 (1895) 44, t. 13; BUCH. Pfl. R. Heft 16^2 (1903) 58; SMALL, N. Am. Fl. 17 (1909) 52; BACKER, Handb. Fl. Java 1 (1925) 55; BACKER, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 204, p. 4; BOGIN, Mem. N.Y. Bot. Gard. 9 (1955) 203, f. 10 a–c.—*Alisma subulata* LINNÉ, Sp. Pl. 1 (1753) 343.—*Echinodorus subulatus* ENGELM. in A. Gray, Man. Bot. (1848) 460.—**Fig. 7.**

Delicate water plant with long, subterranean stolons and tubers. Submerged phyllodes linear, 10–30 cm by ½–1 mm; floating *leaves* often absent, if present lanceolate or elliptic, base rounded, blunt or cuneate, apex blunt or rounded, 2½–5 cm long; nerves 5, connected by not very distinct cross-bar veins ascending at 45° and 1–2½ mm spaced, these in turn connected by fine-reticulate veinlets; petiole with longitudinal air-channels, and *in sicco* prominent septation 1½–6 mm spaced; sheath scarious-margined. *Inflorescences* 1–2, flaccid, submerged, 10–40 cm long, flowers in anthesis just above the water. Raceme consisting of 2–14 whorls of 3 flowers, only 2 flowers of the lowest whorl ♀, the others ♂. Bracts spathulate, connate, the free ends 6 mm. Pedicels of the ♀ flowers rather thick, after anthesis somewhat thickened, wide-patent or recurved, in the ♂ flowers slender, 1½–3½ cm. *Sepals* after anthesis wide-patent, broad-elliptic, broad-acute, 2–3 by 1–1½ mm. *Petals* clear white, broad-ovate, ½–1 cm long. *Stamens* mostly 7 (rarely 8 or 13), one central surrounded by a whorl of the others (rarely 2 whorls); filaments glabrous, thickened at the base, ⅔–1 mm; anthers oblong, ½–⅗ mm. *Achenes* ∞, rather thick, obovate, with a narrow dorsal and ventral wing and on both sides narrow, faintly crenate, lateral wings; beak terminal, ensiform, obliquely directed adaxially, ⅕–⅖ mm. *Seed* pale brown.

Distr. East North America (Massachusetts to Florida), introduced in *Malaysia:* Java (BACKER *l.c.*).

Ecol. Cultivated in Java in shallow water tanks and fishponds, *fl.* Jan.–Dec.

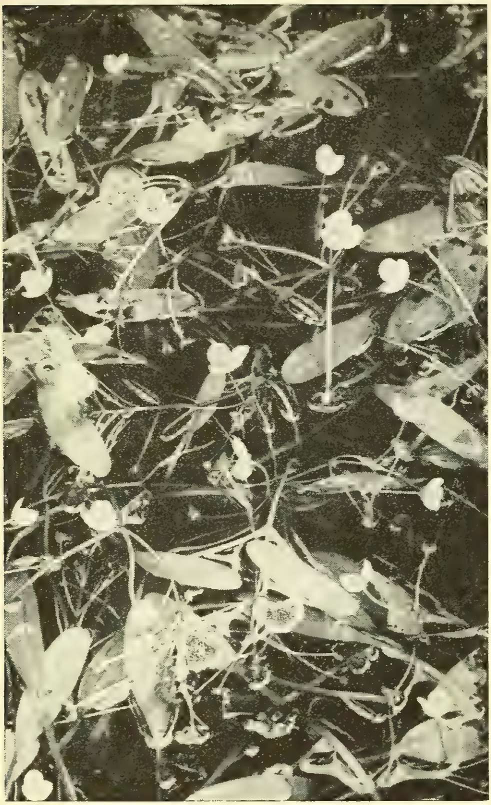

Fig. 7. *Sagittaria subulata* (L.) BUCH. Cultivated in Kebun Raya Indonesia (photogr. F. HUYSMANS).

Note. Description made from data by BACKER *l.c.* and from additional American material. According to the description given by BACKER the material cultivated in Malaysia belongs to *ssp. subulata*.

4. Sagittaria platyphylla (ENGELM.) J. G. SMITH, Rep. Mo. Bot. Gard. 6 (1895) 55, t. 26: BUCH. Pfl. R. Heft 16^2 (1903) 57; SMALL, N. Am. Fl. 17 (1909) 53; KERN, Trop. Natuur 32 (1952) 127 *cum fig.*—*S. graminea* MICHX. *var. platyphylla* ENGELM. in A. Gray, Man. ed. 5 (1867) 494; MICHELI in DC. Mon. Phan. 3 (1881) 70; BOGIN, Mem. N.Y. Bot. Gard. 9 (1955) 208, f. 11 a–c.—**Fig. 8.**

Perennial, glabrous, with subterranean stolons. Emerged *leaves* erect, narrow-elliptic to lanceolate, acute, gradually narrowed towards the base, 5$^{1}/_{2}$–10 by 1–3 cm; in extra-Mal. specim. also phyllodes; nerves 5–7, arising at the leaf-base, prominent on the undersurface, connected by parallel cross-veins spaced *c.* 1 mm under an angle of *c.* 45°; petiole sharply triangular, narrowly winged, ribbed, with air-channels, 25–40 cm *in sicco* with distinct septations *c.* 5–7 mm spaced; sheath broad. *Peduncles* erect, very bluntly triangular, with air-channels, incl. the raceme 30–40 cm. *Raceme* about $^{1}/_{4}$ as long as the peduncle, with 4–6 whorls of 3 flowers, the lower 2 whorls ♀, the others ♂. Bracts connate, broad-ovate to suborbicular, obtuse, margin scarious, *c.* 3–4 mm. Pedicels 8–20 mm, obliquely erect, fruiting pedicels recurved and strongly thickened. *Flowers c.* 2 cm diam. *Sepals* blunt elliptic, broadly scarious-margined, recurved after anthesis, 4–4$^{1}/_{2}$ mm long. *Petals* white, transverse elliptic, short-unguiculate, slightly sinuate at the apex, 10 by 13 mm. *Stamens* 12–18; filaments *c.* 1 mm, strongly dilated, flattened, slightly hairy; anthers oblong, $^{4}/_{5}$–1 mm. *Carpels* ∞, obliquely elliptic, 1 mm; style apical though ventrally inserted, sometimes curved; stigma punctiform. *Fruiting heads* globular, 8–10 mm. *Achenes* obovate, 2 by 1 mm, dorsally and ventrally winged, with 2 additional dorso-lateral ribs, slightly compressed; beak $^{1}/_{3}$ mm, apical, obliquely erected inward. *Seed* pale brown.

Distr. Native in North America (Mississippi & Gulf of Mexico), introduced in *Malaysia:* West Java (Dèpok; Bogor).

Ecol. In wet rice-fields, between Djakarta and Bogor, up to 250 m, found for the first time by J. H. KERN *l.c.* in 1950; almost certainly escaped from plants formerly cultivated in the Botanic Gardens, Bogor.

5. Sagittaria lancifolia LINNÉ, Syst. Nat. ed. 10, 2 (1759) 1270; MICHELI in DC. Mon. Phan. 3 (1881) 73, *pro var. major*; J. G. SMITH, Rep. Mo. Bot. Gard. 6 (1895) 47, t. 16; BUCH. Pfl. R. Heft 16^2 (1903) 52; SMALL, N. Am. Fl. 17 (1909) 57; BACKER, Handb. Fl. Java 1 (1925) 55; BRUGGEMAN, Ind. Tuinb. (1939) 168, f. 180; BACKER, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 204, p. 4; BOGIN, Mem. N.Y. Bot. Gard. 9 (1955) 214, f. 15 a–c.—**Fig. 9–10.**

Robust, glabrous. Emerged *leaves* erect, oblong-lanceolate, acute, gradually narrowed towards the base, thickish, pale green, 20–60 by 6–20 cm; phyllodes linear; nerves 5–11 of which 4–10 arise from the midrib, prominent beneath, connected by *c.* 1 mm spaced, parallel veins under an angle of 60–70°; petiole robust, 50–80 cm, blunt-triangular, ribbed, with air-channels, *in sicco* prominent septations spaced 3–4 mm; sheath broad. *Peduncle* hollow, ribbed, incl. the raceme 1–2$^{1}/_{2}$ m. *Raceme* consisting of 3–12 whorls of 3 flowers, the lower 1–4 whorls ♀, the others ♂; occasionally a few branches from the lowest whorl. Bracts more or less connate at the base, 8–20 mm, oblong to broad-triangular, very acute towards the apex, thickish, parallel-striped. Pedicels in ♀ 2$^{1}/_{2}$–7$^{1}/_{2}$ cm, ascending, slender. *Sepals* ovate, thickened, 8–12 mm, recurved after anthesis. *Petals* obovate, white, *c.* 16–25 mm. *Stamens* ∞; filaments hairy, filiform, slightly thickened at the base, 3–4 mm;

anthers oblong, 1½–2 by ⅓–½ mm. *Carpels* ∞, elliptic, dorsally and ventrally with a scarious wing, incl. the style *c.* 1 mm; style ⅓–½ mm, apical, thick; stigma punctiform. *Achenes* obovate to falcate with a broad dorsal, a narrow ventral, and 2 lateral wings, 1½–2¼ by ⅘–1.1 mm; beak obliquely attached, thick, ½ mm. *Seed* red-brown, *c.* 1 mm.

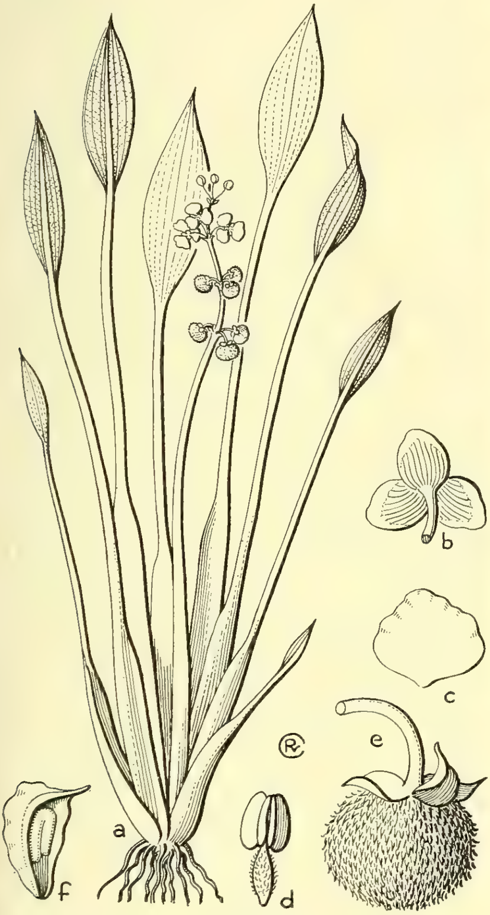

Fig. 8. *Sagittaria platyphylla* (ENGELM.) J. G. SMITH. *a.* Habit × ¼, *b.* calyx, × 3, *c.* petal, nat. size, *d.* stamen, × 7, *e.* fruiting flower, × 3, *f.* fruit. × 7 (KERN 12677).

Distr. Native in tropical South America (from the Amazon to Florida), introduced in *Malaysia:* W. Java.

Ecol. Escaped in small quantities from the Botanic Gardens, Bogor, 250 m. According to BRUGGEMAN also cultivated; *fl.* Jan.–Dec.

Note. The description has been made after American material. According to the description by BACKER (1925 *l.c.*) the material cultivated in Java belongs to *ssp. lancifolia.*

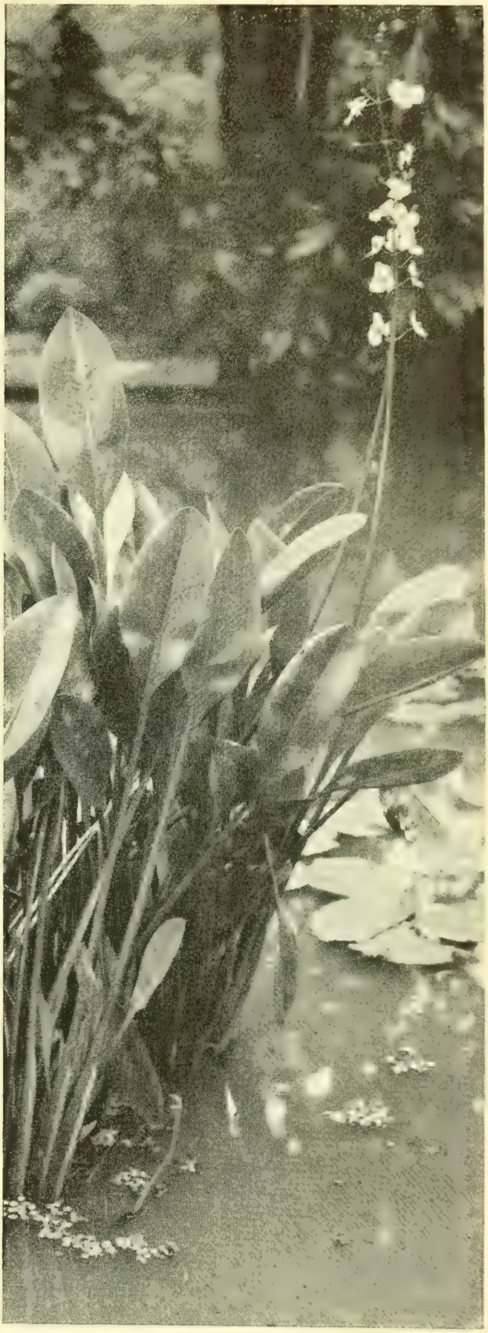

Fig. 9. *Sagittaria lancifolia* L. Cultivated in Kebun Raya Indonesia (photogr. F. HUYSMANS).

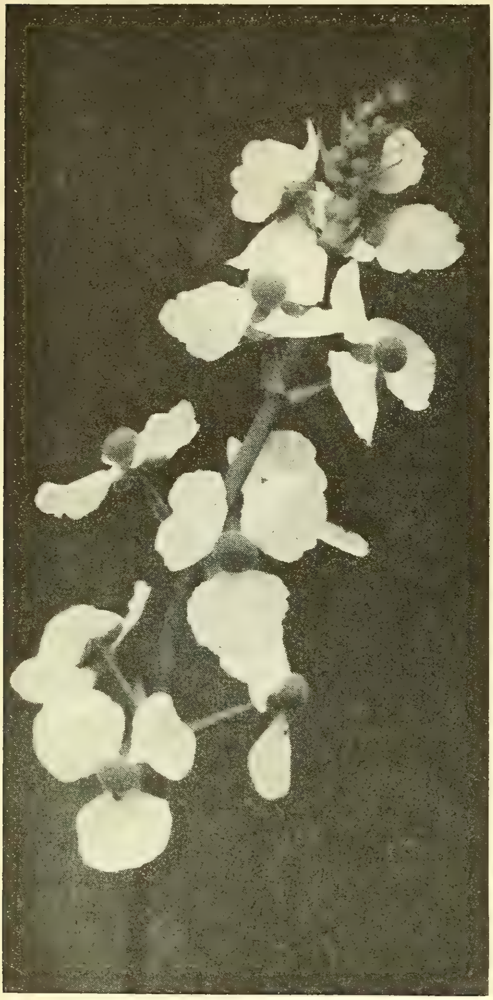

Fig. 10. *Sagittaria lancifolia* L. Detail of inflorescence of fig. 9 (photogr. F. HUYSMANS).

6. Sagittaria sagittifolia LINNÉ, Sp. Pl. 2 (1753) 993.

In European and N. Asian specimens, E in Siberia to long. 105°, the petals are white with a distinct, purple or carmine, basal spot, the anthers are purple or carmine, the sepals are appressed or spreading after anthesis, and the basal lobes of the leaves are blunt at the extreme tip.

The South & East Asian and Malaysian specimens are distinct by pure white petals, yellow anthers, sepals reflexed after anthesis, and basal lobes of the leaves ending in a very acute, needle-like tip.

These characters suffice to recognize two taxa, geographically excluding each other, one temperate and one warm-temperate to tropical to which GLÜCK (*vide infra*) assigns specific rank, whereas BOGIN did not distinguish them. They are here accepted to represent two distinct geographical races, hence of subspecific rank; their distribution has been well mapped by GLÜCK.

ssp. **leucopetala** (MIQ.) HARTOG, *comb. nov.*—*S. trifolia* L. Sp. Pl. 2 (1753) 933.—*S. sagittata* THUNB. Fl. Jap. (1784) 242.—*S. obtusa* THUNB. Fl. Jap. (1784) 242.—*S. sinensis* SIMS, Bot. Mag. 39 (1814) t. 1631; GLÜCK, Ann. R. Bot. Gard. Calc. 150th Ann. vol. (1942) 59–90, f. 1–23.—*S. hirundinacea* Bl. En. Pl. Java 1 (1827) 34; HASSK. Tijd. Nat. Gesch. Phys. 9 (1842) 133; Cat. Hort. Bog. (1844) 26; Pl. Jav. Rar. (1848) 103; MIQ. Fl. Ind. Bat. 3 (1855) 241.—*Alisma sagittifolium* LLANOS, Fragm. Pl. Filip. (1851) 69, *non* WILLD. 1799; F.-VILL. & NAVES, in Blanco, Fl. Filip. ed. 3, 4^1 (1880) 51.—*S. sagittifolia var. leucopetala* MIQ. Ill. Fl. Arch. Ind. 2 (1870) 49; BUCH. Pfl. R. Heft 16^2 (1903) 48; BACKER, Handb. Fl. Java 1 (1925) 55; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 204, p. 4.—*S. sagittifolia* L.; MERR. Philip. J. Sc. 2 (1907) Bot. 421; Sp. Blanc. (1918) 58; En. Philip. 1 (1922) 25 (*sagittaefolia*); OCHSE & BAKH. Ind. Groent. (1931) 8, f. 6: GAGNEP. Fl. Gén. I.-C. 6 (1942) 1203, f. 115, 1–5.—*S. leucopetala* BERGMANS, Vaste Pl. & Rotsheesters (1924) 479.—**Fig. 11–12.**

Glabrous, laticiferous. Emerged *leaves* erect, sagittate, with linear to lanceolate lobes; terminal lobe acutely attenuate, 4–9$^1/_2$ cm long measured along midrib, 1–3 cm wide; basal lobes with needle-like tips, 1–1$^1/_2$(–2) times as long as the terminal one, as wide as it; nerves in the terminal lobes 5–7(–9), in the basal ones 4(–5), connected by ± parallel cross-veins under an angle of 45–70°, these connected again by veinlets parallel with the main nerves; petiole sharply triangular, ribbed, with air-channels, 20–60 cm, septations *c.* 4–5 mm spaced *in sicco* distinctly prominent; sheath with broad scarious margin. *Peduncles* 1–5, erect, sharply triangular, often hexa- or polygonal, incl. the raceme 25–50(–90) cm. *Raceme* $^1/_3$–$^1/_2$ as long as the peduncle, with 2–6 whorls of 3 flowers, 1–3 lower whorls ♀ and mostly with 1–2 lateral branches, the other flowers ♂. Bracts only slightly connate at the base, broad-elliptic, acute, keeled, scarious-margined, 7 mm. Pedicels obliquely erect, $^1/_2$–1$^1/_2$ cm, in ♀ thicker than in ♂. *Sepals* broad-elliptic to suborbicular, blunt with scarious margins, 3–6 by 2$^1/_2$–4 mm, after anthesis reflexed. *Petals* white, without a basal purple spot, suborbicular to broad-elliptic, much larger than the sepals (12–15 mm *sec.* BACKER), unguiculate. *Stamens* ∞, filaments glabrous, about as long as the anthers; anthers yellow, oblong, 1$^1/_2$ by $^3/_4$ mm. *Carpels* ∞, ovate, incl. the style *c.* 1 mm; style terminal, sometimes slightly curved; stigma punctiform. *Fruiting heads* globular, *c.* 1 cm. *Achenes* obovate, 3–5 by 1$^1/_2$–3 mm, with a broad dorsal and ventral wing, sides smooth; beak apical, straight, *c.* $^1/_2$ mm. *Seed* light brown, 1$^1/_2$ mm.

Distr. From the SE. corners of the Black Sea and of Arabia eastward and southward to Japan and Malaysia, the N. border approximately between lat. 40–50° (GLÜCK, *l.c.*, fig. 23), in *Malaysia:* apparently indigenous only in N. Sumatra, SW. &

Central Celebes, and the Philippines (Mindanao, Samar, Leyte, Catanduanes, Luzon), introduced in Java, Borneo, and the Malay Peninsula, and in Australia, the Pacific, and ?N. America.

Ecol. In swamps and wet rice-fields, of very local occurrence, surprisingly rare, up to 1050 m, *fl.* Jan.–Dec.

Uses. Besides the native plant, there occurs an imported form or strain of *Sagittaria sagittifolia* in Malaysia, which has everywhere been imported by the Chinese. This has been described as *S. sinensis* SIMS and is cultivated in China partly as fodder for pigs (the whole plant), partly for the starch-containing, edible tubers which are produced on the ends of stolons. This plant is much coarser generally than the wild arrow-head and BURKILL (Dict. 1935, 1942), who calls it *var. sinensis*, says that the Chinese brought it to the north of Malaya, where its cultivation is steadily increasing southwards from Wellesley to Perak, Pahang, and Selangor, for the sake of the edible tubers, the plants being fed to pigs.

Some authors assume this form to flower rarely. Taxonomically it is generally considered to belong to *S. sagittifolia* and has even not been distinguished as a distinct variety in recent monographs.

The same form was apparently cultivated much earlier by the Chinese in Banka where KURZ (Nat. Tijd. N.I. 27, 1864, 221) records it from Chinese settlements round Muntok. This was also mentioned by HEYNE (Nutt. Pl. 1927, 139) and it was described and figured by OCHSE & BAKHUIZEN VAN DEN BRINK *l.c.*, who say it is rarely cultivated by Chinese near Djakarta, producing tubers 3–6 by 2–3$^{1}/_{2}$ cm on 15–35 cm long stolons.

Chinese in the Philippines equally cultivate this edible form, according to W. H. BROWN (Useful Pl. Philip. 1, 1950, 87), for the tubers in Camarines and round Baguio (Luzon).

HILLEBRAND (Fl. Haw. 1888, 457) recorded its introduction in Hawaii by Chinese, and A. C. SMITH (Bull. Torr. Bot. Cl. 70, 1943, 533) assumes it of recent introduction in Fiji; WILDER (Bull. Bish. Mus. 86, 1931, 16) gives it as introduced in Raratonga. In Australia EWART (Fl. Vict. 1930, 95) says it is naturalized locally in Victoria since 1910.

FILET (Plant. Bot. Tuin Weltevr. 1855, 10) mentions *S. sagittifolia* as a vegetable, but this use cannot have been general and on a large scale as it is exceedingly rare in Java; probably he was misled by the vernacular names *bia-bia* and *ètjèng*, which apply equally to the very common *Monochorias*.

STEINMANN interpreted (Trop. Natuur 23, 1934, 219) some bas-reliefs on Borobudur stupa in Central Java as representing a broad-leaved form of *S. sagittifolia ssp. leucopetala*. As has been mentioned it is at present very rare in Java and certainly introduced.

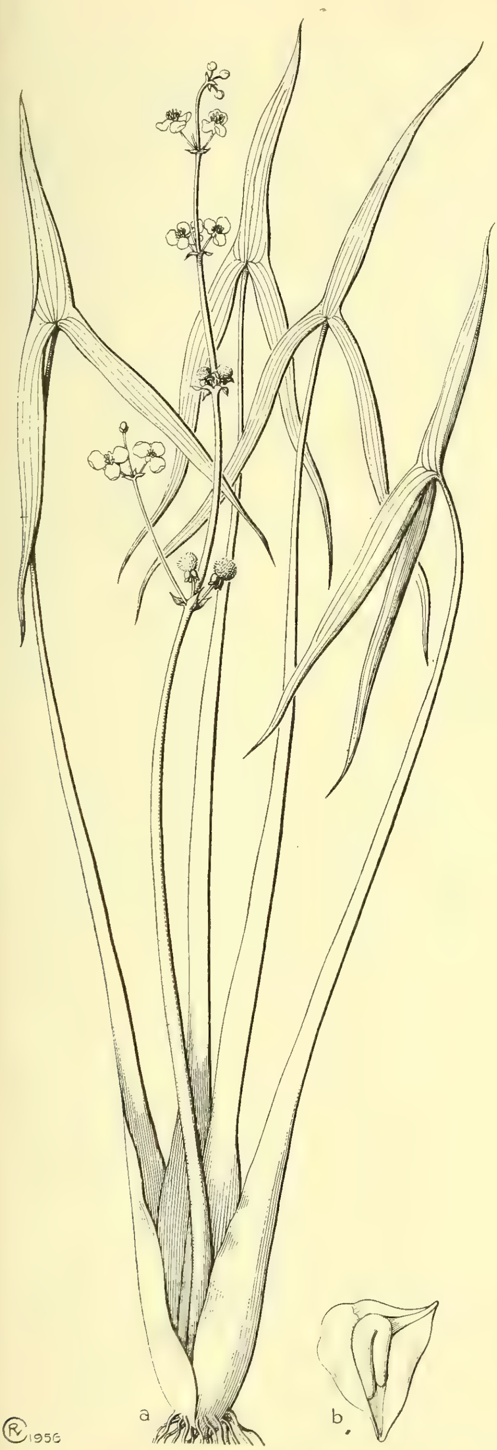

Fig. 11. *Sagittaria sagittifolia* L. *ssp. leucopetala* (MIQ.) HARTOG. *a*. Habit, × $^{2}/_{5}$, *b*. fruit, × 5 ← (Celebes).

BOGIN (*l.c.* 222) mentions that *S. latifolia* WILLD. (Sp. Pl. 4, 1805, 409) is cultivated as a vegetable in California by Chinese and Japanese and that this has apparently been imported by them in Hawaii, but recorded there under the name *S. sagittifolia* L.

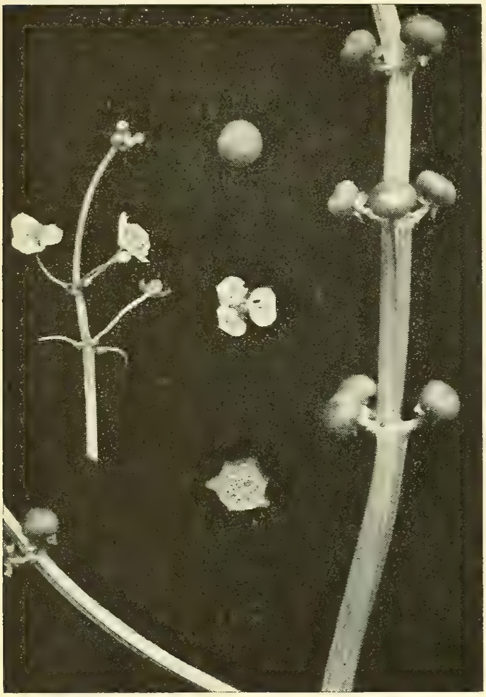

Fig. 12. *Sagittaria sagittifolia* L. *ssp. leucopetala* (MIQ.) HARTOG. Parts of inflorescence in flower and fruit, fruiting flower, open flower, and cross-section of peduncle. Kebun Raya Indonesia (photogr. F. HUYSMANS).

Vern. *Ètjèng, béa-béa*, S, M. *bia bia*, M, *ètjèng gèndjĕr*, S, *kalopak, tjunkait*, Celebes, *arrow weed, arrow-head*, E, *pijlkruid*, D; Philippines: *gauai-gauai*, S.L.Bis., *tikóg*, Bik; *ubi kĕladi, kĕladi chabang*, Mal. Pen., for the cultivated form.

Notes. Wild Malaysian specimens have very narrow leaves, in distinction to the introduced form which possesses much coarser leaves with a terminal lobe up to 10 cm wide. As a matter of fact such variations in shape and size of the leaf have led MAKINO and others to distinguish infra-specific and even specific taxa. I agree with GLÜCK and BOGIN that these forms do not deserve taxonomic recognition; they are minor variations occurring parallel both in *ssp. leucopetala* and *ssp. sagittifolia.*

JOHRI (Proc. Ind. As. Soc. B 1, 1935, 341) mentions occasional occurrence of rudimentary carpels in ♂ flowers.

Cultivated

Alisma plantago LINNÉ, Sp. Pl. 1 (1753) 342; BRUGGEMAN, Ind. Tuinb. (1939) 161; BACKER, Fl. Java (em. ed.) 10 (1949) fam. 204, p. 2.—This ubiquist is not found native in Malaysia and has been cultivated in Java, but so far as known to me only in the Botanic Gardens.

Dubious

Sagittaria triflora NOROÑA, Verh. Bat. Gen. K.W. 5 (1790) 84, *nomen nudum.*—Only the vernacular name *bia bia* is given; this is used both for *Sagittaria spp.* and for *Monochoria*; its precise specific identity remains, therefore, uncertain.

Excluded

Luronium natans (L.) RAFIN. Aut. Bot. (1840) 63. —*Elisma natans* (L.) BUCH. Jahrb. Wiss. Bot. 7 (1868) 25; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 174–175; Trop. Natuur 34 (1935) 54–56, f. 1; BACKER, Fl. Java (em. ed.) 10 (1949) fam. 204, p. 2.—The specimen of this European plant, said to have come from Java, has been erroneously localized, as has been proved bij VAN DER WERFF (Blumea 7, 1954, 599–601).

GOODENIACEAE (P. W. Leenhouts, Leyden)

Herbs or shrubs. *Leaves* spirally arranged—often radical or in tufts at the end of the twigs—very rarely opposite, simple, penninerved, exstipulate. Indument, if present, either consisting of simple, or fasciculate, or stellate hairs; leaf-axils often with hair tufts. *Inflorescences* cymose, bracteate, or flowers solitary, in the latter case sometimes together resembling racemes. *Flowers* 5-merous, epi- (or peri-) gynous, bisexual, protandrous. *Calyx* gamosepalous, tube nearly always adnate to the ovary, lobes usually well-developed. *Corolla* gamopetalous, nearly always zygomorphous by a dorsal slit; the free segments with very thin, sharply induplicative, membranous margins. *Stamens* 5, episepalous, free (rarely the anthers cohering in a tube), usually fully glabrous; filaments slender, linear, usually slightly narrowed from base to apex; anthers basifixed, introrse, rather long and narrow, 2-celled, cells opening lengthwise by a slit. *Disk* absent. *Ovary* 2- or (often imperfectly) 1-celled; style cylindrical, simple (in *Calogyne* bi- or trifid at the apex); stigma surrounded by a cup-shaped (in *Lechenaultia* distinctly 2-lobed) indusium, the margin of which is often ciliate. *Ovules* ∾–1, either axillary or ± basally attached, anatropous, rarely campylotropous. *Fruits* usually capsular, sometimes drupaceous; calyx persistent. *Seeds* ∾–1, provided with endosperm.

Distribution. Fourteen genera comprising *c.* 300 *spp.*, almost exclusively Australian, in (mostly *East-*)*Malaysia* 5 genera with 7 *spp.* conspecific with or allied to Queensland species.

Among the 14 genera 8 are strictly confined to Australia (1 also in Tasmania), one is distinctly subantarctic in the S. Pacific (*Selliera*), two possess a stray representative through Malaysia to SE. Asia (*Calogyne*, *Goodenia*), two others have a stray representative in New Guinea and the Aru Islands (*Lechenaultia*, *Velleia*), and one genus is wider distributed (*Scaevola*). Besides two littoral species which are widely distributed in the Old and New World, *Scaevola* centers in Australia but possesses also species in SE. Asia (1), Malaysia (2), Melanesia (several), New Zealand (1), Hawaii (several), and the Marquesas (2).

Ecology. The family is nearly exclusively confined to rather arid or periodically dry regions with open vegetation, consequently in *Malaysia* representatives are collected on sandy beaches, on open slopes, in savannahs, on dry rice-fields, and along forest edges. Only one species is important physiognomically, *viz Scaevola sericea;* it is a typical constituent of the littoral *Barringtonia*-formation behind the sandy beach. In places it may grow socially and form a pure, tall, shrubby fringe. In small islands, notably in the Pacific atolls, it is often very abundant and occurs not infrequently in the more open sandy or bouldery areas towards the centre of the islands. On rocky shores it is found on cliffs up to several tens of metres above sea-level.

Pollination. KRAUSE gave a rather extensive review on the flower biology of the representatives of this family (Pfl. R. Heft 54, 1912, 13). The flowers appear to be protandrous, the anthers releasing the pollen when the flowers are still in bud. This pollen is deposited in the cupular indusium surrounding the stigma. At that stage the style equals the stamens in length and the stigma is not yet receptive, and often not developed. The pollen remains in the indusium and becomes available immediately after anthesis and may then be carried away by visiting insects, mainly bees and butterflies. The style enlarges during anthesis and the stigma becomes receptive at a later stage. Though self-fertilization is possibly not quite excluded, cross-fertilization seems to be the rule. A remarkably parallel flower biology is found in the also predominantly Australian family *Proteaceae* (*cf.* p. 149).

Dispersal. The fruits of most genera are capsular, opening by valves or slits. The seeds are usually small, light, flattened, and margined or rather narrowly winged, a structure suitable for dispersal by wind. The fruits of *Scaevola*, however, are drupaceous; their pericarp is more or less fleshy, the stone very hard, woody or sometimes corky. Dispersal will obviously be effected by frugivorous birds. In two littoral species, *viz S. sericea* and *S. plumieri*, fruits float very well in seawater retaining their viability for a long time (see GUPPY, Plants, seeds & currents, 1917, p. 227–236). Their social occurrence, consequently an abundant production of fruit, and the easy means of dispersal by seawater and currents, is apparently mainly responsible for their large area of distribution.

Anatomy. See METCALFE & CHALK, Anat. Dicot. 2 (1950) 807–810.

Taxonomy. *Goodeniaceae* are closely related to the *Campanulaceae-Lobelioideae*, from which they are mainly different by the absence of latex and by the much stronger development of the indusium. The monotypical Australian family *Brunoniaceae* has by some authors—among which recently ERDTMAN, on palynological grounds—been united with the *Goodeniaceae.* Furthermore, there is some relationship with the *Stylidiaceae.*

Phytochemically, the presence of *dipsacaan* in *Scaevola sericea* is interesting as this pigment is otherwise known only from the *Dipsacaceae* (see TAMMES, Rec. Trav. Bot. Néerl. 5, 1908, 84). Furthermore, the presence of *inuline* has been recorded, a starch common to many *Synantherae.*

KEY TO THE GENERA

1. Shrubs or lianas. Fruits drupaceou . . . . **5. Scaevola**
1. Herbs. Fruits capsular.
  2. Leaves narrowly linear, *c.* 1 mm wide. Fruits linear, long-beaked, in the basal half opening by longitudinal slits . . . . **4. Lechenaultia**
  2. Leaves at least 5 mm wide. Fruits ellipsoid, not long-beaked, opening by valves.
    3. All leaves radical. Flowers in cymes. Calyx free. Corolla adnate to the basal half of the ovary. Capsules 4-valved . . . . **1. Velleia**
    3. Part of the leaves cauline. Flowers solitary. Calyx-tube fully adnate to the ovary. Corolla epigynous. Capsules 2-valved.
      4. Style simple. Leaves distinctly petioled, obovate to spathulate . . . . **2. Goodenia**
      4. Style 3-fid at the apex. Leaves sessile, linear . . . . **3. Calogyne**

1. VELLEIA

J. E. SMITH, Trans. Linn. Soc. 4 (1798) 217; KRAUSE, Pfl. R. Heft 54 (1912) 27.

Herbs. *Leaves* radical, spathulate. *Inflorescences* from the axils of the rosette leaves, peduncled, repeatedly (cymosely) forked, erect or ascending. *Sepals* free or at the base slightly adnate to the ovary. *Corolla* hypo- or sometimes perigynous. *Ovary* superior or semi-inferior, imperfectly 2-celled. *Capsule* (2- or) 4-valved. *Seeds* few, compressed, margined or winged.

Distr. About 20 *spp.*, all but one restricted to Australia and Tasmania.

1. Velleia spathulata R. BROWN, Prod. (1810) 580; JUSSIEU, Ann. Mus. Hist. Nat. 18 (1811) t. 1, f. 3; DON, Gard. Dict. 3 (1834) 726; DC. Prod. 7 (1839) 518; DE VRIESE, Nat. Verh. Holl. Mij Wet. II, 10 (1854) 174; KRAUSE, Pfl. R. Heft 54 (1912) 29, f. 7 E–F; MERR. & PERRY, J. Arn. Arb. 22 (1941) 387; STEEN. Blumea 7 (1954) 597.

Apparently perennial herb, *c.* 10 cm high (Australian specimens somewhat larger). *Leaves* 3½–5 by 1–1½ cm, herbaceous, glabrous (white-bearded in the axils); margin entire to faintly sinuate, sometimes with a few small teeth; apex rounded. *Cymes* 2–6, ascending, 7–12 cm long, laxly branched, few-flowered, mainly towards the apex with some scattered, reverse, appressed short hairs; bracts spathulate, up to 5 by 1½ mm. *Flowers* 8–9 mm long. *Sepals* 3, free, ovate, 5 by 2 mm, acute, outside glabrous, inside minutely tomentose towards the apex. *Corolla* adnate to the lower half of the ovary, 8 mm long, light-yellow, outside in the lower half sparsely pubescent, dorsally slit up to *c.* 1½ mm from the base, dorsal and lateral petals connate for 3½ mm, lateral ones and ventral one for 6 mm, ventral lobe slightly longer, dorsal ones slightly shorter than lateral ones, all with broad membranous wings, those at both sides of the dorsal slit being longer than the other ones. *Stamens* 3 mm long. *Ovary* 1½–2 mm long, halfway connate with the corolla, glabrous, with *c.* 7 ± basal ovules; style 3½ mm long, with some scattered short hairs; indusium membranous, ciliate, in the basal part adnate to the semi-discoid, crenulate stigma which is 1½–2 mm in diam. *Capsules* 3 mm, the upper half opening by 4 valves. *Seeds* 2–3, elliptic, *c.* 2 mm long, margined.

Distr. E. Australia (Queensland, New South Wales) and *Malaysia:* SE. New Guinea (Western Div.: Oriomo River, Wassi Kussa).

Ecol. Damp places in the savannah-forests at low altitude in seasonal regions. *Fl.* Dec.–March.

Note. This species belongs to sect. *Velleia* (*Velleiae verae* R. BROWN, *sect. Trisepala* KRAUSE), characterized by the 3-merous calyx.

2. GOODENIA

J. E. SMITH, Sp. Bot. New Holl. pt 1 (1793) 15; Trans. Linn. Soc. 2 (1794) 346; KRAUSE, Pfl. R. Heft 54 (1912) 41.—**Fig. 1.**

Herbs or shrubs. *Calyx-tube* adnate to the ovary. *Ovary* (sub-)inferior, usually imperfectly 2-celled. *Capsule* 2-(or 4-)valved. *Seeds* usually compressed, margined.

Distr. About 110 *spp.* all but one restricted to Australia and Tasmania.

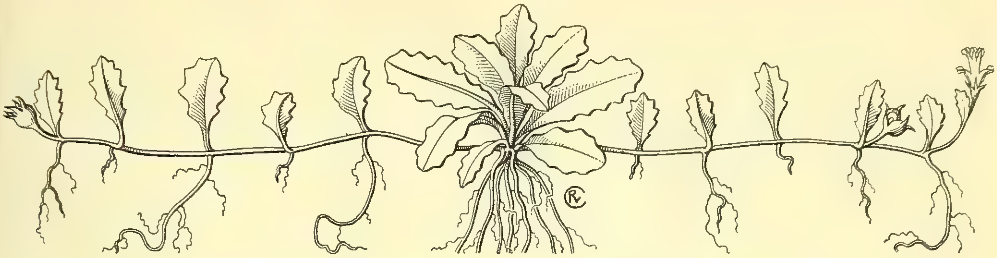

Fig. 1. *Goodenia koningsbergeri* (BACK.) BACK., × ⅔ (COERT 937).

1. Goodenia koningsbergeri (BACK.) BACK. *ex* BOLD. Zakfl. (1916) 88; BACK. Onkr. Suiker. (1931) 744; MERR. Brittonia 5 (1943) 32; BACK. Bekn. Fl. Java (em. ed.) 8 (1949) fam. 185, p. 1.—*Selliera koningsbergeri* BACK. Bull. Jard. Bot. Btzg II, 12 (1913) 36.—*Calogyne cambodiana* DANGUY, Not. Syst. 3 (1914) 22, *cum fig.*—*G. cambodiana* KERR, Fl. Siam. En. 2 (1936) 301.—**Fig. 1.**

Creeping, glabrous (except hair-tufts in the axils of young leaves), slightly succulent, annual herb. *Stems* rooting, terete, slender, up to 50 cm long, internodes 1½–2 cm. *Leaves* radical and cauline; pale green, obovate to spathulate, 1½–6½ by ¾–3 cm, slightly fleshy, narrowed towards the base; margin coarsely scattered-dentate; apex blunt to acute; petiole flattened, ½–4 cm. *Flowers* solitary, axillary, 7–10 mm long, glabrous; pedicel *c.* ½–1½ cm long; bracteoles 0. *Calyx-lobes* lanceolate, 2–3½ by ¾–1 mm, acute. *Corolla* 5–8 mm long, pale yellow, white at base, the margin sometimes violet, and with some brown blotches on the inner side, dorsally slit up to 1 mm from the base, ventral and lateral lobes connate for 5–6 mm, dorsal ones slightly shorter and connate with the lateral ones for 1½ mm, all lobes with a pair of deltoid, membranous wings at the apex, dorsal lobes moreover with a second wing along the dorsal margin. *Stamens* 2½–5 mm long, connective acuminate. *Ovary* inferior, 1-celled, with 8 basally inserted ovules; style 3–5 mm, glabrous; indusium 1 by 1½ mm, ciliate, including the cupular *c.* 1½ mm high, crenulate stigma. *Capsules* on up to 2½ cm long, recurved pedicels, slightly flattened-globular, 5–6 mm diam., 2-valved. *Seeds* 2–6, elliptic, compressed, *c.* 5–6 by 4 mm.

Distr. Siam, Cambodia, and *Malaysia:* Java (from Indramaju eastwards), Madura, Kangean, and Timor.

Ecol. A weed of dry rice-fields, of heavy, poorly drained clay-flats, in open places, restricted to low altitudes, up to 400 m, in distinctly seasonal regions, often gregarious. *Fl.* Dec.–Aug., *fr.* Febr.–May.

Note. This species belongs to *sect. Goodenia* (*Eugoodenia* BENTH.) *subsect. Ebracteolatae* KRAUSE. I doubt whether the subdivision of the section based on the presence or absence of the bracteoles is a natural one.

3. CALOGYNE

R. BROWN, Prod. (1810) 579; KRAUSE, Pfl. R. Heft 54 (1912) 94.—*Balingayum* BLANCO, Fl. Filip. (1837) 187.

Annual herbs. *Leaves* spirally arranged, irregular-dentate. *Flowers* axillary, without bracteoles. *Calyx-tube* adnate to the ovary. *Ovary* inferior, imperfectly 2-celled; style 2- or 3-branched, indusium 2-lobed, ciliate; stigma inconspicuous. *Capsules* 2-valved. *Seeds* flattened, margined to narrowly winged.

Distr. Species 3–8, with the exception of *C. pilosa* restricted to Australia.

1. Calogyne pilosa R. BROWN, Prod. (1810) 579; DC. Prod. 7 (1839) 517; DE VRIESE, Nat. Verh. Holl. Mij Wet. II, 10 (1854) 180; BAILL. Hist. Pl. 8 (1886) f. 180; E. & P. Nat. Pfl. Fam. 4, 5 (1889) f. 43 R; BANKS & SOL. Bot. Cook's Voy. 2 (1901) 55, t. 177 B; MERR. Publ. Gov. Lab. Philip. *no* 35 (1905) 68; KRAUSE, Pfl. R. Heft 54 (1912) 95, f. 17 A.B; MERR. Sp. Blanc. (1918) 374; En. Philip. 3 (1923) 589; MERR. & PERRY, J. Arn. Arb. 22 (1941) 388.—*Balingayum decumbens* BLANCO, Fl. Filip. (1837) 187; ed. 2 (1845) 132; ed. 3, 1 (1877) 237; F.-VILL. Nov. App. (1880) 93; MERR. Publ. Gov. Lab. Philip. *no* 27 (1905) 48.

Erect, annual herb, (3–)10–25 cm high, the few leafy and flower-bearing stems creeping after flowering. *Stems* terete, slender, laxly branched, laxly appressedly short-pubescent, mainly at the apex. *Leaves* spirally arranged, most of them contracted into basal rosettes and at the ends of the stems, sessile, linear, 4–8 by ½–¾ cm, herbaceous, bluish green, laxly subpatently short-pilose, upper surface sometimes subglabrous; base narrowed to hastate; margin coarsely irregularly dentate; apex acute; midrib rather prominent beneath. *Pedicels* 1 cm. *Flowers* 9 mm, sparsely pubescent. *Calyx-lobes* linear-lanceolate, 3 by

1 mm; throat inside with a ring of hairs. *Corolla* 8 mm long, outside light brownish purple, inside yellow with an orange spot; dorsally slit up to *c.* $1\frac{1}{2}$ mm from the base, ventral and lateral lobes connate for *c.* 5 mm, dorsal and lateral ones for *c.* 2 mm, all lobes with membranous wings at both sides at the apex, those along the dorsal slit being rather long, all other ones deltoid; outside mainly with some cilia on the nerves in the apical part of the lobes, inside glabrous. *Stamens* 5(–3?), 3 mm long, connective mucronate. *Ovary* 1 mm long, septum nearly invisible, with 6 ovules, inserted on both sides of a low rim at the base; style 4 mm, with a few patent, long, and stiff hairs, 3-branched, indusium deeply 2-lobed. *Capsules* ellipsoid, 4–5 by 2–$2\frac{1}{2}$ mm, laxly pubescent; calyx slightly enlarged (lobes *c.* 4 mm long). *Seeds* 5, ovate, 4 by 2 mm.

Distr. N. Australia to S. China, in *Malaysia:* Philippines (Luzon: Rizal, Zambales, and Bulacan Prov.; Culion), Moluccas (Tenimber Isl.: P. Jamdena), and S. New Guinea (Merauke & Oriomo River).

Ecol. In Luzon apparently rather common in fallow rice-fields, in New Guinea and the Tenimber Isl. in rather dry savannahs and savannah-forests, apparently always under seasonal climatic conditions, up to 100 m. *Fl.* and *fr.* Nov.–March.

Vern. *Baliñgáyo*, Tag.

4. LECHENAULTIA

R. BROWN, Prod. (1810) 581; KRAUSE, Pfl. R. Heft 54 (1912) 97 *(Leschenaultia).*—**Fig. 2.**

Herbs or small, often ericoid, shrubs. *Leaves* spirally arranged, linear. *Flowers* solitary, in the upper leaf-axils or in racemes. *Stamens* 5, anthers usually connate surrounding the style. *Ovary* inferior, linear, 2-celled; ovules ∞, inserted on 2 parietal placentas; indusium 2–3-lobed. *Capsule* linear, ∞-seeded, sometimes beaked, opening by 4 slits caused by decay of interneval tissue.

Distr. About 20 *spp.*, all but the present one restricted to Australia.

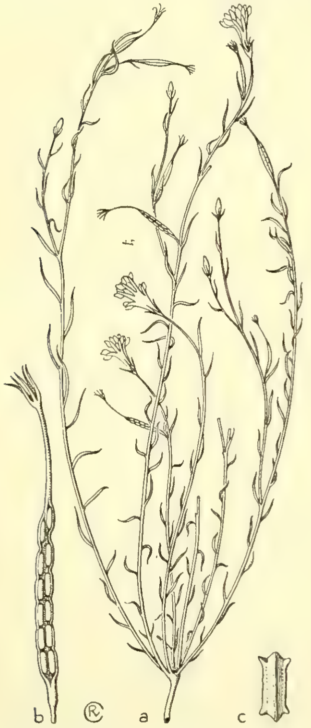

Fig. 2. *Lechenaultia filiformis* R.BR. *a.* Habit, *b.* fruit, *c.* seed (*a* × $\frac{3}{4}$, *b* × 3, *c* × $7\frac{1}{2}$; *a* VAN ROYEN 5054, *b–c* BUWALDA 5527).

1. Lechenaultia filiformis R. BROWN, Prod. (1810) 581; DC. Prod. 7 (1839) 519; F.v.M. Fragm. 6 (1868) 9, t. 48; F. M. BAIL. Queensl. Fl. 3 (1900) 892; KRAUSE, Pfl. R. Heft 54 (1912) 108; MERR. & PERRY, J. Arn. Arb. 30 (1949) 60; STEEN. Blumea 7 (1954) 598.—**Fig. 2.**

Erect, apparently annual, herb, 10–25 cm. *Stems* terete, with 4 ridges, slender, stiff, glabrous or with very few appressed, short hairs, the internodes rather long. *Leaves* sessile, glabrous, 1–2 cm by 1 mm, entire, mucronate, midrib prominent beneath. *Flowers* few, in the upper leaf-axils, stalked, 2–$2\frac{1}{2}$ cm long. *Calyx-tube* adnate to the ovary; lobes linear, acute, dorsal one and both ventral ones 2 by $\frac{1}{3}$ mm, lateral ones $3\frac{1}{2}$ by $\frac{1}{2}$ mm. *Corolla c.* $1\frac{1}{2}$ cm long, dorsally slit up to *c.* 3 mm from the base, lobes connate for *c.* 7 mm, dorsal lobes *c.* 1 cm long, lateral and ventral ones distinctly longer, all—specially the larger ones—with broad membranous margins, which are undulate at the base and *c.* 2 mm longer than the corolla segments; corolla outside minutely pubescent at the base, mainly on the nerves, inside sparsely pilose; cream-coloured at the base, pale lilac towards the apex. *Stamens* $4\frac{1}{2}$ mm long, anthers emarginate at the apex. *Ovary c.* 1 cm long, as slender as the pedicel; style $7\frac{1}{2}$ mm long, glabrous; indusium $1\frac{1}{2}$ mm high, 3-lobed, inside velvety pubescent, stigma not prominent. *Capsules* $1\frac{1}{2}$ cm long, constricted between the seeds when dry, with a 6–7 cm long, sterile beak, basal 1–2 mm also sterile; slits only in the fertile part. *Seeds* ellipsoid, $1\frac{3}{4}$ by $\frac{3}{4}$ mm, distinctly flattened, strongly truncate and acuminate at both ends; testa hard.

Distr. Queensland, North Australia, and *Malaysia:* New Guinea (Wassi Kussa & Kebar Valley), S. Moluccas (Aru Isl.: P. Trangan).

Ecol. Among grasses of savannahs and savannah-forests on acid soil under seasonal climatic conditions, up to 650 m. *Fl.* July, Nov.–Dec.

Note. This is the type species of *sect. Latouria* Endl. Gen. (1838) 508, which is mainly characterized by the beaked fruits.

5. SCAEVOLA

Linné, Mant. (1771) 145; Krause, Pfl. R. Heft 54 (1912) 117.—**Fig. 3–5.**

Shrubs *(Mal. spp.). Leaves* spirally arranged or opposite, entire to dentate. Pubescence, if dense, often consisting of stellate hairs. *Inflorescences* axillary, cymose, provided with bracts and bracteoles. *Flowers* subsessile. *Calyx-tube* adnate to the ovary. *Ovary* (sub-)inferior, 2(–1)-celled, every cell with 1 axillary ovule. *Stigma* 2-lobed (*Mal. spp.*). *Drupes* sometimes more or less fleshy; stone rather hard, containing 1 or 2 seeds.

Distr. The genus *Scaevola* has been subdivided into 6 sections, in total comprising *c.* 80 *spp.* Three of these sections, with *c.* 60 *spp.*, are nearly exclusively Australian (one *sp.* also in Tasmania, one exclusively in the Kermadec Isl.). Of the remaining three sections two are monotypical, one being restricted to SE. Asia (Formosa, Hainan, and Tonkin), the other (*Enantiophyllum*) to E. Malaysia & N. Australia.

Sect. Scaevola contains 19 *spp.*; 2 of its species are littoral and widely distributed (*S. sericea* from Madagascar through SE. Asia, *Malaysia*, and tropical Australia to the Central Pacific and *S. plumieri* from the Galapagos Isl. through tropical America and Africa to Ceylon and India). The remaining species are all extra-Australian: 2 are endemic in the Marquesas Isl., 8 in the Hawaiian Isl., 1 in Fiji, 1 in the New Hebrides, 4 in New Caledonia, and 1 in Malaysia.

KEY TO THE SPECIES

1. Leaves spirally arranged, usually tufted at the ends of the branches (*sect. Scaevola*).
  2. Flowers 2–2½ cm long. Calyx-lobes usually 2½ mm or more. Fruits globular, white, *c.* 1 cm. **1. S. sericea**
  2. Flowers 1 cm long. Calyx-lobes 1 mm. Fruits ellipsoid, black, 5–6 mm long . **2. S. micrantha**
1. Leaves opposite (*sect. Enantiophyllum*) . . . . **3. S. oppositifolia**

1. Scaevola sericea Vahl, Symb. Bot. 2 (1791) 37; Bl. Bijdr. (1826) 730; Presl, Reliq. Haenk. 2 (1835) 57; DC. Prod. 7 (1839) 506; de Vriese, Ned. Kruidk. Arch. I, 2 (1850) 31; Nat. Verh. Holl. Mij Wet. II, 10 (1854) 29; Miq. Fl. Ind. Bat. 2 (1856) 581; Merr. Philip. J. Sc. 5 (1910) Bot. 250; Fosberg & Sachet, Taxon 5 (1956) 7, with full discussion of synonymy.—*Buglossum litoreum* Rumph. Herb. Amb. 4 (1743) 116, t. 54.—*Lobelia plumieri* (*non* L.) Burm. *f.* Fl. Ind. (1768) 189.—*Lobelia frutescens* Mill. Gard. Dict. ed. 8 (1768) *p.p. pro syn.*—*S. lobelia* Murr. Syst. Veg. ed. 13 (1774) 178, *p.p.*, *nom. illeg.*; Willd. Sp. Pl. 1 (1798) 955; Blanco, Fl. Filip. (1837) 147; ed. 2 (1845) 104; ed. 3, 1 (1877) 193, t. 210; de Vriese, Ned. Kruidk. Arch. I, 2 (1850) 20; Nat. Verh. Holl. Mij Wet. II, 10 (1854) 20; Vidal, Sinopsis, Atlas (1883) 29, t. 59.—*Lobelia taccada* Gaertn. Fruct. 1 (1788) 119, t. 25 f. 5.—*S. koenigii* Vahl, Symb. Bot. 3 (1794) 36; R. & S. Syst. 5 (1819) 160; Sprengel, Syst. 1 (1825) 752; Bl. Bijdr. (1826) 730; Curtis, Bot. Mag. (1827) t. 2732; Decne, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1835) 408; DC. Prod. 7 (1839) 505, *sphalm. kaenigii*; Hassk. Pl. Jav. Rar. (1848) 525; Miq. Fl. Ind. Bat. 2 (1857) 580, *incl.* also *var. macrocalyx*; F. Sincl. Indig. Fl. Hawai. (1885) t. 32; Vidal, Rev. Pl. Vasc. Filip. (1886) 165; Schönland, E. & P. Nat. Pfl. Fam. 4, 5 (1889) 76, f. 43 S–T, 47; Schimper, Bot. Mitt. Tropen 3 (1891) 172, t. 7 f. 25; King & Gamble, J. As. Soc. Beng. 74, ii (1906) 50; Koord. Exk. Fl. Java 3 (1912) 305; Guppy, Plants, Seeds, and Currents (1917) 227; Ridl. Fl. Mal. Pen. 2 (1923) 199, f. 88.—*S. taccada* Roxb. Hort. Beng. (1814) 15; Fl. Ind. 2 (1824) 146; ed. 2, 1 (1832) 527; DC. Prod. 7 (1839) 505.—*S. plumieri* (*non* Vahl) Bl. Bijdr. (1826) 730.—*S. velutina* Presl, Reliq. Haenk. 2 (1835) 58.—*S. leschenaultii* DC. Prod. 7 (1839) 506.—*S. macrocalyx* de Vriese, Ned. Kruidk. Arch. I, 2 (1851) 138; Nat. Verh. Holl. Mij Wet. II, 10 (1854) 26, t. 3 f. 1–4.—*S. piliplena* Miq. Fl. Ind. Bat. 2 (1857) 581; Koord. Exk. Fl. Java 3 (1912) 305.—*S. frutescens* (*non Lobelia frutescens* Mill.) Krause, Pfl. R. Heft 54 (1912) 125, f. 25; Merr. Philip. J. Sc. 7 (1912) Bot. 353, *incl.* also *var. sericea*; Int. Rumph. (1917) 496; Sp. Blanc. (1918) 374; Bibl. En. Born. Pl. (1921) 586; En. Philip. 3 (1923) 590; Docters van Leeuwen, Ann. Jard. Bot. Btzg 37 (1927) t. 4 f. 12–13; Heyne, Nutt. Pl. (1927) 1428; Skottsb. Bull. Bish. Mus. *no* 43 (1927) f. 14 h; Burk. Dict. (1935) 1970; Docters van Leeuwen, Ann. Jard. Bot. Btzg 46/47 (1936) 423; Corner, Ways. Trees 1 (1940) 310, f. 101; Back. Bekn. Fl. Java (em. ed.) 8 (1949) fam. 185, 2; Steen. Fl. Sch. Indon. (1949) 378; Henders. Mal. Wild Fl. 2 (1950) 253, f. 236. **Fig. 3–4, 5g.**

Erect or spreading shrub, sometimes a small tree (up to 7 m). *Branchlets* ½–1 cm thick, terete, usually glabrous, but the leaf-axils provided with stiff tufts of white hairs. *Leaves* spirally arranged, the majority crowded at the ends of the branches, sessile, spathulate to obovate, 12–26 by 5–10 cm, herbaceous to thin-fleshy, glabrous (rarely short-tomentose on both sides), narrowed towards the base, margin entire or sinuate to dentate, apex blunt to rounded. *Inflorescences* laxly branched, *c.* 4 cm long, few-flowered, glabrous (to densely woolly pubescent); peduncle *c.* 1 cm long. Bracts persistent, narrowly triangular, up to 3 mm long, white-pilose in the axils. *Flowers* 2–2½ cm long, glabrous or (specially the corolla) more or less densely appressed-pubescent, scentless. *Calyx-lobes* linear to narrowly elliptic, (1½–)2½–5(–15) by ½(–5) mm, blunt,

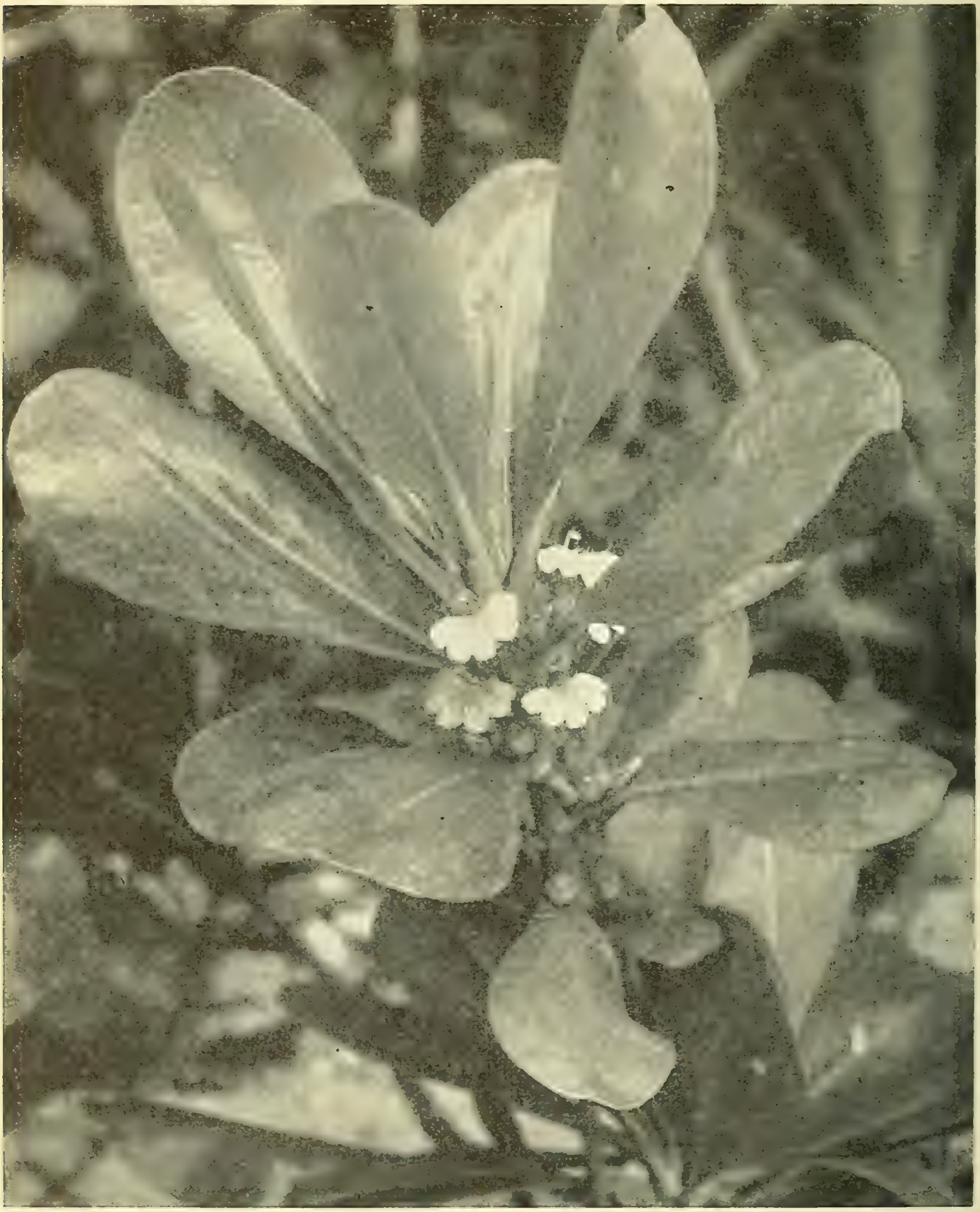

Fig. 3. *Scaevola sericea* (MILL.) KRAUSE in flower and fruit, Udjung Genteng (SW. Java).

erect to faintly recurved. *Corolla* pale yellow, at first lilac-veined, white inside; tube inside densely pubescent, membranous margins of the lobes fimbriate towards the base. *Style* faintly pubescent at the base, sometimes in addition with some scattered long hairs. *Drupe* globular, faintly 2-lobed when dry, *c.* 1–1$^1/_2$ cm in diam., with 4 faint ribs on every lobe, fleshy, (sub)glabrous, pellucid-white when ripe; stone 8 by 6 mm, rugose, septum distinctly prominent.

Distr. Madagascar, SE. Asia, throughout *Malaysia*, tropical Australia, Micronesia, Melanesia, and Hawaii.

Ecol. Restricted to the sea-shore, usually on the open sandy beach or on coastal cliffs of rocky coasts. *Fl.* and *fr.* Jan.–Dec.

One of the commonest, sometimes gregarious, shrubs fringing the tropical sandy beach behind the pescaprae formation, an early, euredaphic pioneer on fresh littoral sands, gravel, and rocks. The drupes are very probably dispersed by birds; the stones are certainly water-borne and are dispersed by sea currents; they are often found washed ashore. They owe their power of buoyancy to the corky outer layer of the stone (see GUPPY, *l.c.*).

DOCTERS VAN LEEUWEN (1927) found flowers frequently visited by large bees; in addition self-fertilization seems also to occur.

Uses. Several parts of this plant are used in native medicine (see HEYNE, *l.c.*). The wood of the basal part is rather hard, but the pieces are small; as it is resistent against sea-water, it is used for making nails for canoes. The thick, soft pith of the young twigs is used in microscopical technique, replacing elder-pith. As this pith can easily be cut and painted, people (specially in the Moluccas) make flowers, small birds, and fruits *etc.* from it.

Vern. *Sea-lettuce tree*, E, *strand ossetong*, D, *ambong-ambong*, *ambung-ambung*, *among-among*, *bĕruwas laut*, *buwas-buwas laut*, *gabusan*, *kaju*

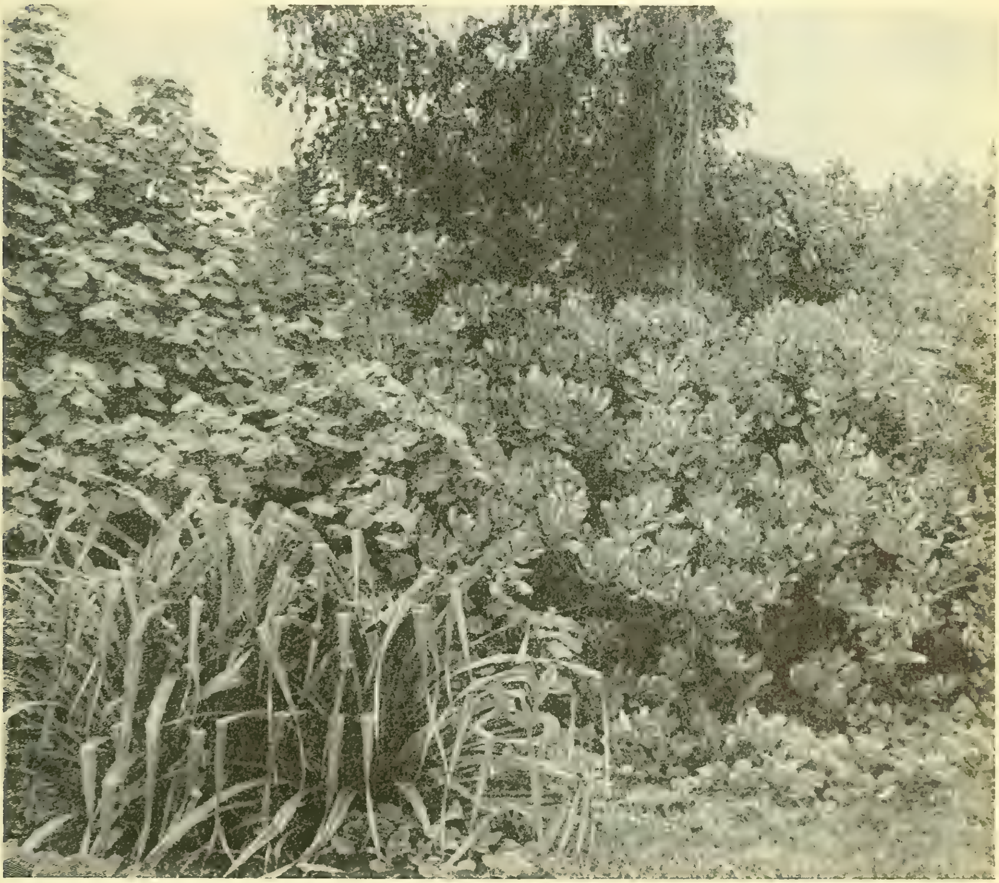

Fig. 4. Beach vegetation on the westcoast of Humboldt Bay, West New Guinea; on the right *Scaevola Sericea* VAHL, to the left *Hibiscus tiliaceus* L. and *Pandanus sp.*, in the background *Terminalia catappa* L. with *Cassytha filiformis* L. (Photogr. L. VAN DER HAMMEN, 1954).

ambong, *merambong*, *moh among*, *pělampong*, M, *subang-subang (suběng-suběng, subong-subong)*, Sum., *tjilekle*, Mentawei, *babakoan*, *b. lalaki*, *gagabusan*, *niangka*, *porang*, S, *dudulan (wudulan)*, *gabus*, *g. tjina*, *pohodo'elang*, J, *djati pasir*, Md, *klindo*, *pělěnda laut (polindo l.)*, Bali, *bodjo*, Sumbawa, *tabuté*, Alor, *batang lampung*, Borneo; Philippines: *balak-bálak*, *balok-bálok*, *bokabok*, *bosboron*, *boto*, *linu*, *mosboron*, *panabolong*, *pañgangtolon*, Tag., *bokabok*, *bosboron*, *boto*, *mosboron*, *panabolong*, *pangangtolon*, *tagustus*, Bis., *chalmalukung*, *dudukdukin*, Ilk., *hulbo*, Bik., *linog*, Sbl.; *bawuntulon*, *bodjolo*, *bukolako*, *kokolě*, *panimburang*, *papatjèda*, *wintungtasi*, Cel., *anas*, *boppa tseda*, *gilitopa*, *hokal*, *kanum-búlan'a*, *kationgale*, *lotiek*, *mokal (mokar, morai)*, *ndarimbu*, *nèsnas*, *panimbúran'a*, *(pa)patjèda*, Mol., *rauw rauw*, Aru Isl., *fufum*, *kaikikira*, *paimeh*, N. Guinea, *dodogo kubar*, N. Britain.

2. Scaevola micrantha Presl, Rel. Haenk. 2 (1835) 58; DC. Prod. 7 (1839) 507; Miq. Fl. Ind. Bat. 2 (1856) 582; Merr. Philip. J. Sc. 5 (1910) Bot. 250; Krause, Pfl. R. Heft 54 (1912) 121; Merr. En. Philip. 3 (1923) 590; Holthuis & Lam, Blumea 5 (1942) 252.—*Temminckia micrantha* de Vriese, Ned. Kruidk. Arch. I, 2 (1850) 145; Nat. Verh. Holl. Mij Wet. II, 10 (1854) 11.—*S. pedunculata* Merr. Philip. J. Sc. 5 (1910) Bot. 251, *incl.* also *var. mollis*; Gibbs, J. Linn. Soc. Bot. 42 (1914) 100; Merr. Bibl. En. Born. Pl. (1921) 586; En. Philip. 3 (1923) 591.—*S. merrillii* Elm. Leafl. Philip. Bot. 4 (1912) 1491.—**Fig. 5h.**

Shrub, up to *c.* 2 m. *Branchlets* $^1/_4$–1 cm thick, terete, glabrous to densely tomentose; leaf-axils provided with tufts of silky white hairs. *Leaves* spirally arranged, crowded at the ends of the branches, obovate to elliptic, $3^1/_2$–20 by $1^1/_2$–8 cm, coriaceous to herbaceous, glabrous to tomentose mainly on the lower side; attenuate to the distinctly petioled base; margin scattered denticulate, mainly towards the apex; apex rounded to acute, mucronulate; nervation rather conspicuous, specially beneath. *Inflorescences* laxly to rather densely branched, $2^1/_2$–10 cm long, glabrous to densely greyish-tomentose; peduncle 1–6 cm long. Bracts linear, up to 2 by $^1/_2$ cm, with axillary hair-tufts. *Flowers* 1 cm long, glabrous to rather densely pubescent. *Calyx-lobes* deltoid, acute, erect, 1 mm high. *Corolla* greenish-white within and outside at the base, lobes violet; tube inside densely pubescent, membranous margins of the lobes narrowed towards the base, entire. *Style* with some scattered long hairs, mainly at the base. *Fruits* ellipsoid, 5–6 by $2^1/_2$ mm, smooth, glabrous to pubescent, black when ripe.

Distr. *Malaysia:* Borneo (Mt Kinabalu), Philippines (Palawan, Luzon, Sibuyan, Mindanao), and Talaud Islands.

Ecol. On open, sunny slopes, 300–2500 m. *Fl.* and *fr.* Nov.–May.

Vern. *Panimburan'a*, Talaud.

Note. Part of the specimens from Mt Kinabalu and Palawan differ slightly by a densely stellate tomentum in all parts, rather thick twigs, long-petioled and rather large leaves—not unlike those of *S. sericea*—and denser, many-flowered inflorescences; they have been distinguished as *S. pedunculata var. mollis* Merr. The differences mentioned are grading, however, and vary possibly even in one individual plant.

3. Scaevola oppositifolia R. Brown, Prod. (1810) 583.—*S. oppositifolia* Roxb. [Hort. Beng. (1814) 85, *nomen*] Fl. Ind. 2 (1824) 148; ed. 2, 1 (1832) 528; Don, Gard. Dict. 3 (1834) 728; DC. Prod. 7 (1839) 507; Miq. Fl. Ind. Bat. 2 (1857) 582; Ann. Mus. Bot. Lugd. Bat. 1 (1864) 210; Krause, Pfl. R. Heft 54 (1912) 132.—*S. corsoniana* Don *ex* Loudon, Gard. Mag. 18 (1842) 370.—*S. amboinensis* Miq. Ann. Mus. Bot. Lugd. Bat. 1 (1864) 210; Krause, *l.c.* 133.—*S. enantophylla* F.v.M. Fragm. 8 (1873) 58.—*S. novo-guineensis* K. Sch. Bot. Jahrb. 9 (1887) 222; K. Sch. & Laut. Fl. Schutzgeb. (1901) 594; *do*, Nachtr. (1905) 402, *incl. var. glabra*; Krause, *l.c.* 133.—*S. scandens* F. M. Bail. Rep. Exp. Bellenden-Ker (1889) 47.—*S. similis* Hemsl. Kew Bull. (1896) 38; Krause, *l.c.* 131.—*S. minahassae* Koord. Minah. (1898) 628, 513; Merr. Philip. J. Sc. 2 (1907) Bot. 427; Krause, *l.c.* 131; Koord.-Schum. Syst. Verz. 3 (1914) 125; Merr. En. Philip. 3 (1923) 591.—*S. dajoensis* Merr. Philip. J. Sc. 2 (1907) Bot. 427; Krause, *l.c.* 131; Merr. En. Philip. 3 (1923) 590.—*S. acuminatissima* Merr. Philip. J. Sc. 5 (1910) Bot. 249; En. Philip. 3 (1923) 590.—*S. mindorensis* Merr. Philip. J. Sc. 5 (1910) Bot. 250; En. Philip. 3 (1923) 591.—*S. merrilliana* Krause, *l.c.* 131, *nom. superfl.*—*S. lauterbachiana* Krause, *l.c.* 132; Gibbs, Arfak (1917) 183.—*S. forbesii* Krause, *l.c.* 133.—*S. wollastonii* Wernham, Trans. Linn. Soc. Bot. II, 9 (1916) 88.—**Fig. 5a–f.**

Scrambling (rarely erect) shrub or climber. *Branchlets* slender, terete, with long internodes; lateral twigs transverse. *Leaves* decussate, usually pseudo-distichous, distinctly petioled, ovate to ovate-lanceolate, 5–14 by 2–6 cm, chartaceous, glabrous or more or less pubescent, sometimes even densely woolly pubescent beneath; base acute; margin slightly revolute, usually entire to distantly dentate, sometimes lobed; apex acuminate, usually mucronate. *Inflorescences* axillary—often 2 in one leaf-axil and then the upper one stronger developed—widely and laxly branched, 2–5 cm long peduncled, mostly many-flowered, rarely 1–3-flowered, sometimes exceeding the leaves, usually thinly and shortly appressedly pubescent. Bracts persistent, narrowly triangular, up to $^1/_2$ cm. *Flowers* $1^1/_4$–$1^1/_2$(–2) cm long, more or less densely pubescent. *Calyx-lobes* linear, *c.* $2^1/_2$ mm. *Corolla* yellow or outside greenish, in the basal half more or less brownish to purple, tube inside densely velvety pubescent, membranous margins of the lobes entire. *Style* glabrous, the indusium excepted. *Fruits* (in dry state) obovoid to ellipsoid, 5–7 by $2^1/_2$–3 mm, with 2 (septal) grooves, furthermore slightly tuberculate, subglabrous, rarely scattered appressed-pubescent, black when ripe.

Distr. North Queensland and *Malaysia:*

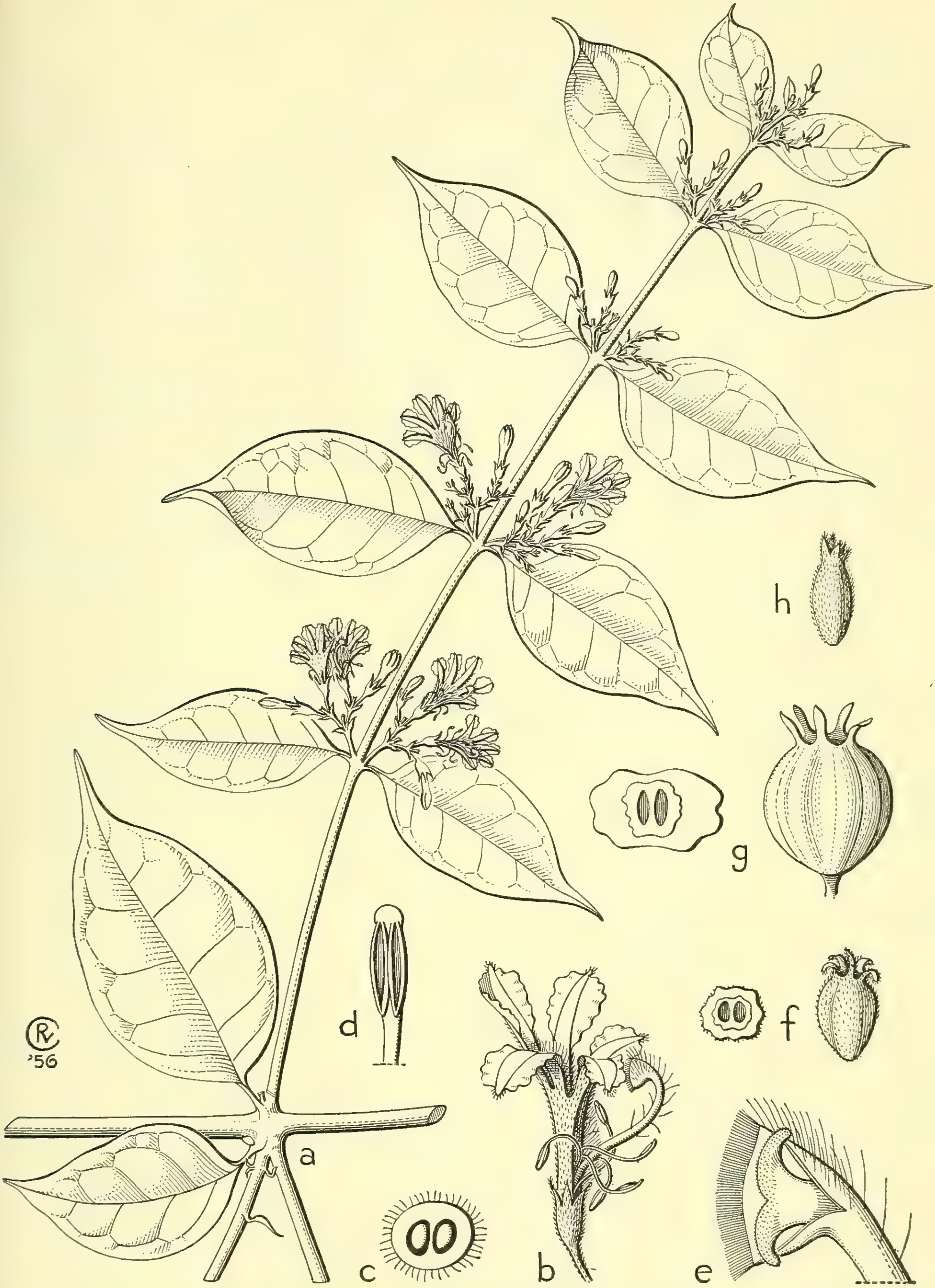

Fig. 5*a–f*. *Scaevola oppositifolia* R.BR. *a*. Flowering twig, *b*. flower, *c*. ovary in cross-section, *d*. anther, opened, *e*. stigma (indusium partly removed), *f*. fruit with cross-section.—*g*. *Scaevola sericea* VAHL, fruit with cross-section.—*h*. *Scaevola micrantha* PRESL, fruit. (*a* × 2/3, *b* and *f–h* × 2, *c* × 6, *d* × 16, *e* × 10; *a–b* KAUDERN 518, *f* VAN ROYEN 3202, *g* NGF 3314, *h* BS 34598).

Philippines (Mindoro, Negros, Sulu Isl., and Mindanao), Celebes, Moluccas (Morotai, Ternate, Sula Islands, Ceram, and Ambon), and New Guinea (incl. New Ireland).

Ecol. Mostly in rather open places, along forest edges, road- and river-sides, in shrubberies and secondary vegetation, rarely in forest, 0–2700 m. *Fl.* and *fr.* Jan.–Dec.

Vern. *Saroka*, Bag., *kakane-mapo*, Minahasa, *gambi*, *ŋjeo bata*, Ternate, *hamboro*, New Guinea.

Notes. This species is specially variable in the degree of pubescence and in the incision of the leaf-margins. Part of the material from E. New Guinea is densely white-woolly pubescent, especially on the lower side of the leaves; this has been distinguished as *S. novo-guineensis*. Specimens from N. Celebes—and to a lesser degree some from the Philippines—possess small, ovate, coriaceous, short-petioled, rather pubescent leaves with a strongly dentate to lobed margin, the nervation being sunken above (*S. minahassae*). Furthermore, the degree of branching of the inflorescence is apparently increasing from west to east. All these characters are grading, however.

The name *S. merrilliana* KRAUSE is superfluous, as one of its syntypes is the type-collection of *S. mindorensis* MERR.

This is the single representative of *sect. Enantiophyllum* B. & H. (Gen. Pl. 2, 1876, 540) which is, in my opinion, monotypic. It is the only section with opposite leaves and a ± climbing habit.

Excluded

Camphusia glabra (H. & A.) DE VRIESE, Ned. Kruidk. Arch. I, 2 (1850) 149.—*Scaevola glabra* H. & A. Bot. Beechey (1832) 89.—A Hawaiian species, erroneously mentioned by Index Kewensis 1 (1895) 408 as being described from Malaysia.

Lemairea amboinensis DE VRIESE, Nat. Verh. Holl. Mij Wet. II, 10 (1854) 189, t. 38.—The description (with plate) of this monotypic genus was based on a sheet, said to have been collected in Ambon, from the herbarium of VENTENAT, preserved in the Herbier Delessert at Geneva; it consisted of a loose flower and a fruiting twig. According to the drawing and description the loose flower is doubtless belonging to *Scaevola sp.*; the twig with fruits, which has kindly been traced at Geneva by Dr. BECHERER appeared exactly to match the rubiaceous *Mycetia javanica* (BL.) KORTH.

BENTHAM & HOOKER and others have all treated *Lemairea* as a *genus delendum*. The name *Lemairea amboinensis* clearly falls under art. 76 of the rules of nomenclature and must be rejected as its characters were derived from two entirely discordant elements.

PITTOSPORACEAE (K. Bakker & C. G. G. J. van Steenis, Leyden)

Mostly evergreen trees or shrubs (outside Mal. some woody climbers), often aromatic (in leaves and fruit), bark of the stem (and roots) containing a circle of schizogenous resin ducts outside the phloem; twigs sometimes ending in a thorny tip; indument if present consisting of simple (exceptionally 2-armed or capitate-glandular) hairs. *Leaves* simple, penninerved, spirally arranged, frequently crowded towards the twig ends, mostly entire. Stipules 0. *Flowers* actinomorphic, mostly 5-merous, bisexual or functionally unisexual or ± polygamous, solitary or in few- to many-flowered, axillary or terminal, bracteate corymbs or thyrses. Bracteoles often 2. *Sepals* imbricate, free or more rarely connate below. *Petals* imbricate, their lower portion often narrow and loosely cohering in a tube, caducous. *Stamens* 5, episepalous, erect, free, or slightly connivent below; anthers 2-celled, introrse, basifixed, dehiscing lengthwise (or by pores). Disk absent (but *cf. Citriobatus*). *Ovary* superior, sessile or short-stipitate, mostly 1-celled, sometimes completely or incompletely 2-celled, placentas 2–5(–6), parietal or basal, (rarely sometimes axile in celled ovaries); style simple; stigma thickened or lobed. *Ovules* mostly ∞, anatropous, with 1 integument. *Fruit* a berry or non-dehiscent, or a loculicidal capsule. *Seeds* mostly ∞, often immersed in a viscid pulp, rarely winged; testa thin, smooth; albumen copious, hard; embryo small, close to the hilum; cotyledons small, 2–5.

Distribution. Only in the Old World, 9 (mostly small) genera of which 6 are entirely confined to Australia, 2 occur in Australia and E. Malaysia, and 1, *viz Pittosporum*, is widely distributed from West Africa (also in Teneriffe & Madeira) and Madagascar through Asia, Malaysia, and Australia to Polynesia. The general character of distribution shows a remarkable similarity to that of *Goodeniaceae*.

Ecology. The family shows capacity for a wide range of tolerance; representatives grow in tropical to warm-temperate countries (apparently none being frost resistant), and under everwet to arid conditions (Central Australia, not in the arid portions of Africa and Asia).

In Malaysia *Citriobatus* grows exclusively under seasonally dry lowland conditions, *Hymenosporum* belongs to the montane rain-forest, *Pittosporums* are found from the lowland to the montane zone, some even penetrating into the lower portion of the subalpine belt. Some species of *Pittosporum* are found apparently as occasional epiphytes (or hemi-epiphytes).

Wood anatomy. See under *Pittosporum*.

Uses. Some species are grown as ornamentals, a few *Pittosporums* might be used for re-afforestation of bare lands.

Notes. The family is subdivided into two tribes *Pittosporeae* with capsular fruits (in Mal. *Pittosporum* and *Hymenosporum*) and *Billardiereae* with non-capsular fruits (in Mal. *Citriobatus*).

The revision of *Pittosporum* is by Mr K. Bakker.

KEY TO THE GENERA

1. Unarmed. Flowers mostly in cymes or corymbs. Capsules dehiscent.
    2. Corolla at most $1^1/_2$ cm long, cream, pink, white, or purple-red. Seeds not winged. **1. Pittosporum**
    2. Corolla *c.* 3–4 cm long, yellow. Seeds winged . . . . **2. Hymenosporum**
1. Most twigs ending in a thorn and/or provided with lateral thorns. Fruit indehiscent. Flowers small, solitary, axillary, on minute short-shoots . . . . **3. Citriobatus**

1. PITTOSPORUM

Banks *ex* Gaertner, Fruct. 1 (1788) 286, t. 59; Putterlick, Syn. Pitt. (1839); Blume, Mus. Bot. 1 (1850) 158; Pritzel, E. & P. Pfl. Fam. ed. 2, 18a (1930) 273; Gowda, J. Arn. Arb. 32 (1951) 263; Cooper, Ann. Mo. Bot. Gard. 43 (1956) 87.—*Senacia* Lamk, Tabl. Bot. 2 (1793) 95, *p.p., typus S. undulata;* DC. Prod. 1 (1824) 347.—*Pseuditea* Hassk. Flora 25, 2 (1842) Beibl. 30.—*Glyaspermum* Zoll. & Mor. Nat. Geneesk. Arch. N.I. 2 (1845) 11.

Evergreen, erect, aromatic, shrubs or trees, sometimes epiphytic. Growth in flushes, terminal bud protected by cataphylls (and/or bud scales?). *Leaves* exstipulate, spirally arranged, often crowded in pseudo-whorls, specially towards the ends of the twigs, petioled or seldom sessile, entire (often sinuate in *1. P. sinuatum*), generally more or less acuminate, penninerved, young leaves often pubescent. *Inflorescences* terminal or axillary, in some *spp.* mainly ramiflorous, few to many-flowered, in fascicles, thyrsoid, or in more or less condensed racemes, rarely solitary, essentially cymose. *Flowers* bisexual or functionally unisexual apparently to various degree, generally white or pale yellow, except in *5. P. berberidoides*, fragrant. *Sepals* 5, free or connate to various degree. *Petals* 5, generally ligulate, free or coherent in the lower part, free segments spreading or recurved. *Stamens* 5, free or occasionally coherent with the corolla tube; filaments in more ♂ flowers slender, in more ♀ flowers somewhat shorter and slightly broadened at the base; anthers dorsifix, introrse, in more ♂ flowers generally oblong, in more ♀ flowers sagittate, and smaller. *Pistil* sessile or stipitate, stipe thick, 5-furrowed, generally passing into the ellipsoid ovary; *ovary* glabrous or pubescent, 1-celled, in more ♂ flowers slender or cuneiform, in more ♀ flowers plumper and thicker; *placentas* 2(–5), (in one case 6!), parietal or basal, with a varying number of ovules; style glabrous, in more ♂ flowers somewhat longer than in more ♀ flowers; stigma in more ♂ flowers hardly thickened, in more ♀ flowers capitate, 2–5-lobed. *Capsule* globose, ellipsoid or ovoid, 1-celled, loculicidally lengthwise 2(–5)-valved, in Mal. *spp.* glabrous, mostly orange when mature, often mucronate by the remains of the style; valves of varying thickness, woody or coriaceous, occasionally with resiniferous cavities, chambers of ducts, inside generally transversely ribbed or pinnately striated; funicles along the median longitudinal placenta or basal. *Seeds* 1–∞, generally compressed against each other and irregularly angular and wrinkled, variably in size and shape, reddish or blackish, coated by a resinous, viscid fluid. Endosperm horny, large; embryo minute; cotyledons 2–5; germination epigeous.

Distr. About 100 *spp.* in Africa (10), South and East Asia to Korea and Japan, Malaysia, Australia, New Zealand, and the Pacific: Bonin Isl., Micronesia (Ponape, Kusaie), Melanesia, Polynesia (Fiji, Tonga, Hawaii), mostly confined to the tropical, subtropical, and warm-temperate regions.

The density of species per island or island group in Malaysia has been indicated in fig. 1, from which it appears that *Pittosporum* is comparatively richest developed in E. Malaysia: New Guinea, the Philippines, and Celebes.

Only one species occurs from Asia to Australia *viz 10. P. ferrugineum;* one is obviously essentially a continental-Asiatic species which is also found in the Malay Peninsula (*7. P. reticosum*), and finally two species occur in Malaysia and Formosa (*9. P. pentandrum, 11. P. moluccanum*). It is possible that the latter two are also racially represented in China, but the far too fine specific delimitation applied by GOWDA, makes it difficult to correlate them satisfactorily with Asiatic species without a complete new study which goes beyond the scope of the present work. I have the impression that also in New Caledonia too many species have been distinguished on unreliable characters.

Ecol. Malaysian *Pittosporums* are generally small to at most medium-sized shrubs or trees from the substage of the rain-forest. They do not tend to be social or gregarious but none of them seems to be rare. Only two species are found in forests which are subject to a distinct dry season and that apparently only in part of their area, *viz P. moluccanum* in the mountain areas of Central and East Java and the Lesser Sunda Islands and *P. ferrugineum* which is also widely distributed and is the only species occurring in Javanese teak-forests. Both of them may be pioneering in open, grassy mountain forest; *P. ferrugineum* is, according to VAN DER PIJL (Ann. Jard. Bot. Btzg 48, 1938, 136, 138), a common pioneer on the lavas of Mt Guntur (W. Java); it has also been employed in re-afforestation work, according to KOORDERS. A similar position is occupied in the Philippines by *P. pentandrum* which is frequent in parang vegetation.

As to altitude many species are rather tolerant; *P. sinuatum* and *P. ramiflorum*, for example, range from sea-level through the tropical and montane zones to the lower part of the subalpine zone up to respectively 2700 and 3200 m altitude. There are only two true mountain species, both endemic in New Guinea, *viz 6. P. pullifolium* (600–)1200–3800 m and *5. P. berberidoides* 3000–3900 m. The former species exhibits in its leaves a certain vegetative adaptation towards high altitudes in getting thicker and smaller with recurving leaf margins and condensed habit in proportion to altitude. A similar behaviour is observed in *P. ferrugineum*, the high-altitude form of which was described as *P. versteeghii*.

Several species have been observed to grow as epiphytes or hemi-epiphytes in tall forest but are also recorded as terrestrial shrubs in more exposed spots.

The same species have occasionally been mentioned to be medium-sized trees. There is a possibility that these records are erroneous and that the epiphytic habit was overlooked, the size taken from that of the host tree. Collectors should check this in the field (*cf. P. pullifolium*).

Pollination. It is certain that the sweet-scented, white or cream-coloured, rarely reddish flowers (*P. berberidoides*) attract insects, but we have no data on pollinators. Flowers are functionally often unisexual.

Dispersal. In fruit Malaysian *Pittosporum* represents a most attractive, lively coloured picture with orange or orange-red valves, inside and outside, against which the sticky seeds, black or black-red give a marked contrast. The open fruit has a distinct aromatic smell. It is astonishing that nothing has been reported on dispersal of these seeds or fruits, save for RIDLEY's casual note (Disp. p. 382) that opossums introduced in New Zealand were observed to feed on the fruit of New Zealand species. Both the epiphytic habit of several species in New Guinea and the Philippines and the frequent occurrence of *Pittosporum* on oceanic islands would point to dispersal by birds.

Morph. KIRK (1872) has apparently been the first to observe sexual dimorphism in some New Zealand species; this was also observed in *P. ferrugineum* in Java by VALETON (1896), in Hawaiian species by ROCK (1913), in Asian & Chinese species by GOWDA (1951), in African species by CUFODONTIS (1951), and in Australasian species by COOPER (1956). The tendency for the separation of sexes seems therefore universal in the genus. On one tree both types of flowers are found in addition to the hermaphrodites!; some appear to be more ♀ or at least functionally ♀, others more ♂ or at least functionally so. The female or maleness seems to be often a matter of degree. In more ♂ flowers the ovary is narrow-lanceolate and sterile and anthers are larger and often longer than in ♀ flowers where the ovary is more plump and stamens and anthers are narrow-sagittate, often sterile or nearly so and reduced to various degree, sometimes even to small staminodes.

In the descriptions of this revision the sizes of sexual flower parts of more ♂ or ♀ flowers have generally been merged except in species 5, 9, 10, and 11, in which the differences were too large and distinct to allow for this practice.

Wood anat. DEN BERGER, Determinatietabel Malesië, Veenman, Wageningen (1949) 42 (hand lens). METCALFE & CHALK, Anat. Dic. 1 (1950) 129 (*Pittosporum*, *Citriobatus*, *Hymenosporum*); MOLL & JANSS. Mikr. 1 (1906) 226–232. JANSSONIUS, Blumea 6 (1950) 435 does not suggest any relationship, CHALK in METCALFE & CHALK *l.c.* mentions a possible relationship with *Araliaceae* (septate fibres and scanty paratracheal parenchyma); see also JANSSONIUS, Key to Jav. woods, Brill, Leiden (1952) 62.C.A.R.–G.

Uses. Several *Pittosporums* are well known to gardeners because of the modest size of the shrubs or small trees, their attractive-scented flowers and orange fruits. Of the Malaysian species the timber is not available in large sizes or quantities and besides does not seem to be durable. The fruits of some species are here and there employed for medicinal purpose against a multitude of illnesses, *e.g. 3. P. resiniferum.* Fruits may contain resin and aromatic oil in such quantity that they are inflammable (*petroleum nut*), for example of *3. P. resiniferum.* Leaves and fruits are used for fish poisoning, their bitter substances are obviously due to saponins.

Taxon. From the work by COOPER, *l.c.* who in his revision of the Australasian representatives reduced a considerable number of species to synonymy, it is clear that the genus as a whole contains too many 'paper species' and that specific delimitation is rather chaotic, which is in part due to the absence of a prior, firm attempt towards correlation in a monographic treatment. For the Malaysian area up till the present 46 specific names were recognized. PRITZEL (1930) indicated already that a number of these did not deserve specific rank. I have been compelled to accept only 10 species, adding one obviously new species. The impression is that in Malaysia only very few novelties can be expected.

There have been several attempts to subdivide the genus into infrageneric taxa. PUTTERLICK (*l.c.* 6–18) divided the genus into three subgenera based on the structure and position of the inflorescences and the shape of the capsules, but it appears that these characters are very plastic. GOWDA (*l.c.* 234) is of opinion that no subgenera and sections can be distinguished in the solid mass of species; however, he distinguished two 'groups' *Trivalvae* and *Bivalvae*—raised by COOPER (*l.c.* 121) to the rank of series—which he mainly based on the number of carpels in the ovary, corresponding with the number of valves in the fruit. It appears doubtful to me whether these two groups or series represent natural affinities indeed, though the number of carpels may serve for the purpose of starting an artificial key. GOWDA noted already that the number of valves is not strictly constant, as in several bivalvate species occasionally 3-valved capsules are found; the same has been observed by COOPER. In the New Guinean *1. P. sinuatum* there is an astonishing range of variability in the number of valves varying between 2 and 5(–6). A similar variability has been recorded by COOPER from the New Zealand *P. tenuifolium*.

PRITZEL (*l.c.* 273–281) did not reach a satisfactory subdivision of the genus and summarized for convenience species with brief keys according to geographical regions, menacing their synthetic correlation.

In my opinion the division into *Bivalvae* and *Trivalvae* is more of a practical value than serving in all cases to indicate affinity.

Notes. Field collectors are invited to make observations on dispersal and pollination. Furthermore they should try to secure both flowering material and ripe fruits which are indispensable for a correct dentification.

KEY TO THE SPECIES

(flowering material)

1. Leaves entire or sinuate, papyraceous. Ovary with 2–5 placentas . . . . **1. P. sinuatum**
1. Leaves entire, mostly chartaceous. Ovary with 2 placentas.
 2. Inflorescences mainly on the bare branches, below the leaves, seldom between the leaves.
  3. Flowers small, *c.* 4–7 mm.
   4. Leaves generally small, *c.* 4–7 by 1½–3 cm, narrowly obovate or narrowly elliptic. **4. P. ramosii**
   4. Leaves generally larger, *c.* 5–18 by 2½–6 cm, elliptic or narrowly elliptic . **2. P. ramiflorum**
  3. Flowers large, *c.* 9–12 mm. Leaves narrowly obovate or oblanceolate, *c.* 8–15 by 3½–5½ cm. **3. P. resiniferum**
 2. Inflorescences terminal or axillary, all between or near the leaves.
  5. Flowers always solitary, axillary. Leaves small, obovate, *c.* 2–4 by 1–3 cm, abruptly shortly acute acuminate. Reticulation conspicuous, prominent on *both* sides. Ovary glabrous. **5. P. berberidoides**
  5. Inflorescence with a varying number of flowers. Leaves generally larger. Reticulation not prominent on *both* sides.
   6. Leaves generally bullate or at least nervation impressed above. Flowers always in (pseudo-) terminal condensed, shortly pedunculate racemes. Petals large, *c.* 9–15 by 2–5 mm. **6. P. pullifolium**
   6. Leaves not bullate. Inflorescences various. Petals *c.* 1–2½ mm broad.
    7. Ovary glabrous or only pubescent at the base.
     8. Leaves very narrowly elliptic. Nerves not very conspicuous. Sepals obtuse. **9. P. pentandrum**
     8. Leaves elliptic or narrowly elliptic. Nerves conspicuous. Sepals obtuse or acute.
      9. Nerves distinctly impressed above, *c.* 5–7 pairs. Sepals free. Ovules 4, basal. **7. P. reticosum**
      9. Nerves conspicuous, but generally not impressed above. Sepals united to varying degree or nearly free. Ovules more than 4, parietal . . . . **11. P. moluccanum**
    7. Ovary pubescent.
     10. Sepals longer than 5 mm, free and acute . . . . **8. P. longisepalum**
     10. Sepals shorter than 5 mm, free or united, acute or obtuse.
      11. Leaves attenuate acuminate; lower surface often with a ferrugineous pubescence. Sepals always free and acute . . . . **10. P. ferrugineum**
      11. Leaves acute or slightly acuminate, occasionally rounded. Young leaves sometimes with a ferrugineous pubescence, generally not persisting on older leaves. Sepals united or nearly free, obtuse or acute . . . . **11. P. moluccanum**

KEY TO THE SPECIES

(dry fruiting material)

1. Leaves entire or sinuate, papyraceous. Fruit 2–5-valved. Funicles long, ribbon-like. **1. P. sinuatum**
1. Leaves entire, mostly chartaceous. Fruit 2-valved. Funicles short.
 2. Infructescences mainly on the bare branches, below the leaves, seldom between the leaves.
  3. Valves hard, rugose, and woody.
   4. Fruits globose, compressed, *c.* 0.7–1.5 cm diam. Leaves generally elliptic or narrowly elliptic, base broadly attenuate . . . . **2. P. ramiflorum**
   4. Fruits ovoid or broadly ellipsoid, compressed; base sometimes emaginate, *c.* 2½–4 by 2–3 cm. Leaves generally narrowly obovate or oblanceolate, base decurrent . . . **3. P. resiniferum**
  3. Valves not hard, smooth, coriaceous and pellucid . . . . **4. P. ramosii**
 2. Infructescences terminal or axillary, all between or near the leaves.
  5. Leaves small, obovate, *c.* 2–4 by 1–3 cm, abruptly shortly acute acuminate. Reticulation conspicuous, prominent on *both* sides. Fruits solitary, ellipsoid . . . . **5. P. berberidoides**
  5. Leaves larger, if small, reticulation impressed above.
   6. Fruits longer than broad (not including the stipe and the apical mucro).
    7. Leaves generally bullate. Fruit valves not strongly recurving when ripe, margins straight. Placenta not raised. **6. P. pullifolium**
    7. Leaves generally not bullate. Fruit valves often strongly recurving when ripe, margins wavy. Placenta raised . . . . **11. P. moluccanum**
   6. Fruits as long as broad or slightly broader than long (not including the stipe and the apical mucro).
    8. Fruit valves rather thick . . . . **11. P. moluccanum**
    8. Fruit valves rather thin.

9. Funicles inserted up to halfway the valves. Leaves elliptic or narrowly ovate, top attenuate acuminate. Nerves *c.* 5–7 pairs . . . . **10. P. ferrugineum**
9. Funicles inserted close to the base of the valves.
  10. Seeds few, *c.* 1–4. Nervation conspicuously impressed above. Leaves elliptic or narrowly elliptic.
    11. Seeds large, *c.* 5 mm or more . . . . **7. P. reticosum**
    11. Seeds smaller, up to *c.* 4 mm . . . . **8. P. longisepalum**
  10. Seeds generally more than 4. Nervation inconspicuous. Leaves very narrowly elliptic. **9. P. pentandrum**

1. Pittosporum sinuatum BLUME, Mus. Bot. 1 (1850) 161; MIQ. Fl. Ind. Bat. 1, 2 (1858) 123; MIQ. Illustr. 1 (1870) 77, t. 35; VAL. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 15; PULLE, Nova Guinea 8 (1910) 365; RIDL. Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 19; PRITZEL, Bot. Jahrb. 62 (1929) 340; E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; MERR. & PERRY, J. Arn. Arb. 21 (1940) 178.—*P. chelidospermum* BL. Mus. Bot. 1 (1850) 161, fig. 33; MIQ. Fl. Ind. Bat. 1, 2 (1858) 123; Illustr. 1 (1870) 77, t. 34.—*P. rumphii* (*non* PUTT.) BL. Mus. Bot. 1 (1850) 160.—*P. novoguineense* MIQ. Illustr. 1 (1870) 79.—*P. galai* K.SCH. in K.Sch. & Hollr. Fl. Kais. Wilh. Land (1889) 71; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 337; Nachtr. (1905) 272.—*P. quinquevalvatum* WARB. Bot. Jahrb. 13 (1891) 320; K.SCH. & LAUT. Nachtr. (1905) 271.—*P. brassii* MERR. & PERRY, J. Arn. Arb. 21 (1940) 178.

Shrub or small tree, *c.* 1–2(–4) m; twigs glabrous, young shoots puberulous, with scattered caducous, minute, bract-like leaves (cataphylls) below the leaves of the apical flush. *Leaves* mostly *c.* 3–5 subverticillate or scattered, papyraceous, very variable in size and shape, elliptic, narrowly elliptic or narrowly obovate, *c.* (6–)12–22(–30) by (3–)4–7(–9) cm; base cuneate, margin entire or more or less deeply irregularly sinuate, top *c.* 1–2$^{1}/_{2}$ cm gradually acute-acuminate; nerves *c.* 5–10 pairs, prominent beneath, forming distinct intramarginal loops; reticulation lax; petiole *c.* 0–1 cm. *Inflorescences* one or more (pseudo-)terminal pseudo-umbels or condensed corymbs; peduncle *c.* $^{1}/_{2}$–1 cm, sometimes longer, ferrugineous-pubescent as are the bracts and pedicels. Bracts narrowly oblong, boat-shaped, *c.* 4–5 mm. Pedicels *c.* 2–6 mm. *Flowers* yellowish-white or pink. *Sepals* free, lanceolate, *c.* 3–6 by 1 mm, top acute, rarely blunt, margin ciliate. *Petals* ligulate, *c.* 10–15 mm, tip rounded. Filaments *c.* 2–8 mm, anthers *c.* 1–2 mm. *Ovary* subsessile or up to *c.* 3 mm stipitate, elliptic, *c.* 2–3 by 1 mm, ferrugineous-pubescent; ovules ∞, on 2–5 parietal placentas; style 2–6 mm. *Fruits c.* 1–3, on woody pedicels of *c.* $^{1}/_{2}$–1 cm, subglobose, obovoid or club-shaped when young, more or less ovoid or ellipsoid when ripe, sometimes angled, *c.* 2–4$^{1}/_{2}$ by 1–2 cm when dry, 2–5-valved, valves coriaceous, yellow or orange at both sides also when dry, inside not distinctly transversely ribbed; funicles long, ribbon-like, orange. *Seeds* ∞, subreniform, *c.* 5–8 mm.

Distr. *Malaysia:* New Guinea (incl. also Aru Isl.).

Ecol. More or less common in the undergrowth of poorly drained rain-forest, in mossy forests or swamp forest, 50–2700 m.

Uses. A decoction of the roots is locally applied for belly-ache of children.

Vern. *Galai, talli-wal.*

Notes. In spite of its variability in leaf-shape and number of fruit valves, this species is very easy to recognize by its very thin, light green, often sinuate leaves and the structure of its fruit. Of a total of 69 fruits examined I obtained the following figures: 17 had 2 valves, 11 had 3 valves, 22 had 4 valves, 18 had 5 valves, and 1 had 6 valves. Of specimens of which at least 2 fruits were available, the figures were: 4 had strictly 2 valves, 1 had 3 valves, 2 had 4 valves, 3 had 5 valves, and 8 possessed a variable number of valves. The number of valves tends therefore to be more or less constant in one specimen.

Sinuate and entire leaves may be present in one specimen. WARBURG (1891) already hinted at the possibility that *P. chelidospermum*, *P. novoguineense*, *P. galai*, and *P. sinuatum* might appear to be conspecific with his *P. quinquevalvatum* (of which I saw a 'rubbing' from the Wroclaw Herbarium). These reductions have been accepted by PRITZEL and after a thorough examination of abundant material and the types I fully agree; I have also included *P. brassii.*

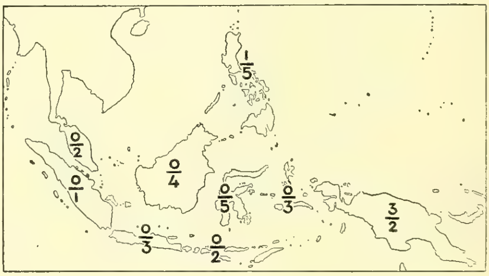

Fig. 1. Distribution of *Pittosporum* in Malaysia. The figure above the hyphen indicates the number of endemic species in each district, the figure below the hyphen the number of non-endemic species.

2. Pittosporum ramiflorum (ZOLL. & MOR.) ZOLL. *ex* MIQ. Fl. Ind. Bat. 1, 2 (1858) 122; Illustr. 1 (1870) 82, t. 37; K. & V. Bijdr. 4 (1896) 56; BOERL. Cat. Hort. Bog. 1 (1899) 57; MERR. Philip. J. Sc. 5 (1910) Bot. 180; BACK. Schoolfl. (1911) 74; KOORD. Exk. Fl. Java 2 (1912) 309; BREMER, Ann. Jard. Bot. Btzg 29 (1916) 161 (embryology); MERR. Philip. J. Sc. 11 (1917) Bot. 274; En. Philip. 2 (1923) 223; KOORD. Fl. Tjib. 2 (1923) 96; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274;

MERR. & PERRY, J. Arn. Arb. 21 (1940) 176, *incl.* var. *parvifolium*; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) Fam. 81, p. 2.—*Glyaspermum ramiflorum* ZOLL. & MOR. Nat. Geneesk. Arch. N.I. 2 (1845) 11.—*P. floribundum* (*non* W. & A.) HASSK. Pl. Jav. Rar. (1848) 228.—*P. ramiflorum* var. *parviflorum* K.SCH. in K.Sch. & Hollr. Fl. Kais. Wilh. Land (1889) 70; PRITZEL, Bot. Jahrb. 62 (1929) 340.—*P. comptum* K.SCH. & LAUT. Fl. Schutzgeb. (1900) 338.—*P. clementis* MERR. Philip. J. Sc. 3 (1908) Bot. 137.—**Fig. 2.**

Shrub or tree, (3–)5–20(–30) m, occasionally epiphytic. *Leaves* spirally arranged or in pseudowhorls of 3–6, elliptic to narrowly elliptic, *c.* 5–18 by 2½–6 cm, subcoriaceous; base broadly cuneate, margin slightly recurved, top *c.* ½–1½ cm rather abruptly acuminate, nerves *c.* 5–8 pairs, reticulations fine, tessellate; petiole *c.* 1½–2½ cm. *Inflorescences* generally on the bare branches below the leaves, variously densely branched and flowered; peduncles pubescent, occasionally up to *c.* 3 cm. Bracts ovate, *c.* 1½–1 mm, caducous. Pedicels up to *c.* 6 mm. *Sepals* united at their base in a shallow cup *c.* 1½–2 mm high, short free lobes rounded at the top. *Petals* (4–)5–6(–7) by (1–)2(–3) mm, narrowly elliptic, rounded. Stamens *c.* 4–5 mm, filaments *c.* 3–5 by ⅓ mm, anthers oblong, ¾–2 mm. *Ovary* subsessile, ellipsoid or obovoid, *c.* 2–3 by 1–1½ mm, brownish pubescent; style 1–3 mm, stigma 2-lobed. *Fruits* varying in number, on woody pedicels, compressed globose, *c.* (7–)10–12(–15) mm diam., 2-valved, mucronate, valves hard, *c.* 1–2 mm thick, wrinkled, placentas up to near the top. *Seeds* numerous, very irregular-roundish, flat, *c.* 2–3 mm diam.

Distr. Solomon Isl., in *Malaysia:* Java, Celebes, N. Borneo (Mt Kinabalu), southern Philippines, (Negros, Cebu, Mindanao, Bohol), Moluccas (Ambon, Buru, Ceram), and New Guinea.

Ecol. Substage tree in rain-forests and on banks of forest streams, occasionally in mountain forests

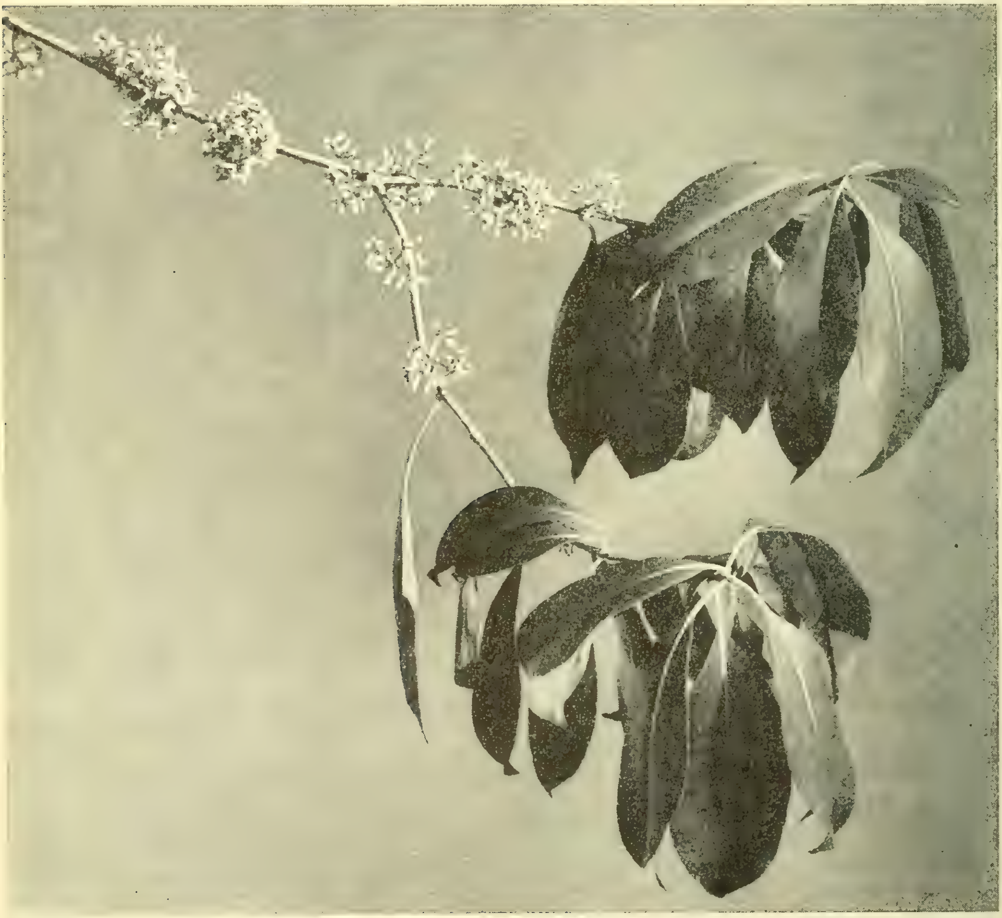

Fig. 2. *Pittosporum ramiflorum* (Z. & M.) ZOLL. *ex* MIQ. Flowering twig, × ¼, from a tree cultivated in Kebun Raya Indonesia (Photogr. F. HUYSMANS).

and in mossy oak forests, 0–3200 m, mostly above 1000 m.

Vern. Java: *Wuru*, (*w.*) *tjombrangan*, J. Philippines: *duong*, *malagus*, Bag., *kolinus-hamolaon*, C. Bis., *riin*, Lan. Celebes: *karangkang-banti*, *mawuring*, Tombulu. New Guinea: *aratna*, Aiyura dial.

Note. In my opinion size of flowers or leaves give no reason for distinguishing varieties within this species.

A specimen collected by KOSTERMANS (2408) has remarkably large flowers (*c.* 10 mm) and fruits (*c.* 2½ mm diam.). It was collected together with another specimen (KOSTERMANS 2407) which doubtless represents *P. ramiflorum* and has average-sized flowers and fruit. As the large-fruited specimen further agrees entirely (!) with *P. ramiflorum*, I distinguish this deviation for the present as *P. ramiflorum f.* **macrocarpum.**

3. Pittosporum resiniferum HEMSL. Kew Bull. (1894) 344; MERR. Publ. Gov. Lab. Philip. *no* 35 (1906) 17, *incl. var. orbiculatum*; Philip. J. Sc. 1 (1906) Suppl. 60; *op. cit.* 2 (1907) Bot. 275; *op. cit.* 5 (1910) Bot. 352; BROWN, Min. Prod. Philip. For. 2 (1921) 106, t. 38; MERR. En. Philip. 2 (1923) 224;

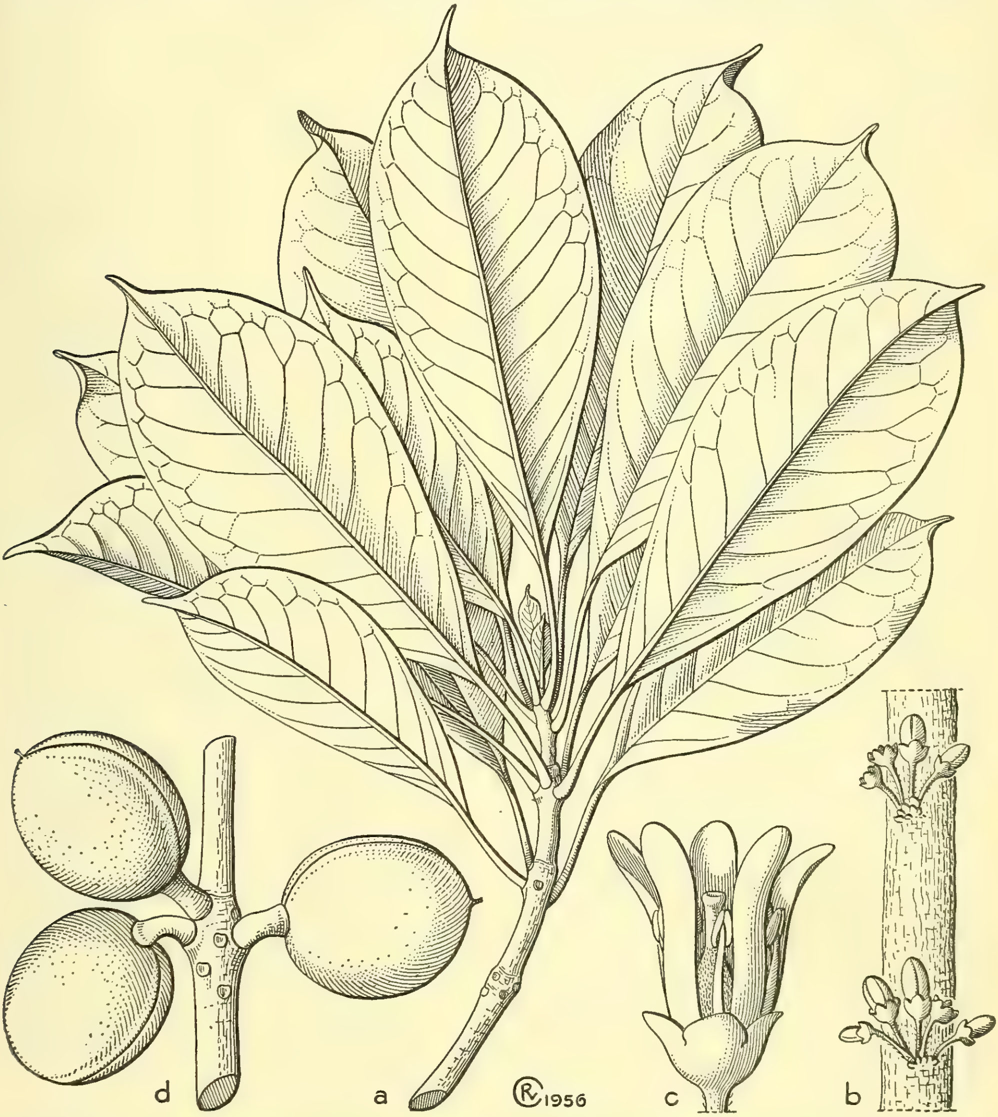

Fig. 3. *Pittosporum resiniferum* HEMSL. *a.* Twig, × 2/3, *b.* ramiflorous inflorescences, × 2/3, *c.* flower, × 3, *d.* infructescence, × 2/3 (*a* after ELMER 9232, *b–c* RAMOS BS40750, *d* RAMOS BS1501).

PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; BROWN, Useful Pl. Philip. 2 (1950) 62, f. 23–24; QUIS. Med. Pl. Philip. (1951) 353.—*P. epiphyticum* MERR. Philip. J. Sc. 3 (1908) Bot. 138; En. Philip. 2 (1923) 222; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. acuminatissimum* MERR. Philip. J. Sc. 14 (1919) 402; En. Philip. 2 (1923) 221.—**Fig. 3.**

Small tree or shrub, often epiphytic, *c.* 2–5 m, occasionally *c.* 15 m; twigs glabrous. *Leaves* spirally arranged or slightly crowded in pseudo-whorls, stiff-coriaceous, narrowly obovate or oblanceolate, *c.* (6–)8–15(–21) by (2½–)3½–5½ (–6½) cm, glabrous, the very young ones pubescent; base cuneate, decurrent, top rather abruptly *c.* ½–1 cm acuminate; nerves 7–10 pairs, prominent beneath, reticulations very fine; petiole *c.* 2–4 cm. *Inflorescences* almost always on the bare branches below the leaves, fascicles or shortly peduncled pseudo-umbels. Bracts ovate, *c.* 2 by 1½ mm, pubescent. Pedicels *c.* 2–6(–10) mm, pubescent or glabrescent. *Sepals* in their lower half united into a shallow cup *c.* 1–2 mm high, free lobes rounded at the top, *c.* 1–2 mm long. *Petals* narrowly oblong, *c.* 9–12 by 1½–2 mm. Filaments slender *c.* 6–7 mm, anthers *c.* 1½–2 mm, oblong. *Ovary* sessile, ellipsoid, *c.* 4–5 by 1½–2 mm, densely pubescent; style *c.* 2–2½ mm, stigma thickened. *Fruits* 1–6, on woody pedicels, globose, ellipsoid or ovoid, compressed, *c.* 2½–4 by 2–3½ cm, 2-valved; valves very hard, *c.* 4–5 mm thick, with large resiniferous cavities, cordate at the base, rugose; funicles inserted up to near the top. *Seeds* many, irregular in shape, *c.* 4 mm.

Distr. *Malaysia:* North Borneo (Mt Kinabalu) and Philippines (Luzon, Mindoro, Panay, Catanduanes, Leyte, and Mindanao).

Ecol. Common in mountain forests (mossy forests) on exposed ridges as a small tree or epiphyte, (400–)1000–2200(–3000) m, in the lower localities at 400 and 600 m apparently exclusively epiphytic.

Uses. The fruit is called 'petroleum nut' in the Philippines. It contains a considerable amount of pleasant-smelling oil, composed of dihydroterpene and normal heptane. It burns readily and is therefore used for illuminating purposes. Further it is considered as a universal medicine, *cf.* QUISUMBING *l.c.*

Vern. *Petroleum nut,* E, *abkél, abkól, apisang, botiak, daél, diñgo, kabilan, kiligto, lañgis, obkol,* Ig., *amimit, bualau, tago-ngirit,* Bik., *balicbican,* Tag., *kalapakab, pilai,* Bon., *sagága,* Ting.

Note. The only specimen from Mindanao (CLEMENS 1040) is the type specimen of *P. epiphyticum.* The two specimens from Leyte (WENZEL 807 and RAMOS B.S.15225) have formerly also been identified as *P. epiphyticum.* As the specimens from outside Luzon differ all more or less from the bulk of the Luzon material, it seems to me, that this species must be reduced to *P. resiniferum,* from which it only differs in the size of the leaves. The same can be said of *P. acuminatissimum.*

4. Pittosporum ramosii MERR. Philip. J. Sc. 5 (1910) Bot. 180; En. Philip. 2 (1923) 223; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.

Tree or shrub, *c.* 3–6 m. *Leaves* spirally arranged, sometimes somewhat crowded apically, elliptic, narrowly elliptic or narrowly obovate, c. 4–7 by 1½–3 cm; base decurrent, top abruptly *c.* ¾–1 cm acuminate; nerves *c.* 5–6 pairs, separated by a distinct intermediary secondary nerve, reticulations fine; petiole *c.* 1–1½ cm. *Inflorescences* mainly on the bare branches, below the leaves, but also axillary, fascicles or shortly peduncled pseudo-umbels. Bracts triangular, acute, *c.* 1 mm. Pedicels slender, *c.* 1 cm, glabrous. *Sepals* united at the base, elliptic, *c.* 1 mm long. *Petals* (immature) ligulate, *c.* 7 by 1½ mm. Filaments *c.* 4½ mm, anthers oblong, *c.* 1½ mm, cordate. *Ovary c.* 2 mm stipitate, ellipsoid, *c.* 2 by 1 mm, pubescent; style *c.* 2–2½ mm; stigma capitate. *Fruits c.* 1 cm stalked, *c.* 2 mm stipitate, subglobose, *c.* 8–10 mm diam., 2-valved, mucronate; valves coriaceous, pellucid, with large resiniferous cavities, smooth, inside faintly transversely ribbed; funicles inserted up to halfway the valves. *Seeds c.* 8–10, irregularly angled, *c.* 4 mm.

Distr. *Malaysia:* Philippines (Luzon).

Ecol. In forests, *c.* 1500 m.

Vern. *Albon,* Ig., *tungtuñga,* Bon.

Note. Obviously closely allied to *P. ramiflorum,* and hardly distinguishable from it in flower, but different in fruit by its coriaceous, pellucid, strongly resiniferous valves. It might possibly represent a subspecies (geographical race) of *P. ramiflorum* which it excludes geographically.

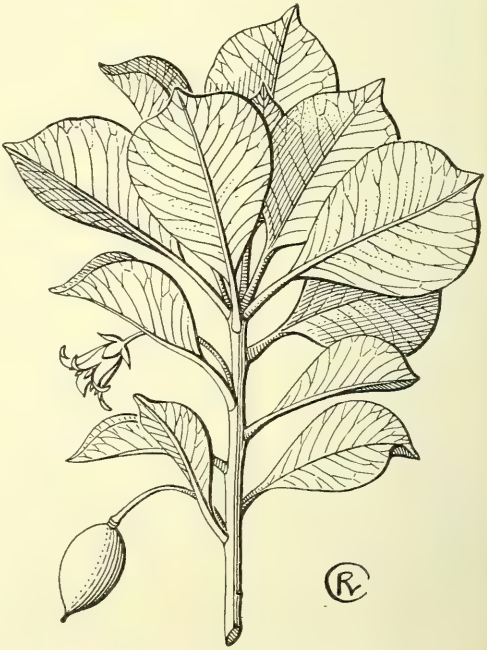

Fig. 4. *Pittosporum berberidoides* BURKILL, nat. size (BRASS 4399).

5. Pittosporum berberidoides BURKILL, Kew Bull. (1899) 96; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 276; MERR. & PERRY, J. Arn. Arb. 21 (1940) 175.—**Fig. 4.**

Slender tree, 3–6 m; young shoots purple-red. *Leaves* coriaceous, obovate, *c.* 2–4 by 1–3 cm; base cuneate, top abruptly and very short (*c.* 3 mm) acuminate; upper surface greyish-olive green, midrib impressed, *c.* 10–15 pairs of nerves, prominent, reticulations not fine; lower surface brownish-olive, midrib, nerves and reticulations yellowish, prominent; petiole *c.* 1 cm, purple-red. *Flowers* solitary, in the axils of often small leaves. Pedicels *c.* 1–2 cm. *Sepals* free, ovate or narrowly ovate, *c.* 3–3$^{1}/_{2}$ by 1$^{1}/_{2}$–2 mm, deep purple-red, margins ciliate, top acute. *Petals* ligulate, *c.* 12 by 2–2$^{1}/_{2}$ mm, deep purple-red, 3-nerved, apex rounded. Filaments *c.* 6 mm, slightly thickened towards the base; anthers narrowly ovate, *c.* 2 by 1 mm, base cordate. *Ovary* subsessile, ellipsoid, *c.* 3 mm long, glabrous, with *c.* 10–12 ovules; style *c.* 2–2$^{1}/_{2}$ mm, stigma not thickened. *Fruit* ellipsoid, *c.* 12 by 8 mm, purple-black *in herb.*, 2-valved, mucronate; valves hard, rather thin, funicles inserted on the lower half, *c.* 1–2 mm long. *Seeds c.* 6, irregular, *c.* 3–4 mm long.

Distr. *Malaysia:* New Guinea (Central Divison: Mts Scratchley & Albert Edward).

Ecol. Apparently only in subalpine mountain forests, 3000–3960 m, according to BRASS rather common on Mt Albert Edward.

6. Pittosporum pullifolium BURKILL, Kew Bull. (1899) 96; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 276; MERR. & PERRY, J. Arn. Arb. 21 (1940) 176.—*P. nubigenum* RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 18; PRITZEL, E. &. P. Pfl. Fam. ed. 2, 18a (1930) 276.—*P. batavorum* PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 276, *in clav.*—*P. ledermannii* PRITZEL, Bot. Jahrb. 62 (1929) 338; E. & P. Pfl. Fam. ed. 2, 18a (1930) 274, t. 157.—**Fig. 5.**

Small tree or shrub, *c.* 1–5 m, at lower altitudes hemi-epiphytic, said occasionally to be a medium-sized tree, *c.* 15–20(–36) m, young shoots yellowish brown pubescent. *Leaves* more or less in pseudo-whorls, stiffly coriaceous, elliptic, narrowly elliptic or narrowly obovate, *c.* 2$^{1}/_{2}$–25 by 1$^{1}/_{2}$–9 cm, pubescent when young, pubescence occasionally persisting beneath; base attenuate, margin slightly recurved or distinctly revolute, top rounded or abruptly *c.* $^{1}/_{2}$–1 cm acuminate; midrib, 5–10 pairs of nerves, and the lax reticulations impressed above, midrib and nerves prominent beneath; petiole $^{1}/_{2}$–3$^{1}/_{2}$ cm. *Inflorescences* terminal or pseudo-terminal, condensed racemes, exceptionally solitary axillary; peduncle firm, *c.* (0–)1–1$^{1}/_{2}$ cm, pubescent; rhachis *c.* $^{1}/_{2}$ cm, pubescent. Bracts triangular or narrowly oblong, *c.* 3–10 by 2–3 mm, acute. Pedicels 0–10 mm. *Flowers* large. *Sepals* free, narrowly elliptic to broadly elliptic, *c.* 4–6 by 2–3$^{1}/_{2}$ mm, yellow or purple, ciliate. *Petals* ligulate, *c.* 9–15 by 2–5 mm, top rounded. *Stamens* in ♂ flowers *c.* 9–12 mm, in ♀ flowers 4–4$^{1}/_{2}$ mm; filaments in ♂ flowers, *c.* 6–9 mm, in ♀ flowers *c.* 3 mm; anthers in ♂ flowers oblong, *c.* 2–3 mm, in ♀ flowers small, *c.* 1–1$^{1}/_{2}$ mm. *Ovary* sessile, in ♂ flowers reduced, cuneiform. *c.* 1 mm, pubescent, in ♀ flowers ellipsoid, *c.* 4–6 by 2$^{1}/_{2}$ mm, style in ♂ flowers *c.* 3 mm, in ♀ flowers slightly shorter. *Fruits* up to 20, on woody pedicels of *c.* 1–2(–3) cm, ellipsoid to broadly ellipsoid, sometimes compressed, *c.* 1$^{1}/_{2}$–3$^{1}/_{2}$ by 1–2 cm, 2- or occasionally 3-valved, mucronate; valves rugose, slightly recurved when mature, *c.* 1–2 mm thick at the straight margins, in the median line up to 4 mm diam., funicles inserted up to the top of the valves. *Seeds* numerous, irregular, flattened, *c.* 5 mm.

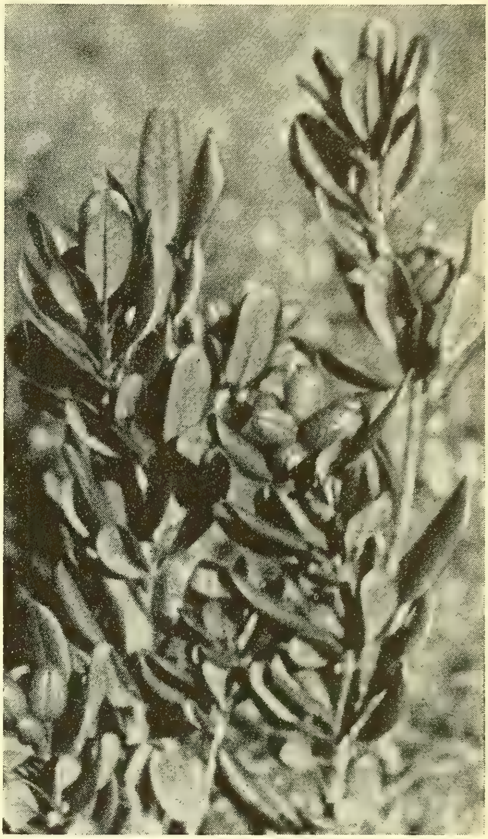

Fig. 5. *Pittosporum pullifolium* BURKILL near Lake Habbema (W. New Guinea), 3225 m alt., fruiting branches with typical convex leaves (Photogr. BRASS *no* 9087A).

Distr. *Malaysia:* New Guinea.

Ecol. The mountain form is a common small tree or shrub in edges of subalpine forests (3200–3800 m), the specimens from lower altitude are hemi-epiphytic shrubs or small trees in rain-forests or mossy forests (1200–2100 m, once at 600 and 100 m).

Note. The type of *P. pullifolium* represents the mountain form, which has small, thick leaves with revolute margins and short petioles. In specimens from lower altitudes which have been referred to as *P. ledermanni*, leaf characters show a complete range from large and rather thin to rather small and thick. An authentic specimen of *P. batavorum* entirely agrees with *P. pullifolium.* The fragmentary type specimen of *P. nubigenum* has only immature flowers; it differs from *P. pullifolium* by its smaller flower parts and by its few, axillary flowers. *P. ledermanni* was considered to be an epiphytic shrub developing later into a tree. On the labels of the collectors one finds mostly 'epiphytic shrub' or 'small tree'.

7. Pittosporum reticosum RIDL. Fl. Mal. Pen. 1 (1922) 137.—*P. kerrii* CRAIB, Kew Bull. (1925) 16; Fl. Siam. En. 1 (1931) 98.

Small tree or shrub, *c.* 3–5 m high. *Leaves* spirally arranged and crowded towards the ends of the twigs, coriaceous, elliptic or narrowly elliptic, *c.* 4–15 by 2–4½ cm; base attenuate to decurrent, margin often wavy; top acute and generally *c.* ½–1 cm acuminate; midrib, *c.* 5–7 pairs of nerves and the fine reticulations more or less finely impressed above, prominent below; innovations yellowish or ferrugineous-pubescent; petiole *c.* ½–1 cm. *Inflorescences* terminal, thyrsoid panicles, all parts ferrugineous-pubescent; peduncle *c.* ½ cm, rhachis *c.* 1½–3 cm, lower branchlets 3-flowered. Bracts *c.* 4–5 mm long, caducous. Pedicels *c.* 2–3 mm. *Sepals* free, broadly elliptic, *c.* 2–2¼ by 1½ mm, rounded or acute, membranous towards the irregular margins. *Petals* narrowly elliptic, rounded *c.* 6 by 2½ mm. Filaments *c.* 3½ mm, anthers ovate, *c.* 1½ mm long, cordate at the base. *Ovary* subsessile, including the 5-furrowed stipe *c.* 2½ by 1¼ mm, pubescent at the base, apically nearly glabrous; style *c.* 2 mm, stigma not capitate. Ovules 4, basal. *Fruits* subglobose or broader than long, 2-valved, *c.* 1–2 cm pedicelled, *c.* 8–12 by 10–14 mm, mucronate; valves thin, slightly notched at the apex. *Seeds* 4 or less, inserted near the base, large, *c.* 4–6 mm, black, smooth.

Distr. S. China (Yunnan), Indo-China, Burma, Siam, and *Malaysia:* Malay Peninsula.

Ecol. In forests 1000–1800 m.

Note. As from the Malay Peninsula only fruiting specimens were available, the flowers have been described from a specimen from Siam (KERR 5559, the type of *P. kerrii*) which is obviously conspecific with *P. reticosum.* The type specimen of *P. reticosum* (WRAY & ROBINSON 5444), has somewhat longer and more slender fruit pedicels than the rest of the material (*c.* 1½–2 cm).

8. Pittosporum longisepalum BAKKER, *nov. sp.*—**Fig. 6.**

Habitu P. ferrugineo, sed differt sepalis eis duplo longioribus et alabastrum maturam conspicue excedentibus, seminibus 1–4, ad valvarum basin insertis. Typus Clemens 35096.

Treelet (or occasionally an epiphytic shrub?), *c.* 6 m; innovations pubescent. *Leaves* in pseudowhorls, narrowly elliptic, *c.* 4–6 by 1½–2 cm; base cuneate, decurrent, margin recurved, top acute and *c.* ½–¾ cm acuminate; midrib, *c.* 5–7 pairs of nerves and the fine reticulations finely impressed above; more or less pubescent beneath; petiole *c.* ½ cm. *Inflorescences* a small number of apical, 3-flowered cymes; peduncle terete, *c.* 2–3 cm, pubescent. Bracts linear, *c.* 5–6 mm, pubescent; pedicels ½–1½ cm. *Sepals* free, linear-lanceolate, *c.* 6–7 by 1–1½ mm, pubescent, acute, exceeding the petals in bud. *Petals* narrowly oblanceolate, *c.* 8 by 1–2 mm, acute, 3-nerved. Filaments *c.* 3 mm; anthers oblong, *c.* 2 mm, apiculate. *Ovary* subsessile, ellipsoid, densely pubescent on a *c.* 1 mm long, 5-furrowed stipe, *c.* 2 by 1–1½ mm, ovules 6–8; style *c.* 1½ mm, stigma capitate. *Fruit* subglobose, *c.* 7 mm diam., mucronate, 2-valved; valves thin, rugose; funicles inserted close to the base. *Seeds* 1–4, *c.* 4 by 3 mm.

Distr. *Malaysia:* North Borneo (Mt Kinabalu) and Central Celebes (P. VAN DER GOOT 1).

Ecol. Mountain rain-forests, 1200–1500 m.

Vern. Central Celebes: *Patjikala*, Toradja.

Note. This species seems to be related to *P. ferrugineum* AIT., but differs distinctly in having sepals about twice as long and a fruit with funicles inserted close to the base of the valves and containing much less seeds.

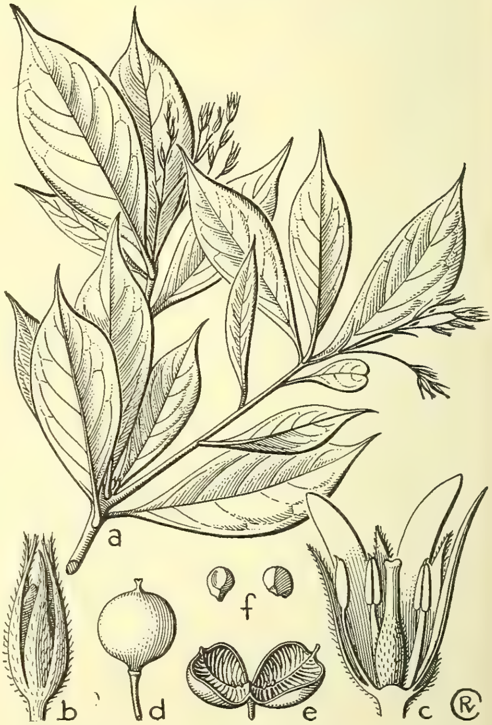

Fig. 6. *Pittosporum longisepalum* BAKKER. *a.* Twig with buds, × ⅔, *b.* bud, × 4, *c.* flower, × 4, *d.* fruit, nat. size, *e. ditto*, open, nat. size, *f.* seeds, nat. size (*a* after CLEMENS 33025, *b–c*, *e–f* CLEMENS 35096, *d* CLEMENS 31270).

9. Pittosporum pentandrum (Blanco) Merr. Publ. Gov. Lab. Philip. *no* 27 (1905) 19; *op. cit. no* 35 (1906) 16; Philip. J. Sc. 1 (1906) Suppl. 57; Bacon, Philip. J. Sc. sect. A, 4 (1909) 118; Merr. Philip. J. Sc. 5 (1910) Bot. 352; Sp. Blanc. (1918) 162; Brown, Min. Prod. Philip. For. 2 (1921) 105; Merr. En. Philip. 2 (1923) 222; Pritzel, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; Brown, Useful Pl. Philip. 2 (1950) 61; Li, J. Wash. Ac. Sc. 43 (1953) 45; Quisumbing, Med. Pl. Philip. (1951) 352.—*Aquilaria pentandra* Blanco, Fl. Filip. ed. 1 (1837) 373; Meisn. in DC. Prod. 14 (1857) 602.—*Limonea laureola* (*non* DC.) Blanco, Fl. Filip. ed. 2 (1845) 251; Naves in Blanco, Fl. Filip. ed. 3, 2 (1878) 101, t. 128.—*Bursaria inermis* Azaola in Blanco, Fl. Filip. ed. 2 (1845) 124; ed. 3, 1 (1877) 222.—*P. brachysepalum* Turcz. Bull. Soc. (Imp.) Nat. Mosc. 27, 2 (1854) 366; Rolfe, J. Bot. 23 (1885) 210; Vidal, Phan. Cuming. (1885) 95; Rev. Pl. Vasc. Filip. (1886) 50; Ceron, Cat. Pl. Herb. Manila (1892) 18.—*P. ferrugineum* (*non* Ait.) F.-Vill. Nov. App. (1880) 13.—*P. floribundum* (*non* W. et A.) F.-Vill. Nov. App. (1880) 13.—*P. fernandezii* F.-Vill. Nov. App. (1880) 13; Vidal, Cat. Pl. Prov. Manila (1880) 17; Sinopsis Atl. (1883) 13, t. 8, f. A; Rev. Pl. Vasc. Filip. (1886) 50; Ceron, Cat. Pl. Herb. Manila (1892) 18.—*P. pseudostipitatum* Merr. Philip. J. Sc. 14 (1919) 401; Pritzel, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.

Tree, *c.* 3–10(–17) m high, (2–)10–20(–30) cm diam. *Leaves* spirally arranged or subverticellate, very narrowly to narrowly elliptic or oblanceolate, *c.* (4–)6–10(–12) by 1–3 cm; base decurrent, margin often slightly undulate, top acute or very seldom rounded, generally slightly and gradually acuminate; midrib prominent, nerves not very conspicuous, *c.* 10–14 pairs the almost equally strong secondary ones included, reticulations very fine; petiole *c.* 1–$1^{1}/_{2}$ cm. *Inflorescences* terminal or axillary, many-flowered, thyrsoid *c.* 3–4 cm diam.; peduncle *c.* 2–4 cm, pubescent; rhachis *c.* 1–$4^{1}/_{2}$ cm, pubescent; lower branches *c.* 2 cm, upper ones *c.* $^{1}/_{2}$ cm, all pubescent. Bracts narrowly ovate, boat-shaped, *c.* 3 by 1 mm, slightly ciliate; pedicels 0–5 mm. *Sepals* nearly free, coherent at the base, elliptic, rounded, *c.* 1–2 by $^{2}/_{3}$–1 mm, ciliate. *Petals* almost ligulate, *c.* 6–8 by 1 mm, 3-nerved, top almost truncate. *Stamens* in ♂ flowers *c.* 4-5 mm, in ♀ flowers shorter; anthers in ♂ flowers oblong, *c.* $1^{1}/_{2}$–2 by $^{1}/_{2}$ mm, apiculate, in ♀ flowers sagittiform, *c.* $^{1}/_{2}$–1 mm. *Ovary c.* 1 mm stipitate, glabrous, in ♂ flowers hardly thickened, *c.* $1^{1}/_{2}$ by 1 mm; ovules *c.* 6–8; style *c.* 2–$2^{1}/_{2}$ mm, stigma not thickened; stipe in ♀ flowers thicker; ovary ovoid, compressed, *c.* $1^{1}/_{2}$–2 by $1^{1}/_{3}$–$1^{1}/_{2}$ mm, glabrous; ovules *c.* 8–10; style *c.* $1^{1}/_{3}$ mm, stigma thickened. *Fruits* globose, compressed, mucronate, *c.* 7 mm diam., often with a stipe of variable (*c.* 1–3 mm) length; valves 2, thin, rugose; funicles inserted at the base of the valves, knob-like. *Seeds c.* 6–8, subreniform, *c.* 3 by 2 mm.

Distr. Formosa and *Malaysia:* Philippines (throughout) and N. Celebes.

Ecol. Characteristic for 'parang' , *i.e.* thickets left of former forests from which the valuable timber trees have been removed (selective cutting), occasionally in rain-forest, common at low and medium altitudes up to 2300 m.

Uses. The fruits are used for medicinal purpose; they contain the so-called 'mamális oil', *cf.* Quisumbing, *l.c.*

Vern. *Abuagon, lamayen, lasuít, pasgik,* Ig., *balinkauáyan, bolonkóyan, saboágon,* P. Bis., *basuít, opláì, upláì,* Ilk., *buyobuyo,* Vis., *darayau, mamáli, marabiñga,* Tag., *dili,* Gad., *mamális,* Pang., Tag., *panagusipsip,* Malaghi, *pañgantóan, pañgatóan, antoan,* C.Bis., *pasik,* Bon., *taliú,* Sbl., *parabiñga,* Tagb.

Note. The type specimen of *P. pseudostipitatum* differs only from the bulk of the material in having a slightly longer fruit stipe.

10. Pittosporum ferrugineum Ait. Hort. Kew ed. 2, 2 (1811) 27; Bot. Mag. 46 (1819) t. 2075; DC. Prod. 1 (1824) 246, *excl. var. β ?filarium*; Putterl. Syn. Pitt. (1839) 8; Benth. Fl. Austr. 1 (1863) 112; Miq. Illustr. 1 (1870) 77; Hook. *f.* & Th. Fl. Br. Ind. 1 (1872) 199; K.Sch. & Hollr. Fl. Kais. Wilh. Land (1889) 71; King & Gamble, J. As. Soc. Beng. 59, ii (1890) 128; K. & V. Bijdr. 4 (1896) 53; Bailey, Queensl. Fl. 1 (1899) 70; Boerl. Cat. Hort. Bog. 1 (1899) 56 *incl. var. javanicum, var. moluccanum (pro specim.)*; K.Sch. & Laut. Fl. Schutzgeb. (1900) 337; Merr. Publ. Gov. Lab. Philip. *no* 35 (1906) 18; Back. Schoolfl. (1911) 74; Koord. Exk. Fl. Java 2 (1912) 309; Koord.-Schum. Syst. Verz. 1 § 1 (1912) Fam. 118; Koord. Atlas 1 (1913) t. 136; Gibbs, J. Linn. Soc. Bot. 42 (1914) 58; Hallier *f.* Med. Rijksherb. 37 (1918) 5; Merr. En. Born. (1921) 287; Ridl. Fl. Mal. Pen. 1 (1922) 136; Pritzel, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; Craib, Fl. Siam. En. 1 (1931) 98; Burk. Dict. (1935) 1763; Back. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 81, p. 2; Heyne, Nutt. Pl. (1950) 688; Gowda, J. Arn. Arb. 32 (1951) 321; Corner, Ways. Trees (1952) 517; Cooper, Ann. Mo. Bot. Gard. 43 (1956) 177.—*Itea javanica* Bl. Bijdr. (1826) 863.—*Pseuditea javanica* Hassk. Flora 25, 2 (1842) Beibl. 30; Cat. Hort. Bog. (1844) 160.—*P. densiflorum* (*non* Putt.) Mor. Syst. Verz. (1846) 21; Miq. Fl. Ind. Bat. 1, 2 (1859) 122; Suppl. (1860) 392.—*P. floribundum* (*non* W. et A.) Hassk. Pl. Jav. Rar. (1848) 228, *excl. syn. Glyaspermum ramiflorum* Zoll.—*P. javanicum* Bl. Mus. Bot. 1 (1850) 159; Miq. Illustr. 1 (1870) 75.—*P. rufescens* Turcz. Bull. Soc. (Imp.) Nat. Mosc. 27, 2 (1854) 367; Koord. Exk. Fl. Java 2 (1912) 310.—*P. moluccanum* (*non* (Lamk) Miq. Illustr. 1 (1870) 76, *pro specim.*—*P. nativitatis* Baker in Andrews, Monogr. Christm. Isl. (1900) 171; Ridl. J. Str. Br. R. As. Soc. *no* 45 (1906) 172.—*P. versteeghii* Merr. & Perry, J. Arn. Arb. 21 (1940) 177.

Tree or shrub, *c.* ($1^{1}/_{2}$–)3–15(–22) m high. *Leaves* spirally arranged or slightly crowded in pseudowhorls, elliptic or narrowly elliptic, rarely narrowly ovate, *c.* 5–15 by $1^{1}/_{2}$–5 cm; base cuneate or slightly decurrent, margin slightly wavy, top acute and *c.* $1\frac{1}{2}$–2 cm attenuate-acuminate; nerves *c.* (4–)5–8(–11) pairs, sometimes prominent beneath, reticulations fine; young leaves entirely ferrugineous-pubescent, older leaves glabrescent to various degree, pubescence often persisting beneath; petiole *c.* 1 cm. *Inflorescences* terminal or less frequently axillary, thyrsoid, many-flowered; peduncle pubescent, *c.* 1–5 cm. Buds distinctly acute. *Sepals* free, lanceolate or narrowly lanceolate, *c.* 2–3(–4) by $\frac{3}{4}$–1 mm, acute and often acuminate, generally ferrugineous-pubescent. *Petals* ligulate, *c.* 6–8 by 1 mm, acute, 3-nerved. *Stamens* *c.* 3–4 mm; filaments *c.* $2\frac{1}{2}$–$3\frac{1}{2}$ mm; anthers oblong, in more ♂ flowers *c.* 1 by $\frac{2}{3}$ mm, in more ♀ flowers *c.* $\frac{1}{2}$ by $\frac{1}{3}$ mm. *Ovary* inconspicuously (*c.* 1 mm) stipitate, ellipsoid or cylindric, *c.* 2–$2\frac{1}{2}$ by 1–$1\frac{1}{2}$ mm, densely ferrugineous-pubescent; style *c.* 1–$1\frac{1}{2}$ mm; stigma hardly capitate in ♂ flowers, in more ♀ flowers 2-lobed. *Fruits* 1–16, 2-valved; valves often broader than long, *c.* 7–10 by 9–12 mm, generally notched and mucronate at the top, narrowed towards the often pubescent base, rather thin, *c.* 1 mm, seldom 2 mm across, rugose; funicles inserted up to halfway the valves. *Seeds* *c.* 8–24, *c.* 3–4 mm.

Distr. SE. Asia to Australia, and Melanesia (Bismarck & Solomon Isl.), throughout *Malaysia*, also from the SW. Philippines (Palawan: Sulit PNH 12442).

Ecol. Common small tree or shrub in the tropical and montane zones, near the seashore (edge of swamps, rocks, *etc.*), along rivers, in dry bushes, on steppes and in open savannah land, sometimes as undergrowth in rain-forests or in secondary forests from the lowland up to 1800 m, in New Guinea once at 2800 m.

Uses. Bruised leaves and fruits are used as a fish poison, leaves and roots are used medicinally in Malaya.

Vern. Malay Peninsula: *Akar bĕlalang puak*, *bunga sapong*, *chabek hantu*, *chĕmpĕrai ikan*, *gĕramong*, *kĕpialu pajan*, *kĕlat tupai*, *kĕpilu*, *mĕdang kĕlĕlawat*, *m. pasir*, *pokok lĕsai*, *p. nasi-nasi*, *p. sĕruras*, *pulai puak*, *sĕrangnok*. Banka: *lĕting*. Sumatra: *kaju tappul salaon*, M, *makamkadé*, Atjeh, *kaju madan kado*, W. Coast, *djarum djarum*, *longgáhan*, *simarsihula*, E. Coast, *simar sihalah*, Toba-Batak. Java: *mĕdang pasir*, M, *huru hon(d)jè*, *huru sĕréh*, *kihon(d)jè*, *kiladja*, S, *bĕrasan*, *brasa*, *kĕtjombrangan*, *lĕri*, *mangir*, *manisdjangan*, *mĕntaos*, *ondjé-ondjèan*, *pĕtjari*, *pundungan*, *sapèn*, *sonko*, *tjombrangan*, *wuru gĕlĕr*, J.. Borneo: *mĕdang lilin*, M, *ara bukit*, Brunei, *bangkulit*, *nonok nonok*, *pĕtaling*, Dusun, *sibutu*, Bajau. Celebes: *milai*, *ririh*, P. Muna, *soté*, Bonthain, *poëtjé*, *londji*, *maraë*. Talaud Isl.: *abólo'a*, *ribusár'a*. Moluccas: *asi*, *kaiporo*, Noef, *guseeman*, *rarakai*, Aru Isl.. New Guinea: *bagiha*, Orokaiva language, Mumuni, *giche*, Constantinhafen, *jetapa*, Miniafia language, Utukap, *kapuwimbu*, Rawa, *pehfor*, Bemhi, *salinki*, Kaigorin, *sehpir*, Madang, *tormuya*, Anona dial.

Note. This is the most widely distributed species in Malaysia. It is rather common and can always easily be recognized; its characters are remarkably constant in comparison with those of *e.g. P. moluccanum*. *P. rufescens* was considered by Koorders as a doubtful species. The type specimen represents, however, without any doubt, *P. ferrugineum*. The specimens referred by Miquel to *P. moluccanum* (Lamk) Miq. are rather glabrous specimens of *P. ferrugineum*. *P. nativitatis* from Christmas Isl. (Ind. Oc.) has been distinguished on account of its congested inflorescence, but the type material contains only young inflorescences and these are often condensed in *P. ferrugineum*. The leaves of other specimens (Ridley 32 and 32a) are somewhat larger and have up to 11 pairs of nerves. The top of the leaves is acute but not acuminate.

The type locality of *P. ferrugineum*, as given by Aiton ('Guinea') is obviously an error, as has already been pointed out by Hooker *f.*, *l.c.*

11. Pittosporum moluccanum (Lamk) Miq. Illustr. 1 (1870) 76, *excl. specim.*, *syn. part*; Merr. Int. Rumph. (1917) 243, *excl. syn. P. ferrugineum β filarium*.—*Cortex foetidus* Rumph. Herb. Amb. 7 (1755) 12, t. 7.—*Anasser moluccana* Lamk, Tabl. Enc. Méth. Bot. 2 (1793) 40.—*Anassera moluccana* Pers. Syn. (1805) 265.—*Itea umbellata* Roxb. [Hort. Beng. 1814, 85, *nomen*] Fl. Ind. 2 (1824) 419.—*Senacia undulata* (*non* Lamk) Decaisne, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 429.—*P. rumphii* Putterl. Syn. Pitt. (1839) 7, *excl. syn. P. ferrugineum β filarium*; Blume, Mus. Bot. 1 (1850) 160, *excl. specim.*, *excl. syn. ditto*; Miq. Fl. Ind. Bat. 1, 2 (1858) 123, *ditto*.—*P. timorense* Bl. Mus. Bot. 1 (1850) 160; Miq. Fl. Ind. Bat. 1, 2 (1858) 122; Illustr. 1 (1870) 80, t. 36; Boerl. Cat. Hort. Bog. 1 (1899) 57, *incl. var. teysmannianum*; Pritzel, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. monticolum* Miq. Illustr. 1 (1870) 83; K. &. V. Bijdr. 4 (1896) 60; Koord. Exk. Fl. Java 2 (1912) 309; Koord.-Schum. Syst. Verz. 1, § 1 (1912) Fam. 118; Koord. Atlas (1913) t. 137; Pritzel, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; Steen. Bull. Jard. Bot. Btzg III, 13 (1933) 49; Back. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 81, p. 2.—*P. fissicalyx* Miq. Illustr. 1 (1870) 81; Dammerman, Nat. Tijd. N.I. 86 (1926) 108; Pritzel, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. brackenridgei* (*an* A. Gray?) Miq. Illustr. 1 (1870) 83.—*P. glabratum* (*non* Lindl.) F.-Vill. Nov. App. (1880) 13; Vidal, Sinopsis Atlas (1883) t. 8, f. B.—*P. microcalyx* K. & V. Bijdr. 4 (1896) 62; Back. Schoolfl. (1911) 74.—*P. zollingerianum* Binn. *ex* K. & V. Bijdr. 4 (1896) 58, *incl. var. tenuinervis* & *var. argentea*; Boerl. Cat. Hort. Bog. (1899) 56; Ic. Bog. (1906) t. 138.—*P. odoratum* Merr. Publ. Gov. Lab. Philip. *no* 35 (1906) 16; Philip. J. Sc. 1 (1906) Suppl. 60; Philip. J. Sc. 2 (1907) Bot. 275; Philip. J. Sc. 3 (1908) Bot. 406; En. Philip. 2 (1923) 222; Pritzel, E. &. P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. littorale* Merr. Philip. J. Sc. 5 (1910) Bot. 179; En. Philip. 2 (1923) 222; Pritzel, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274; Li, J. Wash. Ac. Sc. 43, 2 (1953) 45.—*P. megacarpum* Merr. Philip. J. Sc. 5 (1910) Bot. 179; En. Philip. 2 (1923) 222; Pritzel, E. &. P. Pfl. Fam. ed. 2, 18a (1930)

274.—*P. pulgarense* ELMER, Leafl. Philip. Bot. 5 (1913) 1825; MERR. En. Philip. 2 (1923) 223.—*P. subverticillatum* ELMER, Leafl. Philip. Bot. 8 (1915) 2795.—*P. glaberrimum* MERR. Philip. J. Sc. 14 (1919) 402; En. Philip. 2 (1923) 222; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. euphlebium* MERR. Philip. J. Sc. 17 (1920) 258; En. Philip. 2 (1923) 222; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 274.—*P. obscurinerve* MERR. Philip. J. Sc. 17 (1920) 257; En. Philip. 2 (1923) 222.—**Fig. 7–8.**

Shrub or tree, (2–)8–15(–20) m high; young shoots often ferrugineous-pubescent. *Leaves* spirally arranged or crowded towards the ends of the twigs, subcoriaceous, very variable in shape and size, generally narrowly elliptic, narrowly obovate or oblanceolate, rarely narrowly ovate, *c.* 5–15(–23) by $2^{1}/_{2}$–$5^{1}/_{2}$(–7) cm; base cuneate, generally decurrent, margins generally undulate, top gradually or abruptly shortly acuminate, often also rounded; nerves *c.* 6–12 pairs, reticulations fine; petiole *c.* 1–2 cm. *Inflorescences* terminal or axillary subsessile or peduncled fascicles or panicles, peduncles up to *c.* 6 cm. Bracts linear, acute, pubescent, *c.* 3 mm long. Pedicels *c.* 1–6 mm. *Sepals* nearly free or united to varying degree, narrowly elliptic or lanceolate, sometimes the calyx split to the base at one side, *c.* 4 mm long, tops acute or rounded. *Petals* ligulate, (9–)10–12 (–15) by 2 mm. *Stamens* in ♂ flowers c. 8–12 mm, in ♀ flowers *c.* $4^{1}/_{2}$–6 mm; anthers in ♂ flowers oblong, *c.* $1^{1}/_{2}$–3 mm, apiculate, in ♀ flowers triangular or sagittiform, *c.* $^{1}/_{2}$–$1^{1}/_{2}$ mm. *Ovary* stipitate or almost sessile, in ♂ flowers *c.* 5 by 1 mm, in ♀ flowers ellipsoid, *c.* 3–5 by $1^{1}/_{2}$–2 mm, glabrous or pubescent (the base, the lower half,

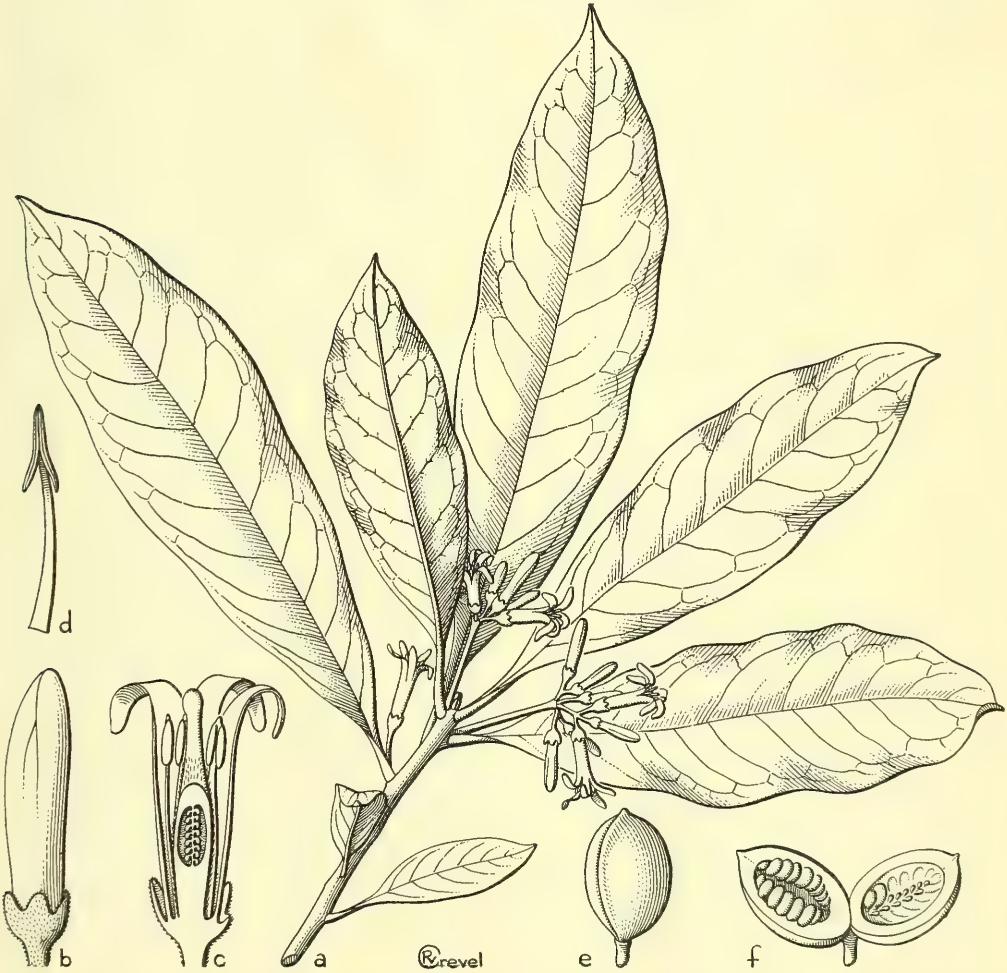

Fig. 7. *Pittosporum moluccanum* (LAMK) MIQ. *a.* Flowering twig, × $^{2}/_{3}$, *b.* bud, × 3, *c.* section of flower, × 3, *d.* reduced stamen of ♀ flower, × 6, *e.* fruit, × $^{2}/_{3}$, *f. ditto*, dehisced, × $^{2}/_{3}$ (after materials from East Java).

or entirely); style in ♂ flowers *c.* 4 mm, in ♀ flowers *c.* 2 mm; stigma in ♂ flowers not, in ♀ flowers distinctly thickened. *Fruits* solitary or few, ellipsoid, compressed-obovoid or -globose, mucronate, *c.* (1–)2–4(–5) by (1–)1½–2(–3) cm, 2-valved; valves thick-fleshy, in the median line *c.* 3-6 mm thick, recurving when dry, margins readily incurved when dry, undulate, rugose; funicles inserted up to near the top. *Seeds* many, of variable size.

Distr. Formosa, and *Malaysia:* Philippines (throughout), Celebes (incl. also Saleyer & Kabaëna Isl.), Moluccas (Buru & Kei Isl.), Java (specially E. Java), Lesser Sunda Isl. (throughout).

Ecol. In light, rather dry woods, mixed monsoon-forest, tjemara forest, steep and bare slopes, occasionally near the sandy beach, on rocky shores, on sand, limestone or volcanic soil, in Java generally between 1000 and 2000 m, in the Philippines between 600 and 1500 m, but here as well as elsewhere also often at lower altitude.

Use. A decoction of the fruits is occasionally used for cleaning wounds.

Vern. Java: *Hondjè bodas*, S, *bĕlatjan, ĕndogĕndogan, gĕdangan, kĕdutan, klapan, pèlong, polean, randu-basin, sĕmutan, sĕngir, suruan, wuru gĕdang, wuru ketek*, J, *adjon, kadju tjankrèng, kalang mangga, kheuleung-manggeuh, sawo alas radja*, Md. Sumbawa: *luha.* Sumba: *aikelihi, kalihi.* Flores: *maramike.* Timor: *natbona, nak bohnah.* Celebes: *lassa darre*, Makass., *tikala*, Toradja. Philippines: *amomu*, P. Bis., *amomunpon*, Vis., P. Bis., *botúnis*, Ilk., *bulálang*, Tag., *camarsutay, dail*, Bon., *kamiding*, Ig., *labagáñgon, libagañgon, sagawan*, Buk., *tapotása, tumpagasog*, Bag., *tikala*, C. Bis.

Nomencl. The type (and sole base) of this species is the description and plate of *Cortex foetidus* of RUMPHIUS (Herb. Amb. 7, p. 12 t. 7), the Amboinese name of which is, according to R., *anasser*. On p. 13 RUMPHIUS described a second plant as *Cortex filarius* (without a plate). The interpretation of these two has caused much confusion as appears from the synonymy.

LAMARCK (Enc. Méth. Bot. 1, 1783, 747) entered *anasser* in his list limiting it to *Cortex foetidus* RUMPH. The fact that LAMARCK did not enter the name *anasser* in his 'Table des noms latins des genres de plantes contenus dans ce volume' proves that he did not accept this vernacular name as the scientific name of a genus, no more than when he entered '*appel*' (*l.c.* 216); scientific names in this work are printed in italics. JUSSIEU (Gen. Pl. 1789, 150) accepted the vernacular name *anasser* as the generic name of a new genus, basing his description, however, on a plant collected by COMMERSON in Bourbon, unfortunately suggesting that this species was '*subsimile plantae rumphianae 7, t. 7 forte congeneri & Anasser dictae*'. This latter assumption has proved to be erroneous as COMMERSON's plant has appeared to belong to *Geniostoma* (*Loganiaceae*).

LAMARCK in his Tabl. (Bot. 2, 1793, 40) accepted JUSSIEU's generic description of *Anasser*, distinguishing two species, *A. borbonica* and *A. moluccana* (based on *Cortex foetidus*). The type species of *Anasser* JUSS. is obviously *A. borbonica.* The latter is also the only species accepted in *Anasser* by GMELIN (Syst. Veg. 1, 1796, 333). The generic name *Anasser* JUSS. is, therefore, a clear synonym of *Geniostoma.*

Why *Anasser moluccana* has been reduced to *Strychnos pseudoquina* in Ind. Kew. is obscure.

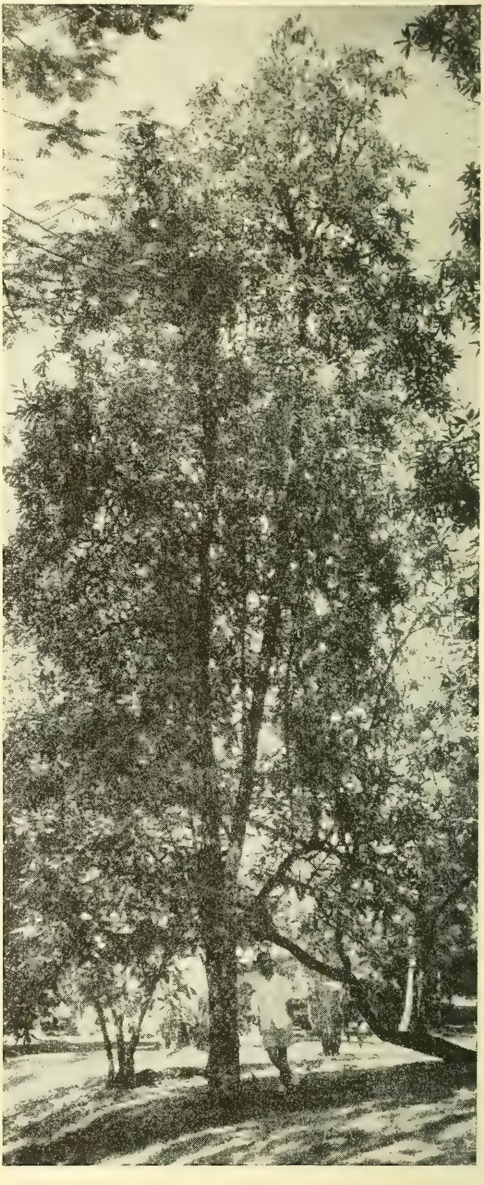

Fig. 8. *Pittosporum moluccanum* (LAMK) MIQ. Tree grown in Kebun Raya Indonesia, Bogor (Photogr. F. HUYSMANS).

J. SMITH (in Rees, Cycl. 1814, under 4. *Pittosporum ferrugineum* AIT.) referred *Cortex filarius* RUMPH. to a plant collected by CHR. SMITH in the type locality (Oma Isl., Moluccas) associating it erroneously with RUMPH. Herb. Amb. 7, p. 13 t. 7 which table belongs to *Cortex foetidus!*. He already noted that he could find no trace of the bark fibres mentioned by RUMPHIUS for *Cortex filarius*. This error in mixing up the two Rumphian plants has been copied repeatedly by later authors and caused much confusion (*e.g.* DC. Prod. 1, 1829, 347 and DON, Gen. Hist. 1, 1831, 374 considered *Cortex filarius* a variety *β ?filarium* of *P. ferrugineum*).

PUTTERLICK *l.c.* was of opinion that the Rumphian plant was distinct from *P. ferrugineum* and based his *P. rumphii* on both *Cortex foetidus* and on *P. ferrugineum β filarium* SM. in REES (which in turn was based on *Cortex filarius* RUMPH.).

VALETON (in K. & V. Bijdr. 4, 1896, 52) was the first who suggested that *Cortex filarius* is not a *Pittosporum* and I agree with MERRILL (Int. Rumph. 1917, 380) that it is a *Gyrinopsis* (*Thym.*).

Cortex foetidus, however, is without any trace of doubt a *Pittosporum*. Superficially the plate suggests in the leaf *P. ferrugineum* which has misled some authors mentioned above. For a correct interpretation the major points in the description are:—leaves 15–22 by 5 cm, lanceolate, acute at both ends; buds in *c.* 2 cm long racemes; fruits solitary or 3–5 together, as large as a 'pigeon-egg' (*i.e. c.* 2$^1/_2$ cm), at last orange-red, with a thick-fleshy pericarp enclosing a cavity as large as a hazelnut; placenta reaching over halfway the valves; seeds numerous, black, shiny; on open places, often on coral limestone.

These characters agree excellently with plate 7, which is, judging from the sizes cited in the description, reduced to *c.* $^2/_5$ of the natural size.

In trying to associate it with a Malaysian species of *Pittosporum* it appears that the only one in East Malaysia which agrees with its characters is what has been called hitherto *P. monticolum* = *P. timorense*. *P. ramiflorum* and *P. resiniferum* are ramiflorous, *P. ferrugineum* has much smaller leaves and fruits, and the New Guinean species are equally out of question.

MIQUEL, following PUTTERLICK, was (1870) on the right track in distinguishing it from *P. ferrugineum*, but curiously his specimens of *P. moluccanum* (coll. ZIPPELIUS, and TEYSMANN) belong to *P. ferrugineum*; he possibly assumed t. 7 to be at natural size when he stated that RUMPHIUS's plate and description of *Cortex foetidus* represent two species.

Final evidence is furnished by the fact that *P. monticolum* = *P. timorense* has actually been collected in Buru (*leg.* DE VRIESE & TEYSMANN, described as *P. fissicalyx* MIQ., and TOXOPEUS 303).

Though it is to be regretted that the well typified *P. timorense* has to be reduced to a species merely based on a Rumphian description and plate, the certainty achieved in identifying it leaves no other way out.

Note. *P. moluccanum* is a very variable species and has, therefore, given way to a vast synonymy. A careful analysis of a vast amount of herbarium material has shown the impossibility of splitting it up satisfactorily into distinct infraspecific taxa. The variability of the calyx lobes (degree of connation and shape of apex) is rather remarkable but is found in various places of the population. The Philippine specimens generally have nearly free sepals with acute tips, while the Java material shows generally connate sepals with rounded tips. These characters, however, are not constant and pass gradually into each other, as does the pubescence of the ovary, which is only present at the base in most Java specimens.

The type specimen of *Itea umbellata* ROXB. in the Brussels herbarium is mounted together with a specimen of *P. ferrugineum*. ROXBURGH's description of *I. umbellata*, however, can only refer to the left specimen on the sheet, which belongs doubtless to *P. moluccanum* (LAMK) MIQ.

In *P. fissicalyx* the leaves are very large and the sepals are almost entirely connate, while the calyx is split at one side, a character often encountered in this species. *P. megacarpum* has been distinguished by its large fruits, but the size of the fruits shows a wide (complete) range of variability; no other character could be found correlated with this large fruit size; flowers of *P. megacarpum* are not known. *P. obscurinerve* differs only from the majority of the sheets by rather thick leaves with an obscure nervation. *P. subverticillatum* has been distinguished by its longer petioles (*c.* 2 instead of 1 cm). *P. glaberrimum* has been proposed only on account of its solitary fruit which has a somewhat thinner pericarp (possibly immature?), as has the fruit of *P. euphlebium*, which species has been distinguished because of a prominent nervation beneath. I have not seen material of *P. pulgarense*, which species is said (ELMER *l.c.* 1913) to be closely related to *P. odoratum* (= *P. moluccanum*). MERRILL (*l.c.* 1923), however, stated, that *P. pulgarense* is allied to *P. pentandrum*, rather than to *P. odoratum*. PRITZEL (*l.c.* 1930) assumed *P. pulgarense* to deviate only little from *P. odoratum*. Judging from the description, the type specimen (which is apparently the only one known) seems to me a more ♀ plant of *P. moluccanum*.

P. moluccanum is among Malaysian species recognized by its fruits, which have a rather thick pericarp. The placenta bears funicles to near the top. In dried specimens the valves recurve strongly and have incurved margins.

Whether it occurs outside Malaysia, is not certain. MIQUEL (1870) identified a collection from Halmaheira (TEYSMANN HB 5646) with the Fijian *P. brackenridgei* A. GRAY which it strongly resembles in habit; further study with abundant material should reveal its relation to *P. moluccanum*.

In two specimens (ESCRITOR BS 21390 and SULIT PNH 10039), both from Mindanao, I found abnormal flowers, in which the sepals were almost entirely connate into a cup with very small free lobes. In both specimens the flowers appeared to contain clumps of small globules which might be eggs laid into the bud by some insect. Stamens and pistil are absent.

Doubtful

Among the collections is one labelled 'GRIFFITH, Malacca', of which a specimen is preserved both in the Gray Herbarium and at Florence. It represents *P. floribundum* W. & A., but I doubt whether it is rightly localized.

Excluded

Pittosporum macrophyllum LAUT. & K.SCH. in K.Sch. & Laut. Fl. Schutzgeb. (1900) 338; RECHINGER, Denkschr. K. Ak. Wiss. M.-N. Kl. Wien 89 (1913) 556 = *Erythrospermum candidum* (BECC.) BECC. in Gibbs, Arfak (1917) 215; SLEUMER, Fl. Mal. I, 5 (1954) 7 (*Flacourtiaceae*).

Pittosporum ferrugineum β ?filarium DC. Prod. 1 (1824) 347, based on *Cortex filarius* RUMPH. Herb. Amb. 7 (1755) 13 (*excl.* t. 7) is according to MERRILL, Int. Rumph. (1917) 380 = *Gyrinopsis brachyantha* MERR. (*Thymelaeaceae*), a reduction with which HEYNE, Nutt. Pl. (1927) 1151 agrees.

2. HYMENOSPORUM

R.BR. *ex* F. v. MUELLER, Fragm. 2 (1860) 77.

Shrub or small tree. *Leaves* entire, often crowded towards the ends of the twigs. *Flowers* in often pseudo-umbellate, terminal corymbs, 5-merous. *Sepals* free, caducous. *Petals* loosely cohering in a tube to above the middle, more or less clawed, large. *Stamens* 5, exserted; filaments linear; anthers ovate-oblong, blunt, cells diverging sagittately at the base. *Ovary* linear, incompletely 2-celled; style short; stigma thickened ± 2-lobed. *Ovules* ∞. *Capsule* (not seen) broad-elliptic to orbicular, with 2 coriaceous valves each bearing a median placenta. *Seeds* (not seen) ∞, flat, reniform, horizontally imbricate, surrounded by a membranous wing.

Distr. Monotypic, E. Australia and *Malaysia:* SE. New Guinea.

1. Hymenosporum flavum (HOOK.) F.v.M. Fragm. 2 (1860) 77; BENTH. Fl. Austr. 1 (1863) 114; F. M. BAILEY, Queensl. Fl. 1 (1901) 71; WHITE & FRANCIS, Proc. R. Soc. Queensl. 35 (1923) 63; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 281; WHITE, Contr. Arn. Arb. 4 (1933) 39; BAKH. *f.* & STEEN. Blumea 7 (1952) 292.—*Pittosporum flavum* HOOK. Bot. Mag. (1854) t. 4799.

Evergreen treelet, 6 m. *Leaves* obovate-oblong to oblanceolate, acute-acuminate, narrow cuneate-decurrent at the base, glabrescent, 7½–15 by 3–4½ cm; petiole 1–1½ cm. *Corymbs* few or many-flowered, tomentose-pubescent; peduncle 3–6 cm, *c.* 10(–20) by 10 cm. Bracts foliaceous, acute, oblong, 10–15 by 3 mm. Pedicels 3–4 cm. Bracteoles small, linear or lanceolate, acute, *c.* 10 by 1–2 mm. Flowers scented, yellow or cream tipped yellow, petals suffused with rosa-violet inside at the base (CARR). *Sepals* oblong-rounded or acutish, 5–6 by 2½–3 mm, with a thin margin. *Petals:* claw-like base 2½ cm, linear, erect, tomentose outside, the spreading lamina rhomboid-ovate, *c.* 1–1¼ by ¾ cm, veined, puberulous outside. *Stamens* pubescent below, glabrous towards the apex; anthers oblong, *c.* 2 mm, cells at the base for ¼ mm free, divaricate. *Ovary* silky-tomentose, terete, *c.* 1¾ cm; style *c.* 4–5 mm. *Capsule* (not seen) stipitate, ± orbicular, compressed, *c.* 2½–3 cm diam. *Seeds* (not seen) *c.* 4–6 mm long, wing 2–3 mm broad.

Distr. Australia (Queensland to New South Wales), in *Malaysia:* SE. New Guinea (Papua: Isuarava and Boridi).

Ecol. In Australia common in cleared rain-forest country, in Papua twice collected in secondary forest, *c.* 1200 m, *fl.* Nov.–Febr. (the rainy season).

Uses. A pretty ornamental, resembling a very large-flowered *Pittosporum*, grown with success in the Tjibodas Mountain Garden (W. Java) under everwet climatic conditions at *c.* 1400 m; also cultivated at Bogor, *c.* 250 m, but not flowering there; also in greenhouses in temperate regions.

3. CITRIOBATUS

CUNNINGHAM *ex* [LOUDON, Hort. Britt. Suppl. 1, 1835, 585, *nomen subnudum*] PUTTERLICK, Syn. Pitt. (1839) 4; F. M. BAILEY, Queensl. Agric. J. 30 (1913) 399, t. 64–68; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 285; C. T. WHITE, Proc. R. Soc. Queensl. 50 (1939) 67.—**Fig. 9.**

Stiff, erect, spiny shrubs; twigs mostly ending in a thorn or/and with lateral, partly axillary thorns, when young their surface normally provided with short, warty emergences which may be crowned by a few fine hairs. *Leaves* small, partially in tufts on knob-like short-shoots. *Flowers* small, polygamo-dioecious if ♀ and ☿ or unisexual and dioecious if ♀ and ♂, 5-merous, white, solitary, axillary, mostly on knob-like very short, short-shoots provided with a number of minute, dry, imbricating scales, sessile, rarely pedicelled. *Sepals* 5, free or cohering at the base, slightly unequal, shortly fimbriate or ciliate. *Petals* 5, in their lower part coherent forming a tube, segments patent or recurved. *Filaments* coherent with the petals, anthers (slightly dorsi-) basifix, connective sometimes shortly and bluntly produced. *Ovary* sessile or short-stipitate, hairy, 1-celled, the stipe at the base sometimes with a ± lobed, disk-like, thickened ring; style glabrous, stigma thickened; placentas 2 or 5, parietal; ovules 10–∞. *Fruit* globular, not dehiscent, glabrous or glabrescent, with either a hard or a thin, finally orange pericarp. *Seeds* few to very numerous, immersed in a sticky resinous, aromatic pulp; cotyledons almost wholly connate, free at the apex; radicle very minute, conical.

Distr. Four *spp.* in Australia (Queensland to New South Wales), in *Malaysia* one species (SE. Java, Celebes, Philippines).

Ecol. Dry and wet rain-forests (Australia), in *Malaysia* a constituent of the lowland monsoon forest flora, often common in second growths.

Taxon. The status of the Australian species has gradually become clear; the opinion of Boerlage & Koorders (*l.c. vide infra*) that properly there would be only one species in Australia seems not justified. In framing a key for all species, it appeared impossible to separate the Malaysian species from the Australian *C. spinescens*, with which it shares an ovary with ± 5 placentas, a thick-walled, very many-seeded, large, hard-shelled fruit, entire, obovate leaves, and relatively large flowers. The form pictured by Bailey *l.c.* as *var. kennyi* Bailey exactly matches the Malaysian sheets. The Malaysian sheets have, averagely, somewhat larger leaves, but the variety just mentioned, sunk into the species by White, occupies an intermediate position as to leaf-size.

As some of the Australian species may occur in the dry parts of southern New Guinea I have given a key to all species with the help of Mr L. S. Smith (Brisbane).

Morph. The base of the ovary shows sometimes a ring-like thickening, indented slightly opposite the filaments, suggesting the presence of glandular disk-tissue. Axillary spines, lateral leaf-tufts, and flowers are borne on or represent short-shoots which are provided at the base with small, dry, imbricating scales. Bailey mentions for *C. lancifolius* stamens opposite the petals; this is an error. This species is remarkable by its leaves being pellucid-dotted and flecked by glands which contain an orange-coloured (?)resinous substance; according to C. T. White fresh leaves of this species taste like carrots. In the other species pellucid dots are absent.

Mr L. S. Smith (Brisbane), to whom I am obliged for vital information, has observed that all species have two kinds of flowers, one kind restricted to one specimen (and therefore to one plant?), similarly as in *Pittosporum*. Flowers with sterile anthers have the stamens only $^{1}/_{2}$–$^{3}/_{4}$ of the length of the pistil; the anthers are stunted and the ovary obviously develops into a fruit. The other kind of flower has fertile anthers and its stamens are about as long as or a little longer than the pistil; the ovary is usually well developed and has the same number of ovules as the functionally ♀ flowers but is often more distinctly stipitate and its stigma is less expanded beyond the width of the style, but specimens available do not indicate whether fruit is set. It is therefore difficult to be certain whether the flowers are ♀ and ☿ (which they look like) or are functionally ♀ and ♂ (which they probably are).

Nomencl. In Loudon's First Additional Supplement, the cover of which bears the date 1835 in the Leyden copy, the generic name attributed to Cunningham, is technically a *nomen seminudum*, as a 'spinous shrub with citrus-like fruit' is hardly acceptable to me as a valid generic description. It is true, as Mr Smith points out to me, that Loudon by giving the genus a number 689a accepts it as pittosporaceous and arranges it following *Bursaria*, which is, however, also spiny. *Bursaria* fruits change rapidly from a pale greenish colour through pale yellow to dull brown (and when ripe they dry fairly quickly). Summarizing, the evidence for a 'description' as required by the Rules is therefore exceedingly meagre. This stands apart from the fact that the identification of Loudon's plants is obviously beyond doubt. And if by stating the fruit to be 'citrus-like' Loudon meant that it was indehiscent it would be right to accept Loudon's as adequate. This is a border-line case; in my opinion we should accept the full description by Putterlick (1839).

He mentioned the same two specific names *C. pauciflora* Cunn. and *C. multiflora* Cunn. as had been mentioned by Loudon, but both are entirely *nomina nuda*. Although both species were grown in many greenhouses at that time, and in some tropical botanic gardens, where they flowered and fruited, the species remained undescribed until about 1860.

Unfortunately von Ettingshausen (Blatt-Skelette Dikot. 1861, 147, t. 61, f. 6–8) has described and figured leaves under the name *C. pauciflorus* Cunn. which doubtless belong to *C. multiflorus* Cunn.

ex BTH. 1863 and unless an older description can be traced validating the latter name, the correct name for the latter species under the Rules is *C. pauciflorus* CUNN. *ex* ETTINGSH.

KEY TO THE SPECIES

1. Pericarp thick, hard, fruit *c.* (1¼–)1½–2½ cm diam., densely hairy when young, glabrescent. Placentas *c.* 5. Ovules 80–100. Seeds *c.* 40–80. Corolla tube almost 6 mm high, segments *c.* 2–3 by 1¼–1¾ mm. Ovary *c.* 2½–3 or 3¼–4½ mm; style 2–2½ or 4–5 mm. Leaves distinctly obovate to obovate-oblong, entire, cuneate to the base . . . . **1. C. spinescens**

1. Pericarp thin, fruit at most 1 cm diam., very sparsely hairy, even when young. Placentas 2. Ovules 10–20. Seeds *c.* 2–20. Corolla tube 2½–5 mm. Leaves either roundish or narrowly lanceolate to oblanceolate. Australian *spp.*

  2. Leaves generally roundish, toothed or lobed and apiculate in the upper part (rarely some entire), ½–1½ by ¼–⅘ cm. Corolla tube *c.* 2½–3½ mm high, lobes 1½–2 by 1 mm. Fertile anthers *c.* 1 mm. Ovary *c.* 1½–2¼ mm long, style *c.* 1¼ mm (*C. multiflorus* CUNN. *ex* BTH. 1863). **C. pauciflorus** CUNN. *ex* ETTINGSH.

  2. Leaves lanceolate or linear to narrowly oblong, oblanceolate, rarely oblong, entire, mostly exceeding 1½ cm. Corolla tube 3½–5 mm high. Fertile anthers *c.* 1¼–1½ mm.

    3. Leaves 1–3½ by ¼–¾ cm, not pellucid-punctate. Flowers 2–5 mm pedicelled. Sepals ovate-oblong, acute, 1–1½ by ½–¾ mm. Corolla tube *c.* 3½–5 mm high, segments 1–2½ by 1–1¼ mm, erect or slightly spreading. (*C. multiflorus* CUNN. *ex* BTH. *var. linearis & var. intermedius* F. M. BAILEY). **C. linearis** (F. M. BAILEY) C. T. WHITE

    3. Leaves *c.* 2–6 by ¾–2 cm, distinctly irregularly orange-pellucid-dotted or flecked. Flowers sessile. Sepals 3–5 mm long, spathulate, obtuse. (*C. lanceolatus* F. M. BAILEY, Compr. Cat. 1913, t. 45, *sphalma?*) . . . . **C. lancifolius** F. M. BAILEY

1. Citriobatus spinescens (F.v.M.) DRUCE, Rep. Bot. Exch. Cl. Br. Isl. for 1916 (1917) 615; PRITZEL, E. & P. Pfl. Fam. ed. 2, 18a (1930) 286.—*Ixiosporum spinescens* F.v.M. Fragm. Phyt. Austr. 2 (1860) 76.—*C. megacarpus* F.v.M., *nomen in sched. et in syn. l.c.*—*C. pauciflorus* CUNN. *ex* [LOUD. Hort. Britt. Suppl. 1, 1835, 585, *nomen*] BTH. Fl. Austr. 1 (1863) 122; F. M. BAILEY, Queensl. Fl. 1 (1899) 74; Queensl. Agric. J. 30 (1913) 402, t. 67–68, *incl. var. kennyi* F. M. BAILEY; WHITE, Proc. R. Soc. Queensl. 50 (1939) 67.—*C. javanicus* BOERL. & KOORD. Ic. Bog. 1 (1901) 5, t. 77; BACK. Schoolfl. (1911) 75; KOORD. Exk. Fl. Java 2 (1912) 310; MERR. Philip. J. Sc. 14 (1919) 401; En. Philip. 2 (1923) 224; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 81, p. 3.—**Fig. 9.**

Widely branched, 2–5 m, most twigs ending in a 1–3 cm long, straight thorn, besides lateral, ± straight thorns. *Leaves* obovate, cuneate to the base, apex rounded, truncate, notched or short-apiculate, 1–3 by 1–1½ cm; nerves 2–3 pairs, ascending; petiole thin, short. *Sepals* 2½–3 by 1¼–1½ mm, oblong, acute, margin finely fimbriate. *Corolla* tube *c.* 6 mm high, segments 3 by 1½–1¾ mm. *Stamens* 5–7 mm, opened in bud, anthers 1½ mm, linear-oblong. *Ovary* densely hairy, subsessile, *c.* 3 mm; ovules very numerous; style 4–5 mm. *Fruit* initially hairy, glabrescent, apiculate by the (mostly) persistent style-base, *c.* 1½ cm diam. *Seeds c.* 40–50, *c.* 3–4 by 2 mm.

Distr. Queensland & New South Wales, in *Malaysia:* Philippines (W. Luzon: Batangas, Mt San Pedro; Mindanao: Davao Prov., Mati and Galintan), N. Celebes (Gorontalo: Molotabu), and SE. Java (Puger). To be expected in the Lesser Sunda Islands and South New Guinea.

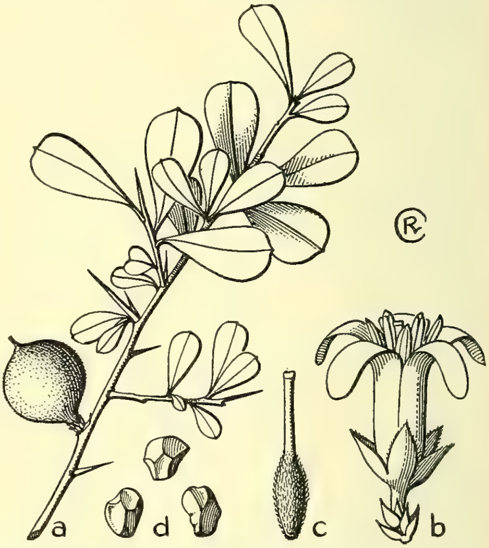

Fig. 9. *Citriobatus spinescens* (F.v.M.) DRUCE. *a.* Fruiting twig, × ⅔, *b.* flower on scaly brachyblast, × 3, *c.* gynaecium, × 3, *d.* seeds, × 2 (*a* EDAÑO 48871, *b–d* BACKER 18043).

Ecol. In dry forests, along forest borders, and in thickets, under seasonal climatic conditions, at Puger on limestone, at Gorontalo common on andesite rocks, 5–300 m. *Fl.* Dec.–Febr., *fr.* Jan.–Dec.

Vern. *Rukĕm rukĕman*, J, *molontiopo*, Gorontalo.

Cultivated

Bursaria spinosa CAV. *var. incana* BTH., a small tree or shrub from Australia, grown in the Botanic Gardens, Bogor, is said to have been introduced as an ornamental in Java, according to BACKER (Bekn. Fl. Jav. (em. ed.) 4a, 1942, fam. 81, p. 3).

HAMAMELIDACEAE (W. Vink, Leyden)

Evergreen (or deciduous) shrubs or trees. Buds perulate (or naked); innovations flush-wise. *Leaves* simple, spirally arranged (rarely opposite), usually penninerved, less often 3–5-plinerved, with entire, crenate-serrate or dentate margins, often slightly oblique at the base. Indument often stellate, tufted or lepidote. Stipules usually present, very small to large. *Flowers* free or connate, in heads, spikes or racemes, ☿, polygamous or unisexual and monoecious (rarely dioecious), usually actinomorphous, usually 4–5-merous, with alternate whorls of floral parts. *Sepals* usually small or lacking. *Petals* often linear or ligulate, often rolled in bud, sometimes lacking. *Stamens* free, often in two whorls, the inner ones staminodial; anthers almost always basifix; connective often produced. *Disk* if present annular or represented by small lobes. *Ovary* consisting of 2 (exceptionally 3) carpels often free at the apex, 2-celled, usually more or less inferior; styles 2, free, long, less frequent short, often recurved, frequently persistent and hardened in fruit; stigmas small and apical or adaxially decurrent along the styles. *Ovules* 1–2 and pendent or 5–∞ and inserted on the dissepiment (or parietal), anatropous, with 2 integuments. *Capsules* 2-celled, in the lower half connate with the receptacle to various degree, rarely superior or perigynous, usually loculicidal and septicidal, hence 4-valved, endocarp often loosening from the exocarp. *Seeds* 1–∞ (in the latter case only very few fertile), sometimes winged; albumen rather thin, embryo straight, cotyledons leaf-like, radicle short.

Distr. Mainly holarctic in the Old World; temperate and warm temperate, but also in Africa and Madagascar, in South East Asia (absent in the Deccan Peninsula and Ceylon, similarly as *Fagaceae!*), throughout Malaysia, in Australia very rare in N. Queensland (*Ostrearia* and an unnamed genus), absent from the Pacific Islands, S. America, and Europe. The present centre of development in Asia, specially China.

A peculiarity of the family is the rather large number of small genera, *viz* monotypic *13* genera, 2 species *3* genera, 3–10 species *6* genera, and over 10 species *3* genera. Furthermore their affinities point to ancient, disjunct, relict distributional areas, for example the gondwana-land distribution of the affinity *Dicoryphe* (Madagascar), *Maingaya* (Mal. Peninsula), *Embolanthera* (Palawan), and *Ostrearia* and an unnamed genus (N. Queensland). The genus *Distylium* shows a marked Pacific disjunction, between Malaysia, East Asia and Central America.

Ecol. In Malaysia constituents of the fagaceous-lauraceous rain-forest at low and medium altitudes in the hills and mountains, just reaching into the inferior portion of the subalpine zone. In Malaysia only *Altingia* shows a rather social occurrence.

Though in more high latitudes representatives may be deciduous, in Malaysia all are evergreen and show at most a simultaneous appearance of flush and flowers from the perulate buds with accompanied rapid fall of old foliage.

Foliar dimorphism. Several genera show a marked dimorphism in the leaves, mainly due to ontogeneous development; an example is that in *Symingtonia.* Fig. 7.

Galls. Various galls have been described; they are caused by gall-mites and -midges in *Altingia, Distylium,* and *Sycopsis*; those in *Distylium* are frequent and conspicuous structures (fig. 4).

Pollination. No definite data have come to our knowledge; many representatives are obviously adapted to wind pollination. A marked exception is *Rhodoleia* which is clearly adapted to pollination by animals of which some observations are recorded on p. 374.

Dispersal. It is remarkable that Ridley in his compilation on dispersal does not mention any records of the family. The seed is winged in many species, but the wings are often small and sometimes early caducous.

There is a distinct tendency in species with many-seeded capsules to develop only one fertile seed in each cell.

In *Altingia* it has been observed that the seeds, which contain fat oil, attract a number of animals (monkeys, birds) and that seeds are also dispersed (and eaten?) by certain kinds of ants, though no obvious elaiosome is developed.

Morphology. *Distylium* and *Sycopsis* have generally been described as possessing sepals; their number would be variable (0–6) in a single inflorescence. As has already been observed by Hemsley

(Hook. Ic. Pl. IV, 9, 1907, t. 2835, 2836) it is difficult to draw a line between the so-called 'sepals' and bract(eole)s.

In adding the numbers of 'sepals' and bract(eole)s as found by HEMSLEY in a Chinese species it appeared that the numbers 3 and 6 were of frequent occurrence and were repeated in the androecium. This has proved a significant feature for the interpretation of the floral structure.

I have verified this regularity with the Malaysian species of *Sycopsis* and *Distylium*. A schematic diagram of the situation in both genera, as far as could be ascertained from herbarium material, is given in fig. 1, in which for convenience bracts and 'sepals' have not been drawn to the same scale. In most cases it appears that the groups of appendages are mostly opposite except in a few cases where they stand at an angle. In *Sycopsis dunnii* (fig. 1S) the number of groups of appendages is rather irregular and they are inserted both on the outer side and on top of the urceolate receptacle. In *Distylium* (fig. 1D) the most apical groups of appendages are inserted just below the superior ovary. It was observed that in several cases the central appendage of each group of 3 had a leaf-like appearance (fig. 1 Da), but the 2 lateral ones were always about lanceolate in shape.

As in both *Sycopsis* and *Distylium* stipules occur, I assume that each group of appendages represents one reduced, bract-like leaf accompanied by two stipules.

In some lateral flowers the number of appendages is less than 3; this seems to be due to lack of space.

In *Distylium stellare* (fig. 1D) the lateral ♂ flowers are sustained by one group of appendages and possess 4(–3) stamens; the distal ♂ flowers are sustained by 2 groups of appendages and contain 8 stamens, suggesting a twin flower; it was impossible to ascertain in herbarium material the precise place of insertion of these stamens. Examination of a distal flower of *D. racemosum* S. & Z. gave strong support to the assumption of the existence of twin flowers; this flower was sustained by 2 groups of appendages containing 1 fertile and 1 rudimentary ovary and 11 stamens of which 2 were inserted *between* the ovaries.

From the above observations *I have concluded that both genera are asepalous* and that in *Distylium* distal flowers are often merged in twos (twins).

In the ♀ flowers of *Altingia* many authors described the presence of a minute calyx limb accressent in fruit. But the rudimentary stamens are, if present, always inserted *outside* the ring of these minute lobes. In my material I found one ☿ head in which the stamens were arranged in whorls surrounding the ovaries but inserted *outside* this ring of lobules, thus proving that the lobules are in fact disk lobes. In *Symingtonia populnea* there is a similar ring of lobules representing the disk, as NIEDENZU pointed out formerly (Nat. Pfl. Fam. ed. 1, 3, 2a, 1891, 117).

Bract-like lobes are in this genus also found *between* the separate flowers, equalling them in number. For that reason they cannot be accepted as sepals, but are in fact bracts, each belonging to one flower. Their undersurface is covered with the same kind of indument as is found on the axial parts between the flowers.

The remarks made above on the morphological interpretation of the flowers in some genera shows

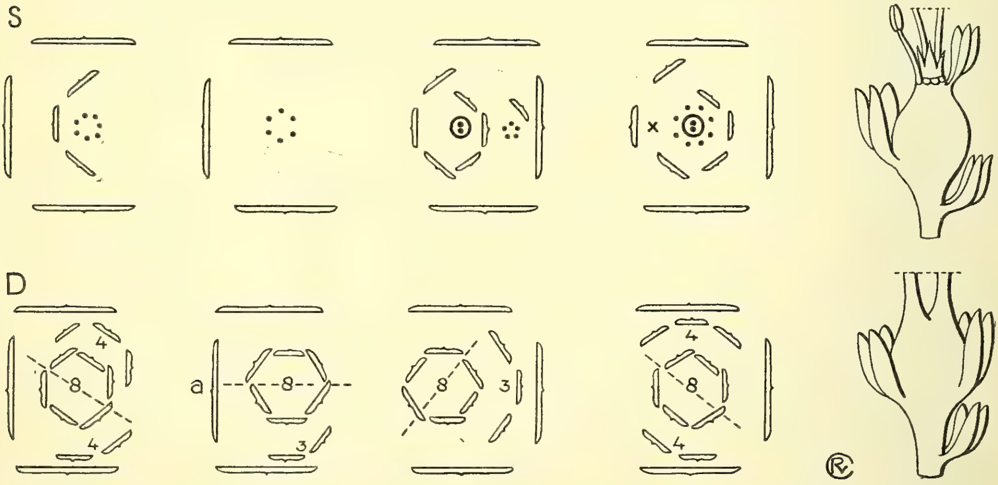

Fig. 1. Diagram of inflorescence and lateral (schematic) view of an enlarged flower of:
S *Sycopsis dunnii* HEMSL. in which *dots* are stamens, *double dots* an ovary, a *circle* the receptacle, a *cross* an indistinct body.
D *Distylium stellare* O.K. in which *3*, *4* and *8* mean the number of stamens, an *interrupted line* the presumed demarcation between two connate (twin) flowers, *a* a leaf-like bract.
For further explanation see the text.

the desirability of detail reinvestigation in other genera (specially *Sinowilsonia*). Such an examination, which is beyond the scope of the present revision may lead to a more precise interpretation of floral structures in this family, which in turn is important for its suprageneric taxonomy.

Wood anatomy. BEEKMAN, Med. Proefstat. Boschw. 5 (1920) 94; DEN BERGER & ENDERT, *ibid.* 11 (1925) 60; DEN BERGER, Determinatietabel Malesië, Veenman, Wageningen (1949) 24, 30, 31, 32; DESCH, Mal. For. Rec. 15¹ (1941) 224 (hand lens). JANSSONIUS, Blumea 6 (1950) 425, Key to Jav. woods, Brill, Leiden (1952) 9; METCALFE & CHALK, 1 (1950) 589 (*Distylium*, *Sycopsis*, *Rhodoleia*, *Symingtonia* (*Bucklandia*), *Altingia*); MOLL & JANSS. Mikr. 3 (1918) 301 (*Altingia*, *Distylium*); TIPPO, Bot. Gaz. 100 (1938) 45 & 66 considers the family to be a derivative of the *Magnoliales.* JANSSONIUS (1950) *l.c.* mentions structural similarity with *Daphniphyllum* and *Theaceae.* The *Casuarinaceae* are higher than the *Hamamelidaceae* in every wood anatomical character (TIPPO, *l.c.* 71) and so support HUTCHINSON's derivation of the *Casuarinaceae* from the *Hamamelidaceae.*—C.A.R.-G.

Uses. In Malaysia most representatives do not attain large sizes and do not occur in such quantity to be important as timber trees. An exception is *Altingia* which by its good timber, obtainable in large sizes and quantities, is one of the most estimated trees of the West Javanese mountain forest.

The Sundanese people in West Java use its flush as a vegetable (lalab).

The aromatic resin of *Altingia*, obviously produced secondarily after injury of the bark and sapwood, is collected for local use.

For reafforestation purposes and for timber *Altingia* has been employed by the Indonesian Forest Service on a large scale both in its native area and outside it; *Distylium* and *Symingtonia* have occasionally been used for the same purpose.

Rhodoleia is a beautiful tree for parks and along waysides in the hill areas by its attractive foliage, pretty flowers, and moderate size.

Notes. In the new edition of the 'Pflanzenfamilien' (1930) HARMS recognized the following subfamilies(1):

(1) **Disanthoideae** (only *Disanthus*, Japan).

(2) **Hamamelidoideae** (5 tribes):
  Tribe: *Hamamelideae (Maingaya, Embolanthera, Loropetalum, Dicoryphe, Ostrearia, etc.).*
  Tribe: *Distylieae (Distylium, Sycopsis, Sinowilsonia).*

(3) **Rhodoleioideae** *(Rhodoleia).*

(4) **Bucklandioideae** *(Symingtonia, Chunia).*

(5) **Liquidambaroideae** *(Liquidambar, Altingia).*

Hamamelidaceae show several characters in common with *Euphorbiaceae:* mostly stipules, often stellate (or lepidote) indument, and in the capsules endo- and exocarp often separating, but the latter is persistent. These characters apparently do not reflect taxonomic relationship with this family.

About the taxonomic position of the family opinions vary. R. BROWN, LINDLEY, and NIEDENZU compare the *Hamamelidaceae* with the *Bruniaceae.* The latter were inserted in the *Rosales* by VON WETTSTEIN, but referred to the *Hamamelidaceae* by GARDNER.

BAILLON merged *Hamamelidaceae* with *Saxifragaceae* arranging *Hamamelidaceae* and *Liquidambareae* as tribes in the *Saxifragaceae.* HOOKER *f.* admitted that he could hardly separate the *Hamamelidaceae* from the *Saxifragaceae.*

HALLIER *f.* made a very wide definition of the *Hamamelidaceae* uniting them with *Buxaceae, Casuarinaceae, Daphniphyllaceae,* and others. He derived them from the *Betulaceae.*

Most recent authors accept the arrangement of VON WETTSTEIN of the *Hamamelidaceae* with the *Platanaceae* and some other small families in the *Hamamelidales* with relationships to *Rosales.*

For wood-anatomical characters see above.

The structure of the pollen shows similarity with that found in *Platanaceae*, *Eucommiaceae* (both inserted by HUTCHINSON in *Hamamelidales*), *Trochodendraceae*, and *Cercidiphyllaceae.*

The subfamily of the *Liquidambaroideae* (*Liquidambar* and *Altingia*) has a somewhat isolated position in the *Hamamelidaceae* by the following characters: the flowers are unisexual and apetalous; there occur medullary secretory canals which otherwise are only present in *Mytilaria*; the pollen grains are polyforate, in contrast to the remaining part of the family where they are usually 3-colpate or 3-colporoidate.

Some authors have considered the *Liquidambaroidae* to represent a distinct family, but there is a very close connection with the other subfamilies through *Symingtonia.*

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(1) *Mytilaria* is insufficiently known and not yet placed.

KEY TO THE GENERA

(based on fertile material)

1. Flowers in distinctly peduncled heads, heads rarely (in ♂ *Altingia* always) in racemes.
  2. Heads rayed with a large involucre . . . . **5. Rhodoleia**
  2. Heads not rayed. Involucre absent or small.
    3. Stipules very large, cohering. . . . . **6. Symingtonia**
    3. Stipules small, not cohering.
      4. Leaves crenate-serrate. Stipular scars punctiform or absent. Heads unisexual . . **7. Altingia**
      4. Leaves entire. Stipular scars annular. Flowers bisexual . . . . **1. Maingaya**
1. Flowers in (sometimes short) spikes or racemes.
  5. Petals long, 2-lobed at the base. Connective horn-like. Indument of simple hairs. **2. Embolanthera**
  5. Petals absent. Connective apiculate.
    6. Ovary setose-pilose, enveloped by a persistent, lepidote receptacle. Indument lepidote. **4. Sycopsis**
    6. Ovary stellate-hairy, not enveloped by a receptacle. Indument lepidote and stellate-hairy. **3. Distylium**

KEY TO THE GENERA

(based on vegetative characters)

1. Stipules leaving annular scars.
  2. Stipules large, cohering. Leaves 3-plinerved . . . . **6. Symingtonia**
  2. Stipules small, not cohering. Leaves penninerved . . . . **1. Maingaya**
1. Leaf scars not annular, small or absent.
  3. Leaf margin glandular-crenate-serrate (fig. 8) . . . . **7. Altingia**
  3. Leaf margin entire or spiny-dentate.
    4. Stipules absent . . . . **5. Rhodoleia**
    4. Stipules present, caducous.
      5. Stipules at least in part capitate-glandular pectinate at the base . . . . **2. Embolanthera**
      5. Stipules entire . . . . **3. Distylium & 4. Sycopsis**

1. MAINGAYA

OLIVER, Trans. Linn. Soc. 28 (1873) 517, t. 44.—**Fig. 2.**

Evergreen tree with bisexual flowers. *Leaves* entire, penninerved. Stipules small, early caducous, leaving annular scars. *Flowers* in dense, globose heads, free, sessile. *Calyx* closed in bud, before anthesis circumscissile, caducous, leaving a narrow annulus. *Petals* 5, linear-spathulate. *Stamens* 5, alternipetalous; filaments very short, stout; anthers basifix, ellipsoid-obovoid, laterally flattened, with 4 pollen sacs, 2-celled, dehiscing laterally with 4 valves; connective produced into a curved adaxial horn and two abaxial teeth. Staminodes 5, epipetalous, adaxially horned as stamens. Disk 10-lobed. *Ovary* half-inferior, 2-celled, each cell with 1 pendent ovule; styles 2, very short, slender, stigma apical, minute. *Fruits* shortly and stoutly pedicelled, free, ovoid, 2-celled, 4-valved, woody, to about halfway enveloped by the receptacle. *Seed* 1 in each cell, wingless.

Distr. Monotypic, *Malaysia:* Malay Peninsula.

Note. *Maingaya* differs mainly from both *Loropetalum* R.BR. and *Embolanthera* MERR. in its different calyx and the presence of well developed staminodes, and moreover, from *Embolanthera* by capitulate inflorescences and entire petals.

1. Maingaya malayana OLIVER, Trans. Linn. Soc. 28 (1873) 517, t. 44; CLARKE, Fl. Br. Ind. 2 (1878) 428; BOERL. Handl. Fl. Ned. Ind. 1, 2 (1890) 454; KING, J. As. Soc. Beng. 66, ii (1897) 307; RIDL. Fl. Mal. Pen. 1 (1922) 691; HARMS, E. & P. Pfl. Fam. ed. 2, 18a (1930) 323.—**Fig. 2.**

Tree, 6–20 m high, 45–60 cm in diam. or less. Ultimate twigs minutely stellate-pubescent, quickly glabrescent. *Leaves* elliptic to lanceolate oblong or lanceolate, (7–)10–25 by (2–)3–11 cm, acuminate at the apex, slightly oblique, rounded or obtuse (or sometimes slightly peltate, KING, *l.c.*) at the base, glabrous on either side, firmly chartaceous; midrib prominent above; nerves 7–10 pairs; petioles 12–25 mm, slightly thickened at base and apex, glabrous. Stipules tomentose. *Flowerheads* c. 15-flowered, 2–$2\frac{1}{2}$ cm in diam.; peduncle 1 cm or less. *Calyx* puberulous. *Petals* 8–12 by $1\frac{1}{2}$–2 mm. *Filaments* glabrous, $\frac{1}{3}$–$\frac{1}{2}$ mm long; anthers $\frac{4}{5}$–1 mm long; horn $\frac{1}{2}$–$\frac{4}{5}$ mm long, provided with an adaxial tooth. Staminodes slender, laterally flattened, nearly as long as the stamens. Disk lobes free, oblong, small. Free part of *ovary* grey-hirsute; styles less than 1 mm long. *Fruits* 10–15 by 8–12 mm; pedicels *c.* $^{1}/_{2}$ cm long, inserted on the thickened apex of the peduncle; endocarp separating from the exocarp. *Seeds* narrowly ellipsoid, tapering much to the apex, white.

Distr. *Malaysia:* Malay Peninsula (Penang, Perak).

Ecol. In primary forests, 300–1000 m.

Notes. About ten specimens are now known, 2 from Perak, the others from Penang.

In the specimens at my disposition the flowers possess only 5 staminodes as described by OLIVER; KING (copied by RIDLEY) erroneously recorded to have observed 10 staminodes.

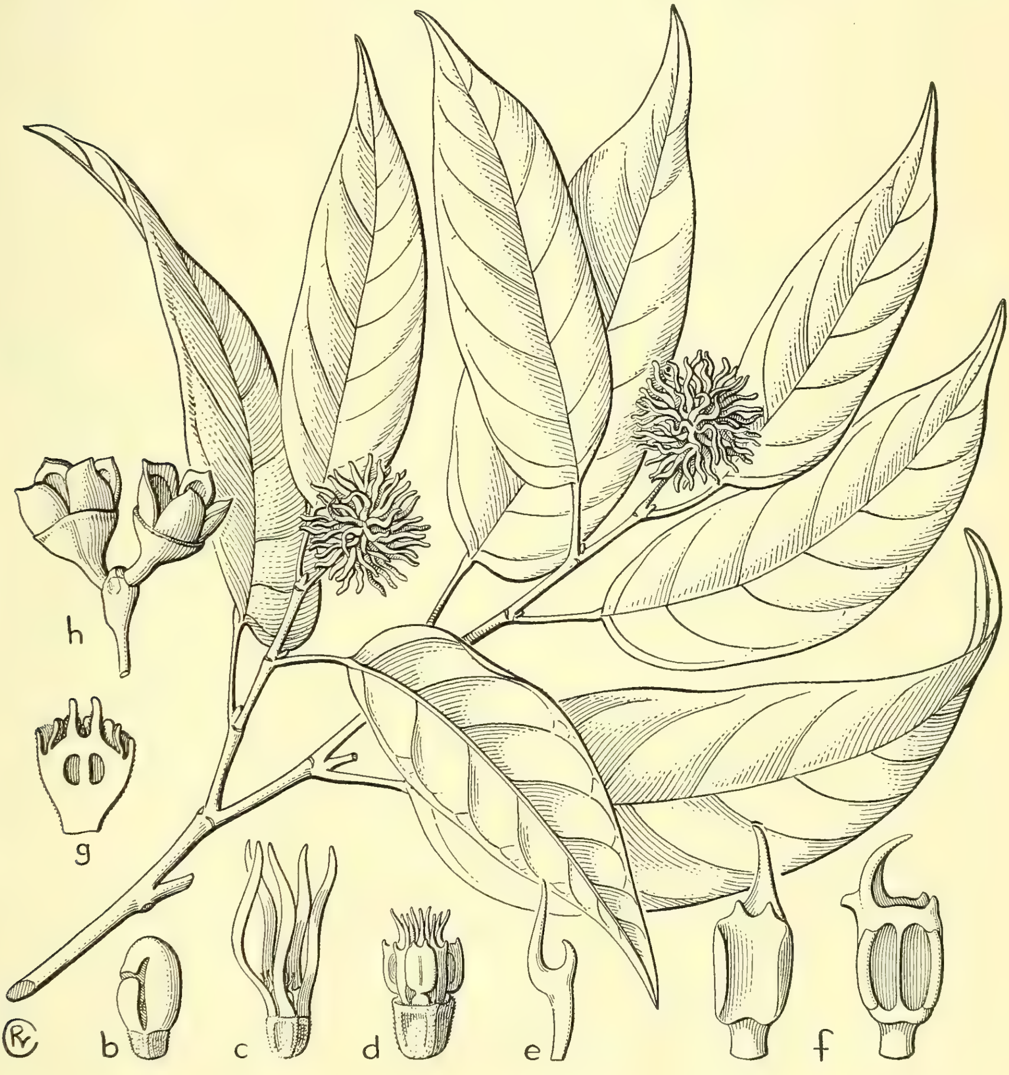

Fig. 2. *Maingaya malayana* OLIVER. *a.* Flowering twig, × $^{2}/_{3}$, *b.* flowerbud with ruptured calyx, × $^{2}/_{5}$, *c.* flower in anthesis, × 4, *d. ditto*, petals removed, × 5, *e.* staminode, lateral view, × 10, *f.* fertile stamen, dorsal and lateral views, × 14, *g.* section of flower (petals & androecium removed) showing the calyx rim, disk lobes, 2 styles, and ovarial cells, *h.* head with 2 dehisced fruits, nat. size.

2. EMBOLANTHERA

MERRILL, Philip. J. Sc. 4 (1909) Bot. 263.—**Fig. 3.**

Evergreen trees with bisexual flowers. *Leaves* entire to spiny-denticulate, penninerved. Stipules small, usually glandular-pectinate at the base, early caducous, leaving small scars. *Flowers* in dense, many-flowered, axillary spikes, free. *Calyx* connate, closed in bud, splitting into 2–4 unequal rather irregular lobes, persistent in anthesis. *Petals* 5, linear-spathulate, with two lateral lobes at the base. *Stamens* (4–)5, alternipetalous, filaments very short, stout, anthers basifix, obovoid, laterally flattened, with 4 pollen sacs, 2-celled, dehiscing laterally with 4 valves; connective produced into an adaxial, subulate awn. Staminodes lacking. Disk lacking. *Ovary* inferior, 2-celled, each cell with 1 pendent ovule; styles 2, slender, very short, with slightly adaxially, decurrent, papillose stigmas. *Fruits* unknown.

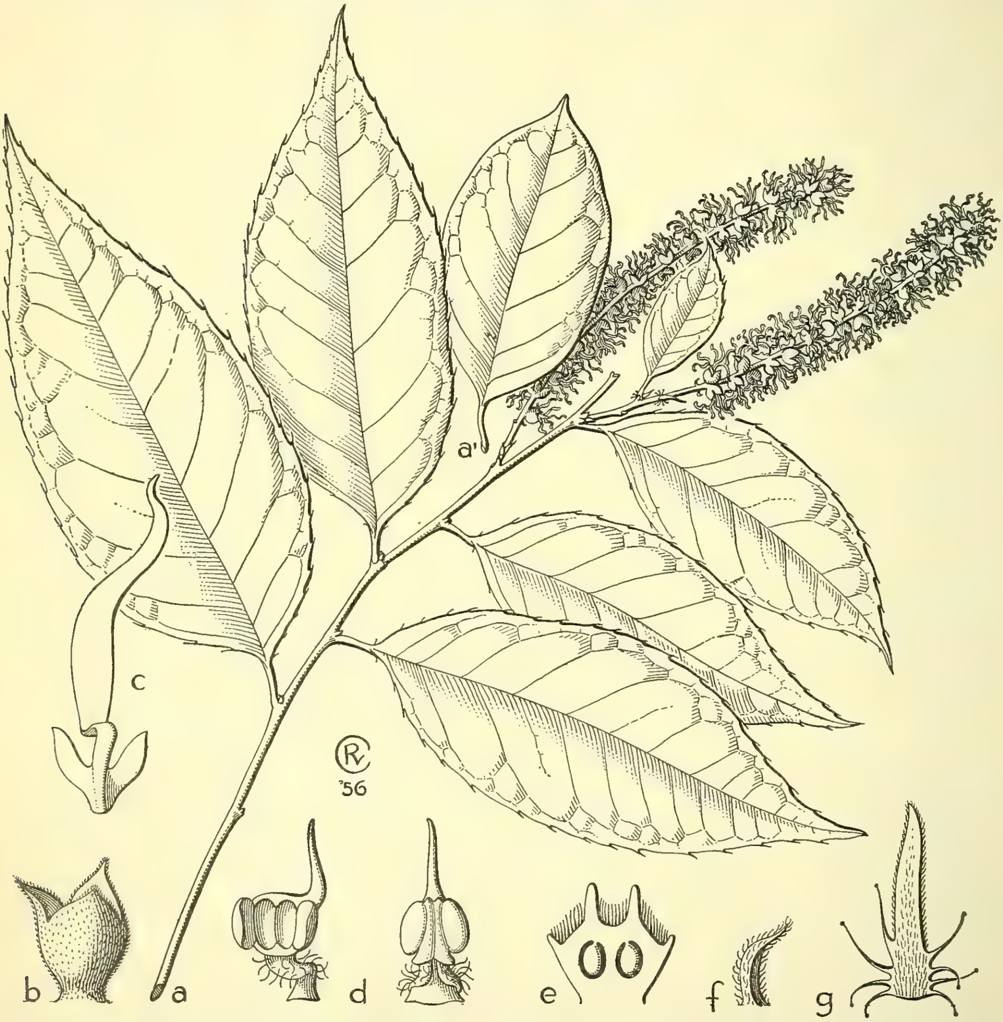

Fig. 3. *Embolanthera spicata* MERR. *a*. Habit and *a'* separate entire leaf, × ²/₃, *b*. calyx, × 4, *c*. petal, × 4, *d*. stamen, × 10, *e*. longitudinal section of ovary, × 10, *f*. bract, × 7, *g*. stipule (pectinate type), × 7 (*a–g* after PNH 12292, *a'* after BS 739).

Distr. Monotypic, *Malaysia:* SW. Philippines (Palawan).

Notes. This genus is closely related to *Maingaya* Oliv. from the Malay Peninsula and *Loropetalum* R.Br. from Assam and China, differing from both in its spicate inflorescence, in its basally lobed petals, and in the absence of staminodes, from *Maingaya* in addition in its different calyx and from *Loropetalum* in its ± 5-merous flowers.

1. **Embolanthera spicata** Merr. Philip. J. Sc. 4 (1909) Bot. 263; En. Philip. 2 (1923) 225; Harms, E. & P. Pfl. Fam. ed. 2, 18a (1930) 324.—**Fig. 3.**

Tree, 7–10 m high, 15–20 cm in diam. Twigs minutely pubescent or glabrous. *Leaves* ovate, ovate-oblong, or oblong, acute to acuminate, sometimes obtuse to rounded, margin entire and slightly recurved to spiny-denticulate, base slightly oblique, acute, obtuse, or rounded, 7–14 by 3–6 cm, glabrous on either side, firmly chartaceous; midrib impressed above, nerves 7–12 pairs. Petioles ½–1 cm, minutely pubescent or glabrous. Stipules ovate-lanceolate to linear, very acute 4–5 by ⅘–1⅓ mm. *Spikes* 3–8 cm long, 1–1½ cm peduncled, rhachis, peduncle, and calyces minutely whitish stellate-pubescent. *Flowers* white. *Calyx* lobes ovate, 3–5 mm long, acute to acuminate, with a tufted-hairy apiculus. *Petals* 11–20 by 1½–2 mm, with *c.* 2½ mm long, basal lobes, just above these lobes with a sharp inward curve. Filaments ⅗–1 mm long, dorsally and ventrally blackish pubescent, curved outward, at the base connate with the base of the petals and falling off with these; anthers ⅘–1 mm long, awn 1⅓–2 mm. Top of *ovary* light yellowish short-villous; styles less than 1 mm; stigmas minute.

Distr. *Malaysia:* S. Philippines (Palawan: Mt Victoria).

Ecol. Along rocky river-banks and in forest, 50–250 m.

Notes. This remarkable plant has been found twice only.

Merrill *l.c.* stated that the calyx is finally circumscissile and caducous, but my material did not allow to verify this statement. The second collection (Sulit PNH 12292) differs from the type specimen by its larger, spiny-denticulate leaves and pubescent twigs and petioles.

3. DISTYLIUM

Sieb. & Zucc. Fl. Japon. 1 (1835) 178, t. 94; Walker, J. Arn. Arb. 25 (1944) 322.—**Fig. 1D, 4.**

Evergreen polygamous-monoecious trees or shrubs. *Leaves* entire or denticulate above the middle, penninerved. Stipules small, caducous, leaving small scars. *Flowers* in headlike spikes or racemes, free, sustained by 0–2 groups of 3(–2) lanceolate small bracts. *Calyx* and *petals* lacking. *Stamens* in ♀ flowers lacking, in ☿ or ♂ flowers 1–8; filaments of varying length, subulate; anthers basifix, ellipsoid, with 4 pollen sacs, 2-celled, dehiscing laterally with 2 longitudinal slits; connective apiculate. Staminodes lacking. Disk lacking. *Ovary* in ♂ flowers lacking, in ☿ and ♀ flowers superior, 2-celled, each cell with 1 pendent ovule; styles 2, subulate, divergent; adaxially with decurrent papillose stigmas. *Fruits* free, 2-celled, 2- or 4-valved, woody; endocarp loosening from the exocarp. *Seeds* 1 in each cell, oblong to ovoid, wingless; albumen present.

Distr. Two species in Central America, ten species from Assam, S. China to Korea and Japan, and in *Malaysia:* S. Sumatra, Malay Peninsula, Java, and Flores.

Notes. *Distylium* differs from *Sycopis* Oliv. mainly in the absence of a persistent receptacle in ☿ and ♀ flowers, the ovary being exposed and lepidote or stellate-pubescent, never densely setose-pilose.

As is shown on p. 364 the calyx is lacking and the organs described as representing sepals have appeared to be bracts.

1. **Distylium stellare** O. Kuntze, Rev. Gen. Pl. 1 (1891) 233; Koorders, Versl. Kon. Ak. Wet. A'dam sect. B (1909) 948; Back. Schoolfl. Java (1911) 475; Koord. Exk. Fl. Java 2 (1912) 313; J. J. Smith, K. &. V. Bijdr. 13 (1914) 80; Hallier *f.* Med. Rijksherb. *no* 37 (1918) 15; Doct. v. Leeuwen, Zoocecidia (1926) 215, f. 341–342 and Ned. Kruidk. Arch. 51 (1941) 159; Harms, E. & P. Pfl. Fam. ed. 2, 18a (1930) 331; Steen. Bull. Jard. Bot. Btzg III, 13 (1934) 219; Walker, J. Arn. Arb. 25 (1944) 330; Backer, Brittonia 3 (1938) 79; Bekn. Fl. Java (em. ed.) 6 (1948) fam. 121, p. 3.—**Fig. 1D, 4.**

Tree, 12–45 m high, 30–150 cm in diam., bole rather straight to columnar, without buttresses; bark grey. Innovations densely stellate-hairy and stellate-lepidote, glabrescent. *Leaves* ovate, ovate-oblong, oblong or ovate-lanceolate, sometimes obovate or roundish, 4-18 by 2–6½ cm, acute, acuminate or caudate at the apex, often slightly oblique, rounded, obtuse or acute at the base, margin entire and recurved or (in saplings and young trees) above the middle of the leaf with 1–3 sharp, glandlike tipped, thickened teeth, when mature glabrous or tardily glabrescent beneath, thin- to firmly coriaceous; midrib impressed above; nerves (3–)4–6 pairs; petiole $^{1}/_{3}$–10 cm. Stipules lanceolate to linear, 3–7 by $^{1}/_{4}$–$^{3}/_{4}$ mm, very acute at the apex, thinly stellate and stellate-lepidote. ♂ *Spikes* or racemes $^{1}/_{2}$–$2^{1}/_{2}$ cm long, rather densely 3–6-flowered, ♀ *and* ☿ *spikes* or (often branched) racemes $1^{1}/_{2}$–3 cm long, rather laxly 4–12-flowered, with the axial parts stellate-hairy and stellate-lepidote. Bracts lanceolate, 2–3 by $^{1}/_{2}$–1 mm. *Filaments* $1^{1}/_{2}$–2 mm long, glabrous; anthers $1^{1}/_{2}$–2 mm long, red. *Ovary* ovoid, $1^{3}/_{4}$–$2^{1}/_{2}$ by 2–$2^{1}/_{2}$ mm, densely dark-brown stellate-tomentose; styles 4–5 mm. *Fruits* ellipsoid to ovoid, 10–14 by 8–11 mm, subacute, apiculate by short remains of the styles, brown stellate-tomentose. *Seeds* ellipsoid to ovoid, *c.* 6–7 mm long, whitish, turning brown and shining; hilum apical, slightly impressed, descending shortly on one lateral side.

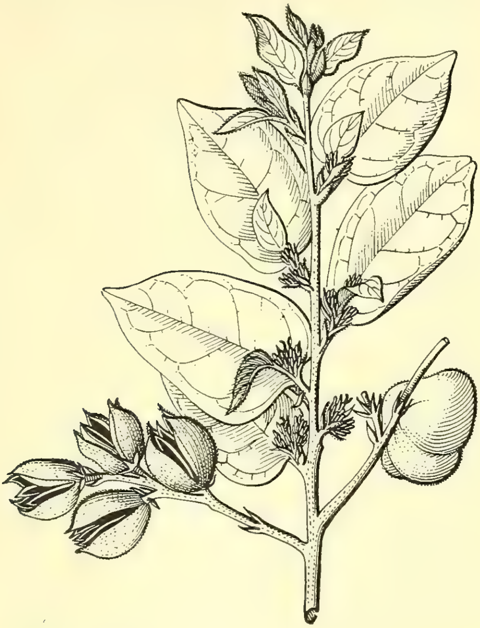

Fig. 4. *Distylium stellare* O.K. Habit of flowering and fruiting twig and a gall, × $^{2}/_{3}$.

Distr. *Malaysia:* Malay Peninsula (Pahang: Cameron Highl.), S. Sumatra, Java (Gedeh to Jang), and Lesser Sunda Islands (Flores).

Ecol. Scattered on slopes and ridges in evergreen, mixed rain-forest, locally common, 1000–2700 m; *fl.* April–Nov., *fr.* June–Oct.

There are several kinds of galls occurring on this species:

(*a*) ellipsoid to globose, dark grey-brown or brown, $1^{1}/_{2}$–3 cm in diam., *in vivo* light green with a peach-coloured hue, caused by an aphid: *Schizoneuraphis gallarum* VAN DER GOOT.

(*b*) obovoid, about rounded at the apex, acute at the base, yellowish brown stellate-hairy, *c.* $2^{1}/_{2}$ cm in diam., *in vivo* apparently light-orange coloured, probably caused by another aphid.

(*c*) long and narrow terete, striate, yellowish brown stellate-hairy, 3–7 by $^{1}/_{2}$–1 cm, often curved, with small to rather large, leaf-like wing below the base.

(*d*) globose, prominent on both sides of the leaf, 5–11 mm in diam.; the young galls are light green with a pink hue, the mature ones are darker or brownish green; caused by an aphid: *Schizoneuraphis distyllii* VAN DER GOOT.

(*e*) circular to oblong, densely light-brown stellate-hairy patches on the lower side of the leaf, 1–3 by 1–2 mm.

(*f*) domatia: pitted, glandlike axils of the lateral nerves with the midrib, often bearing small hair-tufts.

USES. In the mountains used for purposes of reafforestation, sometimes as a wayside tree (Diëng).

Vern. *Ki tambaga, sirom, ki sirum, pangsor*, S, *sĕrut* (Slamet), *pitjis* (Diëng), *sientok* (Ungaran), J, none of them apparently well stabilized.

4. SYCOPSIS

OLIVER, Trans. Linn. Soc. 23 (1860) 83, t. 8; WALKER, J. Arn. Arb. 25 (1944) 335.—**Fig. 1S.**

Evergreen polygamous-monoecious trees or shrubs. *Leaves* entire or denticulate above the middle, penninerved. Stipules small, caducous, leaving small scars. Racemes or headlike spikes, initially sometimes involucre-like enclosed by large lower bracts. *Flowers* free, sustained by 0–2 groups of 3(–2) lanceolate small bracts, which occur also on the sides and the top of the urceolate *receptacle*, which envelops the ovary in ♀ and ☿ flowers and bears in the latter also stamens on its top. *Calyx* and *petals* lacking. *Stamens* in ♀ flowers lacking, in ☿ or ♂ flowers 4–10; filaments of varying length, subulate; anthers basifix, ellipsoid, with 4 pollen sacs, 2-celled, dehiscing laterally with 2 longitudinal slits, connective often apiculate. Staminodes lacking or, occasionally, a few to numerous stamens, sterile and slightly smaller. Disk lacking. *Ovary* in ♂ flowers very rudimentary or lacking, in ☿ and ♀ flowers enveloped by the receptacle, free, 2-celled, each cell with 1 pendent ovule; styles 2, subulate, slender, divergent, adaxially with decurrent, papillose stigmas. *Fruits* free, 2-celled, 2- or 4-valved, woody, at the base surrounded by the split receptacle or wholly enclosed by it. *Seeds* 1 in each cell, ovate-oblong, wingless; hilum apical, impressed; albumen thin.

Distr. Seven species from Assam, Central and S. China to Hainan and *Malaysia:* North to Central Sumatra, Malay Peninsula, Philippines (Luzon), Central to S. Celebes, and New Guinea.

Notes. *Sycopsis* differs from *Distylium* SIEB. & ZUCC. mainly in the presence of a persistent receptacle in ☿ and ♀ flowers enveloping the setose-pilose ovary and bearing the stamens on its top.

As is shown in fig. 1 S the calyx is lacking and the parts described as sepals have appeared to be bracts.

1. Sycopsis dunnii HEMSLEY, Hook. Ic. Pl. 29 (1907) t. 2836; HARMS, E. & P. Pfl. Fam. ed. 2, 18a (1930) 333; CHUN, Sunyatsenia 1 (1934) 245; WALKER, J. Arn. Arb. 25 (1944) 338; STEEN. Nova Guinea 6 (1955) 33, f. 1.—*S. philippinensis* HEMSLEY, *l.c.* p. 2; MERR. En. Philip. Fl. Pl. 2 (1923) 225; HARMS, *l.c.*—*Croton curviflorus* ELMER, Leafl. Philip. Bot. 1 (1908) 310.—**Fig. 1S.**

Shrub or tree up to 16 m high; bark grey. Innovations yellowish-grey (twigs) or reddish (leaves) stellate-lepidote, glabrescent. *Leaves* broadly elliptic or ovate to oblong or lanceolate, 5–12 by 2–5 cm, coriaceous, acute to acuminate at the apex, nearly rounded, obtuse or acute and shortly decurrent at the base, margin entire, often recurved; midrib impressed, at the leaf-base more or less prominent above; nerves 5–9 pairs; petiole 1/3–1 1/5 cm. Stipules lanceolate, acute at the apex, 2–5 by 1–2 mm, yellowish-grey lepidote, glabrescent. *Racemes* or *spikes* 3–6-flowered, 1–2 1/2 cm long, the ♂ inflorescences being the shorter ones, the axial parts densely stellate-lepidote and with ovate, oblong or lanceolate bracts 2–4 1/2 by 1/2–2 mm, not enclosed initially by involucral bracts. *Receptacle* 2–4 by 2–3 mm, outside densely stellate-lepidote, inside sericeous, with 2–6 scattered bracts on its surface and minute, membranous, irregular, connate lobes up to 1 1/2 mm long on its top inserted inside of the androecium. *Filaments* 2–5 1/2 mm, glabrous or with a few stellate scales; anthers 1 1/2–3 mm long. *Ovary* ovoid to conical, 2–3 by 1 1/2–2 mm, brown setose-pilose; styles 8–13 mm; stigmas red. *Fruits* ellipsoid to ovoid, 11–13 by 6–8 mm, acute and with or without short remains of the styles, light greyish-brown setose-pilose; receptacle spathaceous. *Seeds* ovoid, *c.* 3/4–4/5 cm long, dark-brown and very shining; hilum descending shortly on both lateral sides.

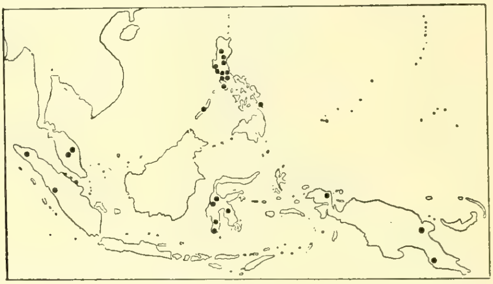

Fig. 5. Malaysian localities of *Sycopsis dunnii* HEMSL.

Distr. S. China (Yunnan to Fukien) and *Malaysia:* North to Central Sumatra, Malay Peninsula, Philippines (Palawan, Mindoro, Luzon, Dinagat), Central to S. Celebes, and New Guinea. —Fig. 5.

Ecol. Mixed mountain forests, 1100–2200 m, *fl.* Jan.–June, *fr.* April, Dec.

Vern. *Marapujan, kalek bĕringin,* Sum. West Coast, *parukápok,* Neg.

Note. WALKER (*l.c.* 340) reported some minor differences between Chinese and Malaysian specimens, the latter having more often obtuse to nearly rounded leaf-bases.

The lower side of the leaves is frequently provided with domatia: pitted, glandlike nerve axils often bearing small hair-tufts. Sometimes additional pitted glands occur alongside the midrib on the intervenium.

5. RHODOLEIA

CHAMPION *ex* HOOK. *f.* Bot. Mag. III, 6 (1850) t. 4509; EXELL, Sunyatsenia 1 (1933) 95.—**Fig. 6.**

Evergreen trees with bisexual flowers. *Leaves* entire, penninerved, occasionally 3-plinerved. Stipules lacking. *Flowers* connate, 5–10 in peduncled heads. Bracts 12–20, the lower ones small, the higher ones large, broadly rounded at the apex, forming an involucre, caducous after anthesis. *Sepals* connate, minute, forming a slightly lobed calyx limb. *Petals* 0–4, spathulate to obovate, unguiculate, exserted beyond the involucre, only those along the outer margin of the head well developed, the head hence rayed and resembling a 'flower'. *Stamens* 7–11; filaments long, slender; anthers basifix, oblong, with 4 pollen sacs, 2-celled, dehiscing laterally with 2 septicidal slits producing 4 narrow valves; connective apiculate. Disk absent. *Ovary* half-inferior, 2-celled, less frequently imperfectly 2-celled or 1-celled; ovules ∞, inserted on the dissepiment; styles 2, long, very slender, only slightly divergent, apically with minute stigmas, caducous in fruit. *Fruits* 6–10 in heads, only basally connate, woody, ovoid, 2-celled, 4-valved; the receptacle only very slightly enlarged. *Seeds* 10-20 in each cell, most of them sterile, wingless, 0–1 fertile, about triangular in cross-section or flattened, laterally narrowly winged; cotyledons ovate, flat, fleshy; radicles cylindrical, *c.* 1/3 as long as the cotyledons; albumen rather copious.

Distr. Monotypic; Yunnan to Hongkong and *Malaysia:* Sumatra, Malay Peninsula.

Notes. EXELL (*l.c.*) distinguished 7 species in his revision. In my opinion, however, only one Linnean species can be accepted for this polymorphous population. As I will show below the distinguishing characters everywhere overlap and are, even in a small geographic area, subject to a considerable range of variability. Moreover, they mostly concern sizes and not structural differences.

Extreme specimens may look very different but are linked by a number of intermediates prohibiting to fix sound demarcations even for the distinction of races.

This appears from the following analysis:

a) The length of the capitules is the smallest in *R. teysmanni* (1½–2½ cm) and *R. ovalifolia* (1½–3 cm), somewhat larger in *R. parvipetala* (2–3 cm) and the largest in *R. championi* (3–4¼ cm) and *R. forrestii* (3–4 cm);

b) The length of the anthers varies in the same way (from *R. ovalifolia* with 1½–3 mm to *R. championi* with 3–5 mm);

c) The petals are the narrowest in *R. ovalifolia* (1–3½ mm) and broader in *R. teysmanni* (2–4(–6) mm), *R. forrestii* (3–6 mm), *R. parvipetala* (3–9 mm), and *R. championi* (4–10 mm);

d) The stamens are (in the dried state) 1–3 mm longer than the petals in *R. ovalifolia* and 0–1 mm in *R. teysmanni*; generally the stamens are shorter in the other species, but there are exceptions: 0–2 mm shorter in *R. forrestii*, 1 mm longer to 6 mm shorter in *R. championi* and 1 mm longer to 7 mm shorter in *R. parvipetala*;

e) The leaf-base is very variable. In *R. teysmanni* it is acute, obtuse or rounded, just as in *R. championi sensu stricto*, but in the latter the rounded leaf-base is more prevailing. In *R. subcordata* the leaf-base is subcordate, in a paratype specimen even cordate, but in an isotype specimen there occur also rounded leaf-bases; therefore, there is no sharp delimitation in this character against other species.

f) R. subcordata is said to be characterized by a tomentose ovary and fruit. S.F. 28830 should be referred to it according to shape, dimensions, and texture of the leaf, the prominence of the nerves, and the subcordate to rounded leaf-base, but it has, however, glabrous fruits.

g) The degree of persistence of the indument on the undersurface of the leaves varies considerably in both *R. subcordata* and *R. forrestii* and this character appears to have no taxonomical value.

h) Even in one specimen the 3-plinerved leafbase may be present or absent; the distinctness of the basal nerves is a matter of degree.

The single character in which there are no transitions is the indument of the ovary (and fruit), but as explained *sub* f this cannot be accepted as of value.

I have not seen any material of *R. henryi*, but it appears very probable that its characters will fall within the range of variability of *R. championi sens. lat.*

As no good delimiting characters or combinations of characters could be found, I feel obliged to unite all species described into *R. championi.*

1. Rhodoleia championi HOOK. *f.* Bot. Mag. III, 6 (1850) t. 4509; VAN HOUTTE, Fl. Serres 6 (1850–1851) 87, t. 561, copied from Bot. Mag.; LUBBOCK, Seedl. 1 (1892) 519, f. 334; EXELL, Sunyatsenia 1 (1933) 96.—*R. teysmanni* MIQ .Versl. Med. Kon. Ak. Wet. 6 (1857) 123, *incl.* f. *minor* MIQ. and f. *major* MIQ.; MIQ. Fl. Ind. Bat. 1, 2 (1859) 669; Suppl. (1860) 532; KING, J. As. Soc. Beng. 66, ii (1897) 309; BACK. Schoolfl. Java (1911) 475; KOORD. Exk. Fl. Java 2 (1912) 312; RIDL. Fl. Mal. Pen. 1 (1922) 690; PORSCH, Oest. Bot. Z. 72 (1923) 147; DOCTERS VAN LEEUWEN, Trop. Natuur 16 (1927) 2, f. 1–4; HARMS, E. & P. Pfl. Fam. ed. 2, 18a (1930) 336; EXELL, *l.c.* 90.—*R. ovalifolia* RIDL. J. Str. Br. R. As. Soc. *no* 75 (1917) 33; Fl. Mal. Pen. 1 (1922) 690; HARMS, *l.c.* 336; EXELL, *l.c.* 100.—*R. henryi* TONG, Bull. Dep. Biol. Yatsen Un. 2 (1930) 35.—*R. parvipetala* TONG, *l.c.*—*R. forrestii* CHUN *ex* EXELL, *l.c.* 97.—*R. subcordata* EXELL, *l.c.* 101.—**Fig. 6.**

Large shrub or tree, up to 25 m high, bole up to 45 cm in diam. *Leaves* broadly ovate to (ob)-ovate-oblong to lanceolate or oblanceolate, 5–13 by 2–6 cm, rounded, obtuse, acute or acuminate

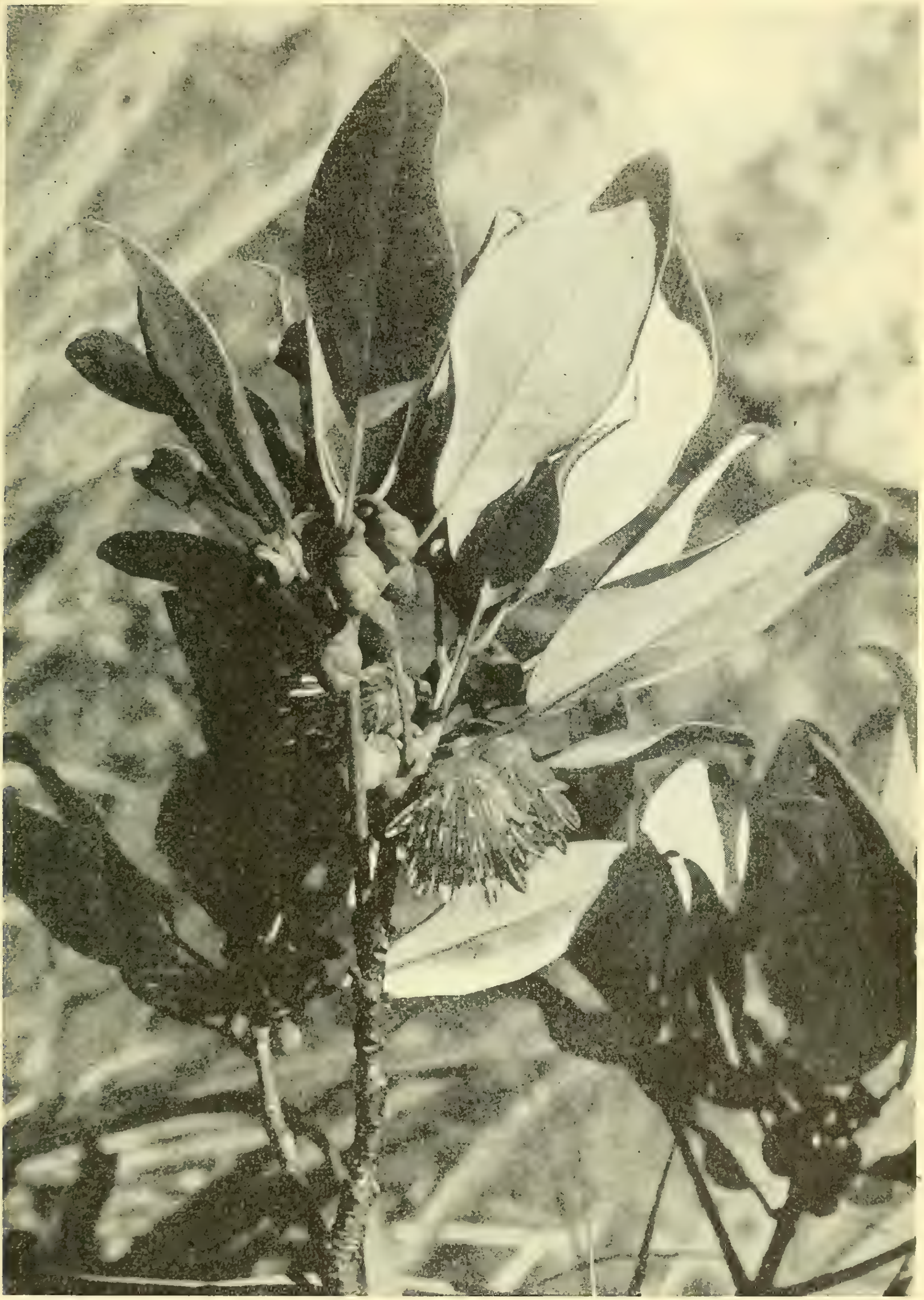

Fig. 6. *Rhodoleia championi* HOOK. *f.* from Mt Bungso near Pajakumbuh, c. 1000 m, Central Sumatra (Photogr. W. MEIJER).

at the apex, cuneate, obtuse, rounded or occasionally (sub)cordate at the base, with a flat or recurved margin, thin or rather firmly coriaceous, often glaucous beneath, glabrous or sometimes with remains of a brown stellate-lepidote or stellate indument, especially beneath; midrib minutely impressed, flat or prominent above; nerves 5–13 pairs. Petioles 2–4$^1/_2$ cm, glabrous or sometimes stellate-tomentose. *Flower heads in sicco* 1$^1/_2$–2$^1/_2$ cm long, hanging or recurved. Lower bracts ferrugineously stellate-lepidote and stellate-hairy, glabrescent, the higher ones densely ferrugineous-tomentose by bundles of basally connate hairs. *Sepals* very thin, glabrous, apically sparsely to densely ferrugineous-ciliate. *Petals* red, 10–20 by 1–4(–6) mm, sometimes with irregular, lateral lobes at or above the middle. *Filaments* 10–18 mm long, glabrous; anthers 1$^1/_2$–3 mm long. *Ovary* glabrous, occasionally ferrugineous-hairy; styles 15–22 mm, glabrous. *Fruit heads* subglobose, 1–1$^3/_4$ by 1–2$^1/_2$ cm. *Fruits* glabrous, occasionally ferrugineous-hairy, 6–10 mm long. *Seeds* 3$^1/_2$–5$^1/_2$ by 2$^1/_2$–3$^1/_2$ mm, the fertile seeds being the larger ones.

Distr. Yunnan, NE. Upper Burma, Kwangsi, Kwangtung, Tonkin, Hongkong, and *Malaysia:* North to Central Sumatra, Malay Peninsula. Occasionally planted in parks or along waysides in the Javanese mountains.

Ecol. Primary rain-forest, rarely in secondary growths, 330-2000 m, *fl.* June–Jan., *fr.* probably Dec.–July.

DOCTERS VAN LEEUWEN has made observations on flower visitors of cultivated trees in the mountain garden Tjibodas, W. Java (Trop. Natuur 16, 1927, 2–4, f. 1–4). He found the pollen not powdery but sticky and flowers to contain abundant nectar obviously produced by small glands surrounding the insertion of the filaments. Several birds are regular flower visitors there, notably *Zosteropidae (Zosterops)* and *Nectariniidae (Aethopyga, Arachnothera)*. More occasional visitors are *Pycnonotus analis* and squirrels but these are possibly not regular pollinators and cause damage to the flowers. *Bombus rufipes* has also been observed as a flower visitor.

Uses. Timber is moderately durable and fit for constructions under roof.

Vern. *Sialagundi*, Tapanuli, *kasi bĕranak*, Sidjungdung, *sidukung anah*, Suliki, *santur*, *mail*, Pajakumbuh, *madang* (*modang*) *galundi*, Fort v. d. Capellen, *kasjiebranah*, *katji barana*, *kaju barana*, *santu*, Sumatra.

Note. The specific description has been drawn after Malaysian materials. Specimens from the northern part of the disjunct distributional area (Burma-S. China) generally have somewhat larger floral parts.

6. SYMINGTONIA

VAN STEENIS, Act. Bot. Neerl. 1 (1952) 443.—*Bucklandia* [R.BR. in Wall. Cat. (1832) *no* 7414 *nom. nud.*] R.BR. *ex* GRIFF. in As. Res. 19, 1 (1836) 94, t. 13–14 and Ann. Sc. Nat. II, 9 Bot. (1838) 176, *non* PRESL in Sternb. Tent. Fl. Primord. (1825) p. xxxiii, *nec* BRONGN. Prod. Hist. Veg. Foss. (1828) 128.—*Exbucklandia* R.W. BROWN, J. Wash. Ac. Sc. 36 (1946) 348, *nom. nud. invalid.*; STEEN. Blumea 7 (1954) 595.—**Fig. 7.**

Polygamous-monoecious evergreen trees. Twigs thickened at the nodes. *Leaves* entire (or in saplings and young shoots palmately 3–5-lobed), 3–5-plinerved. Stipules large, cohering, caducous, leaving annular scars. *Flowers* connate to the base of the petals, 7–20 in peduncled ☿ and ♀ heads not sustained by bracts, initially enclosed by a pair of stipules.—☿ *Flowers*: each flower subtended by a minute bract; calyx lacking; petals 2–7, linear (-spathulate); stamens 10–14, filament of varying length, subulate, anthers basifix or basidorsifix, oblong, with 2 pollen sacs, 1-celled, dehiscing introrsely with two valves, connective apiculate; disk 5–10-lobed, dorsoventrally flattened; ovary half-inferior, 2-celled, ovules 6–8 in each cell, inserted on the dissipiment; styles 2, subulate, divergent, adaxially with decurrent papillose stigmas, caducous in fruit.—♀ *Flowers*: as in ☿, but: petals 4, rudimentary or lacking; stamens lacking. *Fruits* in globose to subglobose, woody heads, obovoid, 2-celled, 4-valved, surrounded by a ring of minute black, glandlike appendages representing the disk. *Seeds* 6–8 in each cell, the 4–5 upper ones sterile, not winged, 1 or 2 lower ones fertile, with a long wing; albumen scant.

Distr. Two species in SE. Asia (from Sikkim and Martaban to Kweichou and Tonkin) and *Malaysia:* Sumatra, Malay Peninsula.

Notes. As PRESL employed the name *Bucklandia* for a fossil cycadoid genus in 1825, it was preoccupied when *Bucklandia* R.BR. *ex* WALLICH (*nom. nud.*, 1832) and *Bucklandia* R.BR. *ex* GRIFF. (1836)

were published. In 1946 R. W. BROWN attempted to propose the new name *Exbucklandia* for '*Bucklandia* R.BR.'. He failed, however, to fulfill the conditions for its valid publication as required by art. 42 of the then (and now) prevailing rules of botanic nomenclature.

The second species described, *S. tonkinensis* (LECOMTE) STEEN., differs apparently mainly by its much larger fruiting heads and fruits. I have not examined whether it deserves specific rank.

There is an astonishing vegetative similarity with the monotypic genus *Chunia* CHANG (Sunyatsenia 7, 1948, 63, f. 11–12) from Hainan. Its flowers are said to differ from those of *Symingtonia* by stamens with 4 pollen sacs, very short styles, and absence of petals in both ☿ and ♀ flowers.

1. Symingtonia populnea (R.BR. *ex* GRIFF.) STEEN. Act. Bot. Neerl. 1 (1952) 444.—*Bucklandia populnea* R.BR. *ex* GRIFF. *l.c.* 95; MIQ. Fl. Ind. Bat. 1, 1 (1856) 837; KURZ, Fl. Burma 1 (1877) 445; CLARKE, Fl. Br. Ind. 2 (1878) 429; GAMBLE, Man. Ind. Timber Trees (1881) 174; KING, J. As. Soc. Beng, 66, ii (1897) 308; BRANDIS, Ind. Trees (1906) 301; RIDLEY, Fl. Mal. Pen. 1 (1922) 691; HARMS, E. & P. Pfl. Fam. ed. 2, 18a (1930) 336, f. 117; STEEN. Bull. Jard. Bot. Btzg III, 13 (1933) 18, f. 5; REHDER, J. Arn. Arb. 17 (1936) 333; CORNER, Ways. Trees (1940) 321, f. 113.—*Liquidambar tricuspis* MIQ. Fl. Ind. Bat. 1, 1 (1858) 1097; Suppl. (1860) 346, t. 4.—*Bucklandia populifolia* HOOK. *f.* & THOMS. J. Linn. Soc. Bot. 2 (1858) 86.—*Bucklandia tricuspis* HALL. *f.* Med. Rijksherb. *no* 37 (1918) 14.—*Exbucklandia populnea* R. W. BROWN, J. Wash. Ac. Sc. 36 (1946) 348.—**Fig. 7.**

Tree, 15–33 m high, 30–40 cm or more in diam.; bark dark-brown, fissured and flaky. *Leaves* broadly ovate, acute or acuminate at the apex, rounded, obtuse or subcordate at the base, 5–15$^{1}/_{2}$ by 3$^{1}/_{2}$–12$^{1}/_{2}$ cm, ferrugineous-tomentose on either side when very young, quickly glabrescent, thin-coriaceous, withering apricot-pink or pinkish-orange; midrib (sometimes minutely) impressed above; petiole 2–6$^{1}/_{2}$ cm, with a red tinge. Stipules obovate to oblong, often asymmetrical, flat, coriaceous, 1$^{1}/_{2}$–4$^{1}/_{3}$ by $^{2}/_{5}$–$^{4}/_{5}$ cm, rounded at the apex, brown-tomentose, glabrescent. Peduncles of flower heads ferrugineous-hirsute, 1–1$^{1}/_{2}$ cm.—☿ *Heads* globose, *c.* 1$^{1}/_{2}$ cm in diam.; petals linear, 2–3 by $^{1}/_{3}$–$^{1}/_{2}$ mm; filaments 2–4 mm, anthers 1–1$^{1}/_{2}$ mm

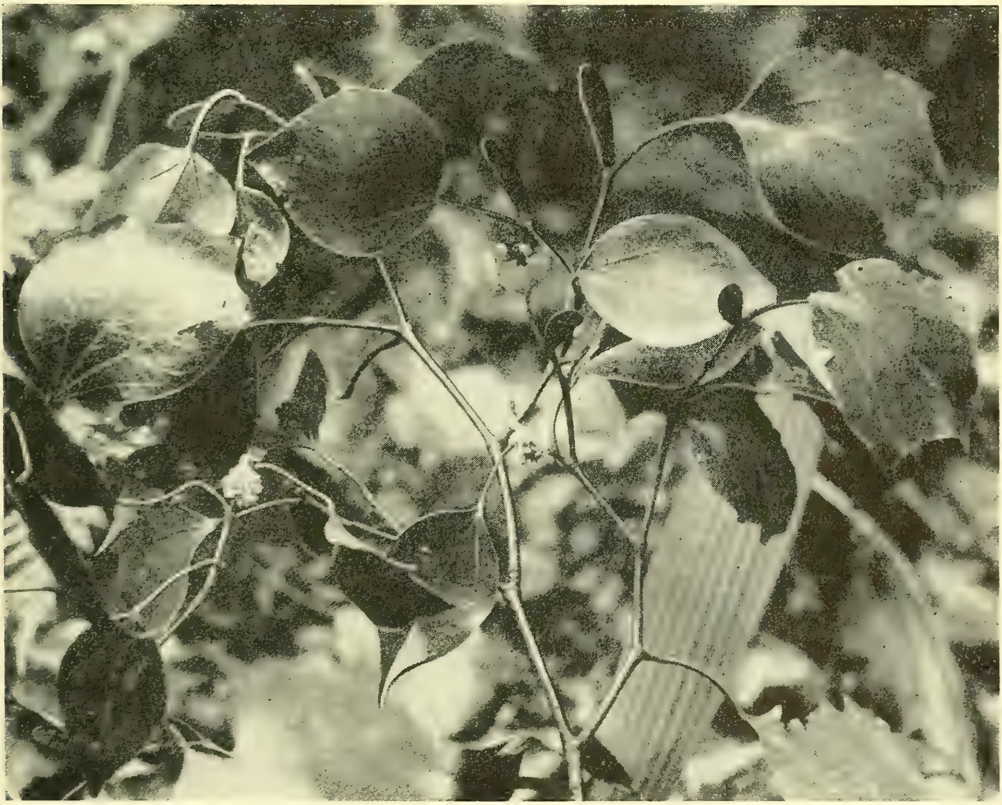

Fig. 7. *Symingtonia populnea* (R.BR. *ex* GRIFF.) STEEN. showing dimorphous leaves and the remarkably large coherent stipules on flowering twigs. Mt Kerintji, c. 2100 m altitude (Photogr. W. MEIJER).

long; disk glabrous; free part of the ovary conical, ferrugineous-hirsute; styles $2^{1}/_{2}$–3 mm, glabrous.—♀ *Heads* globose, $2^{1}/_{2}$–6 mm in diam. *Fruitheads* 2–$2^{1}/_{2}$ by 2–$2^{1}/_{2}$ cm, $1^{1}/_{2}$–$2^{1}/_{2}$ cm peduncled, glabrous. *Fruits* glabrous, 7–11 per head, 6–10 mm long, their free part 4–6 mm. *Seeds* narrowly ovoid, flattened, 3–5 by $^{2}/_{3}$–$1^{1}/_{2}$ mm, wing narrowly oblong, 9–10 by 2–$2^{1}/_{2}$ mm; upper, wingless seeds irregularly prismatical, sterile.

Distr. SE. Asia (Sikkim, Bhotan, Assam, Manipur, Martaban, and S. China: Kweichou) and *Malaysia:* N.–S. Sumatra & Malay Peninsula.

Ecol. Everwet, mixed hill and mountain forests, mainly primary, (800–)1000–3000 m, apparently seldom flowering, but found *fl.* & *fr.* throughout the year.

Uses. The timber is not unimportant, the wood is white and soft, splits good and straight and is classified by ENDERT in durability class iii; it is, however, soon attacked by xylophages. In Assam it is in great demand for planking and door and window frames. In the Toba District (N. Sumatra) it is planted for reafforestation and local timber demands.

Vern. *Malayan aspen* (the leaves quiver on their long stalks like those of aspens, CORNER, *l.c.*), E, *tiga sagi*, *drok* or *groh*, Sakai (Mal. Pen.), *tampu litjin*, Gajo Alas, *sikadundung*, *sigĕdundung*, Talang, *maändung*, Merapi, *hapas hapas* or *kapas kapas*, Toba-Batak, *sigadunduëng*, Minangk., *dulparangan*, Karo, *tapatapa lĕman*, Sum. Westcoast.

Note. Specimens from continental Asia possess in general somewhat larger leaves and stipules.

KURZ (Nat. Tijd. Ned. Ind. 27, 1864, 170) reported with doubt the species to occur in Banka, but this record must be based on an erroneous identification of an apparently juvenile plant belonging to some other family.

7. ALTINGIA

NOROÑA, Verh. Bat. Gen. K. W. ed. 1, 5 (1790) art. 2, p. 9, *non vidi*; *ditto*, ed. 2 (1827) art. 2, p. 41.—*Sedgwickia* GRIFFITH, As. Res. 19 (1836) 98, t. 15; Ann. Sc. Nat. II, 9 Bot. (1838) 179.—**Fig. 8–9.**

Monogamous-monoecious evergreen trees. *Leaves* glandular-crenate-serrate or entire, penninerved. Stipules very small, caducous and leaving minute scars or connate with the petiole and about persistent. *Flowers* in peduncled ♂ and ♀ heads initially enveloped by 4 bracts.—♂ *Heads* in racemes, consisting of masses of stamens, intermingled with some minute ?bracts; *sepals*, *petals*, disk and *ovary* lacking; *filaments* short, thick; anthers basifix, obpyramidal, with 4 pollen sacs, 2-celled; dehiscing with longitudinal slits.—♀ *Heads* solitary, in racemes or in the lower part of ♂ racemes; flowers connate. *Sepals* and *petals* lacking. *Stamens* rudimentary or absent; disk consisting of a variable number of minute lobes. *Ovary* half-inferior to inferior, 2-celled; ovules ∞, in each cell inserted on the dissepiment; styles 2, subulate, divergent, often strongly recurved, adaxially with decurrent, papillose stigmas, caducous (or the basal parts persistents) in fruit. *Fruits* in globose to subglobose, woody heads, obovoid to obpyramidal, 2-celled, 4-valved, surrounded by a ring of enlarged, hardened disk lobes. *Seeds* ∞ in each cell, the upper ones sterile, wingless, 1 or a few lower ones fertile, flattened, narrowly winged along the margin or only apically; albumen scant.

Distr. Seven species from Assam, Yunnan and Fokien to *Malaysia:* Sumatra, Malay Peninsula and W. Java.

Notes. As is explained on p. 364 the disk has often been described as a calyx limb.

1. Altingia excelsa NOROÑA, Verh. Bat. Gen. K. W. ed. 1, 5 (1790) art. 2, p. 9; *ditto*, ed. 2 (1827) 41; JUNGHUHN, Java, ed. 2 (*neerl.*) 1 (1853) 441; KURZ, Fl. Burma 1 (1877) 445; CLARKE, Fl. Br. India 2 (1878) 429; K. & V. Bijdr. 2 (1895) 204, *incl. var. velutina* K. & V.; BRANDIS, Ind. Trees (1906) 302; BACK. Schoolfl. (1911) 476; LÖRZING, Tectona 4 (1911) 490; KOORD. Exk. Fl. Java 2 (1912) 312, f. 62; KERBERT, Tectona 8 (1915) 185–219; KORTZ, Tectona 13 (1920) 715; RIDL. Fl. Mal. Pen. 1 (1922) 692; KOORD. Fl. Tjib. 2 (1923) 98; KRAMER, Med. Proefst. Boschw. 14 (1926) 49; HEYNE, Nutt. Pl. (1927) 690; HARMS, E. & P. Pfl. Fam. ed. 2, 18a (1930) 344, f. 164j, 180; OCHSE & BAKH. v. D. BRINK, Ind. Groent. (1931) 348, f. 219; BURK. Dict. 1 (1935) 116; SARTJO MARTOSOEDIRO, Het Bosch 3 (1935) 123; FERGUSON, Tectona 30 (1937) 235–280; *ibid.* 31 (1938) 34–36; HILDEBRAND, Het Bosch 8 (1941) 268–269; BEEKMAN, Houtteelt Indon. (1949) 246.—*Liquidamber altingiana* BL. Bijdr. Fl. Ned. Ind. 10 (1825) 527.—*Liquidambar altingia* BL. Fl. Javae, 8. Balsamifluae (1829) 2, t. 1, 2 (*Liquidamber altingiana* in tab.); MIQ. Fl. Ind. Bat. 1, 1 (1855)

836.—*Sedgwickia cerasifolia* GRIFF. As. Res. 19 (1836) 99, t. 15; Ann. Sc. Nat. II, 9 Bot. (1838) 179.—**Fig. 8–9.**

Tree, 40–50(–60) m high, clear bole 20–35 m, 80–110(–200) cm in diam.; bark rather smooth, light grey to yellowish- or brownish-grey, with narrow longitudinal fissures, slightly peeling with thin, long, irregular flakes. Ultimate twigs glabrous to yellowish-brown puberulous. *Leaves* elliptic to oblong or ovate to ovate-lanceolate, 6–12(–16) by $2^{1}/_{2}$–$5^{1}/_{2}$(–$6^{1}/_{2}$) cm, acute, acuminate or sometimes caudate at the apex, obtuse, rounded or very slightly cordate, gland-like thickened at the base, with glandular-crenate-serrate margins, glabrous above, glabrous to yellowish-brown puberulous below, very rarely velutinous, thin-coriaceous; midrib about flat above; nerves 5–10 pairs; petiole 13–32 mm, glabrous to yellowish-brown puberulous, apically usually (on the upper side often) with sessile to shortly stalked gland-like appendages. Stipules subulate, 1–6 by $^{1}/_{4}$–$^{4}/_{5}$ mm. ♂ *Heads* 6–14, in racemes, ellipsoid, 6–10 by 3–6 mm. *Filaments* glabrous, $^{4}/_{5}$–1 mm long; anthers 1–$1^{2}/_{5}$ mm long. ?Bracts linear, $^{4}/_{5}$–1 mm long, minutely puberulous.—♀ *Heads* 4–18-flowered, globose to subglobose, 6–9 by 5–8 mm, 2–$3^{1}/_{2}$ cm peduncled, all parts puberulous. *Stamens* rudimentary or lacking. Disk $^{1}/_{3}$–$^{1}/_{2}$ mm high. *Ovary* $^{3}/_{4}$-inferior; styles adaxially sulcate, 3–4 mm. *Fruit heads* $1^{1}/_{5}$–$2^{1}/_{2}$ by $1^{1}/_{5}$–2 cm, 2–$3^{1}/_{2}$ cm peduncled, nearly glabrous. *Fruits* light brown-puberulous at the apex, 4–18 per head, 8–10 mm long. Fertile *seeds* 0–1 in each cell, dorso-ventrally flattened, obovate, 5–$6^{1}/_{2}$ by $2^{1}/_{2}$–$3^{1}/_{2}$ mm, surrounded by a narrow wing; hilum central on the dorsal side; sterile seeds 15–25 in each cell, small, irregularly prismatical.

Distr. SE. Asia (Bhotan, Assam, Pegu, Mergui) and *Malaysia:* Sumatra, Malay Peninsula (Pahang) and Java (eastwards to Garut), planted for reafforestation purposes elsewhere.

Ecol. Everwet, mixed hill and mountain forests, often gregarious and forming the frame of the mountain forest, 550–1700 m, *fl.* mainly March–May and Oct.–Nov., apparently at the change of the seasons, but occasionally in other months of the year, *fr.* according to KRAMER *l.c.* throughout the year but mainly in the middle of both seasons.

Flowers and flush appear simultaneously with rapid change of old foliage; the flush is light-green tinged reddish giving, seen from a distance, a bronze hue to the crowns.

Leaves when crushed possess an agreeable aromatic odor.

Sociology. Many data have been assembled on the 'king of the mountain forest' of Java and Sumatra as JUNGHUHN characterized the 'rasamala'. Its social occurrence, its majestic, high-branched, columnar bole and imposing size of the crown give it a predominant place in the mountain forest. Large, old specimens are the emergent trees here, approached in size and stature only by *Podocarpus neriifolia* and *Podocarpus imbricata*. JUNGHUHN characterized the middle mountain zone as that of the rasamala. According to KERBERT *l.c.* and KRAMER *l.c.* the occurrence is more or less colony-wise, but this is difficult to judge as mature rasamala, of old being recognized as the most valuable timber tree, has been removed in many places by selective cutting. In good, primitive forest 10–35 mature specimens may be encountered per hectare, containing, by their colossal size, (50–)75–85% of the total timber mass, ranging up to 150 m³ per ha. In Sumatra similar conditions seem to prevail in the Barisan Range from South to North Sumatra.

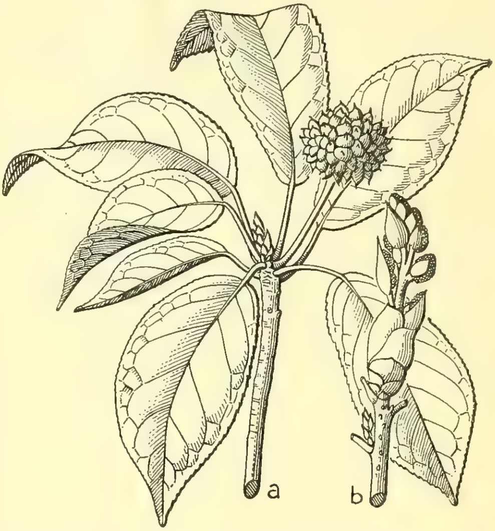

Fig. 8. *Altingia excelsa* NOR. *a.* Twig with a young fruit head, *b.* young ♂ inflorescence.

Following in abundance, its associates are, besides the *Podocarpus spp.*, representatives of *Quercus*, and further a number of other constituents of this type of mountain forest: *Schima*, *Castanopsis*, *Eugenia*, *Sloanea*, *Dysoxylum*, *Engelhardtia*, *Magnolia*, *Michelia*, *Elaeocarpus*, *etc.* After selective cutting these elements rapidly fill the gaps, specially *Quercus* and *Castanopsis.*

The unbranched, columnar bole may reach dimensions between 20 and 35 m, bearing on top an irregularly globular crown; juvenile specimens show a typically acute, conical crown, similar to that in *Schima* and *Dryobalanops.*

Trees grown in the open assume a low, globular shape and a very poor development of the trunk (*cf.* vol. 4, 1948, p. xxxviii, f. 31).

Planting rasamala for reafforestation or for obtaining commercial timber has already started in 1851 (*cf.* FERGUSON, Tectona 31, 1938, 34–36). This was originally managed with seedlings obtained from natural regeneration in the forest, but later done with seed on seed beds. The collecting of seed presents several difficulties, besides those of the picking of the fruits from the large trees.

Germination follows rapidly after sowing (about one week) but growth of the early seedling is slow for the initial few years, after which follows a period of rapid accress; FERGUSON *l.c.* has found that the most rapid growth is found at levels of 600–700 m in cultivated specimens; whether this timber will finally have the same good quality as that of the slower growing specimens at higher altitude is not known.

Rasamala has been used for reafforestation with valuable timber in Central Java and elsewhere outside its natural area, which does not extend E of Garut in Priangan. Though rainfall is there (Mts Slamet, Merbabu) decidedly less, growth appeared satisfactory. The driest month of the year should have apparently at least 100 mm precipitation.

Seed and seed dispersal. The capsules contain up to 35 prismatical seeds; the majority of these is much reduced in size and entirely sterile, only a few are developed and among the latter averagely only one is fully developed and viable. The best method to collect seed is to pick nearly ripe heads and dry them in the open. As is usual among tropical rain-forest timbers germination power is retained only for a short time.

Animals seem very fond of the seeds which, according to SARTJO *l.c.*, have a sweet scent. KALSHOVEN in his essay on pests of rasamala (Tectona 30, 1937, 165) records that monkeys feed on the seed and that birds are observed to pick seeds from the fruit on the tree. The reason for this is, according to KALSHOVEN, that the seeds contain oil. This agrees precisely with the practical experience that the seed on seed beds must be carefully protected from red ants which otherwise remove the seed in no time. *Altingia* is apparently distinctly myrmecochorous, though obviously lacking an elaiosome structure.

Occasionally caterpillars may defoliate individual rasamala trees, giving it the appearance of being deciduous; new flush is soon developing after such an attack.

Galls. Two kinds of leaf galls have been described by DOCTERS VAN LEEUWEN (Ned. Kruidk. Arch. 51, 1941, 159), one caused by a gall midge, the other by a gall mite. Hairy domatia are sometimes found in the nerve axils on the underside of the leaves. Gall-like thickenings of twigs are caused by the loranthaceous parasite *Korthalsella opuntia* (THUNB.) MERR. These were found first by DOCTERS VAN LEEUWEN (Trop. Natuur 21, 1932, 53–56, fig. 1–4); thus far they are only recorded from Mt Gedeh (W. Java). An other viscoideous parasite, *Viscum liquidambaricolum* HAYATA is in Java confined to *Altingia*, according to DANSER (Bull. Jard. Bot. Btzg III, 16, 1938, 57); in Formosa it parasitizes on *Liquidambar*.

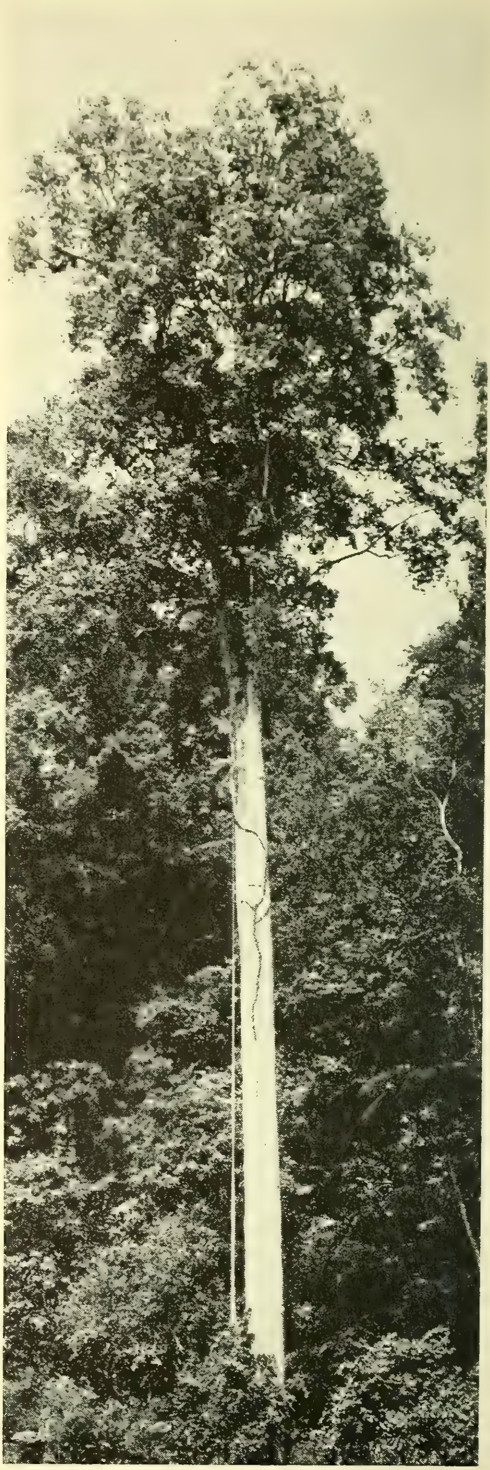

Fig. 9. Mature tree of *Altingia excelsa* NOR. on forest border along Tjibodas Mountain Garden at *c.* 1450 m altitude. Tree *c.* 45 m tall (Photogr. DOCTERS VAN LEEUWEN). →

Uses. In West Java one of the most valuable timber trees from the mountain rain-forest, classified in class ii for strength and durability. It is obtained in large dimensions and used for frames of bridges and buildings; old heart-wood is only slowly attacked by termites. A disadvantage of the timber is its slow drying, and further its tendency to warping and cleaving.

Altingia excelsa produces an aromatic resin (*gĕtah malai, g. kandai*); LÖRZING *l.c.* and others maintain that this is produced only after injuries (similarly to resin formation in *Styrax*); small bees collect the resin and use it for their combs, concentrating it in this way (*cf.* ALMEROOD, Tijd. Land- Tuinb. & Boschkultuur 4, p. 138); it is only locally used and not a product collected in great quantity (*cf.* FERGUSON *l.c.*).

The flush of *Altingia* is eaten as a vegetable (lalab) in West Java (OCHSE, *l.c.*).

Vern. *Rasamala, r. mĕnjan, (ki) mala, m. gadog, m. bodas, m. beureum, m. taribih, m. kapas, m. tanduk,* S; Sumatra: *tjĕmara abang, tj. itam,* Palembang, *rasamalo, sĕludang,* M (Redjang), *sĕmalo,* Lebong, *pulasan,* Karo, *tulasan,* Toba, *lamin, mandung, m. djati, sigĕdundung, ma(ä)ndung,* Minangk.

Notes. Sterile material is easily confused with *Ehretia acuminata* (*Borrag.*) on which an erroneous record is based from Timor (*cf.* DE VOOGD, Trop. Natuur 27, 1938, 61).

RUMPHIUS (Herb. Amb. 2, p. 58) mentioned some scented woods from the Moluccas and New Guinea indicated as '*Caju rasamala*', comparing their leaves with 'ironwood' (*i.e. Intsia*); this unidentifiable mixture is the source of the erroneous record of *Altingia* from E. Malaysia (*cf.* MERRILL, Int. Rumph. 1917, 245). In New Guinea the name *rasamala* seems to be used for *Flindersia* which possesses scented wood (FERGUSON, Tectona 30, 1937, 239).

Mountain people in W. Java distinguish two 'varieties', based on the structure and colour of the timber, white and red; they can not be recognized in botanical specimens.

The *var. velutina* K. & V., characterized by a conspicuously hairy undersurface of the leaves, has only once been collected.

HYDROCHARITACEAE (C. den Hartog, Amsterdam)

Annual or perennial freshwater and marine plants. *Leaves* submerged, rarely floating or partly emerged, radical or arranged along a stem, spirally whorled, distichous, or in pairs, linear, lanceolate, elliptic, ovate or orbicular, sessile or petioled; petioles mostly sheathing; nerves more or less parallel, straight or curved, connected by perpendicular or ascending cross-veins. Stipules sometimes present. Squamulae intravaginales often present. *Flowers* actinomorphous, rarely faintly zygomorphous (*Vallisneria*), unisexual, and then sometimes with rudiments of the other sex, or rarely bisexual, 1—∞ enclosed between 2, more or less connate, rarely free segments (*spathe*). Spathe sessile or peduncled, often ribbed or winged, tip mostly bifid. *Perianth segments* free, 3 or 6, in the later case differentiated in petals and sepals; sepals often green, mostly valvate; petals mostly coloured, imbricate. *Stamens* 2—∞, in 1 or more whorls, the inner ones sometimes staminodial (*Hydrocharis*), the outer ones often doubled (*Stratiotes*, *Ottelia*); anthers basifixed, 2–4-celled, dorsally or latrorsely lengthwise dehiscent; filaments more or less slender, sometimes absent. *Ovary* inferior, linear, lanceolate or ovate, consisting of 2–15 connate carpels, 1-celled, apex often narrowed into a long, filiform beak; parietal placentas sometimes protruding to the centre of the gynaecium, but never connate, sometimes split into 2 lamellae; styles 2–15, often more or less split into 2 crests. *Ovules* ∞, anatropous, with 2 integuments. *Fruits* linear, lanceolate or ovate, opening by decay of the pericarp, rarely stellately dehiscent (*Thalassia*). *Seeds* ∞, fusiform, elliptic, ovate or globose; testa glabrous or densely set with spines or warts; embryo straight, with a very inconspicuous plumule at the base of a lateral groove, and a thick radicle; the marine genera and *Stratiotes* possess, however, a large, well-developed plumule; albumen 0.

Distribution. About 15 genera with *c.* 100 *spp.*, widely distributed in the tropical and subtropical zones with a few species in the temperate zones. Among the freshwater genera only *Vallisneria* and *Ottelia* occur both in the palaeotropics and in the neotropics. Most other freshwater genera are confined to the Old World [*Hydrilla*, *Hydrocharis*, *Blyxa*, *Lagarosiphon* (Africa), *Nechamandra* (S. Asia), *Stratiotes* (Europe), *Maidenia* (Australia)], only 2 are restricted to America (*Elodea* and *Limnobium*). The marine genera are commonly dispersed along the coasts of the Indian and Pacific Ocean going East as far as Hawaii & Tahiti, but do not reach the American Pacific coast; 2 of them occur also in the West Indies, but further they are absent from the coasts of the Atlantic Ocean! See further under ecology.

Ecology. Many water plants show a reduced rate of fertility whereby sexual reproduction is of rather rare occurrence, but vegetative reproduction is proportionally increased. This is for example shown by the anthropogenous dispersal of *Elodea canadensis* in Europe and of *Eichhornia crassipes* in the Indo-Australian area, which have spread very widely on a remarkable scale in a few decades. It is worthy of note that their (vegetative) characters remained very constant notwithstanding the abundant increase in number of specimens.

Mrs Ernst-Schwarzenbach (Arch. Julius Klaus Stift. Zürich 25, 1950, 483–488; Planta 39, 1951, 542–569) investigated the causes of the reduced fertility in *Elodea canadensis* and *E. occidentalis*. She assumes this is due to the scant fertility of the female flower, which contains only 2–6 ovules per ovary and further to a disturbance in the ripening of the pollen grains. The latter remain coherent in tetrads, whereby the buoyancy capacity is raised, but the possibility that pollen grains come into contact with the stigmatic papillae is lowered. Moreover, she found that only 1–2 pollen grains of each tetrad have germinating capacity.

A remarkable feature in the taxonomy of the *Hydrocharitaceae* is the large number of monotypic genera (*Enhalus*, *Hydrilla*, *Maidenia*, and *Stratiotes*) and small genera possessing 2 or a few species (*Hydrocharis*, *Limnobium*, and *Thalassia*).

Freshwater Hydrocharitaceae. They form the majority of the family. In Malaysia they occur up to *c.* 2000 m altitude, in marshes, pools, ditches, swamps, wet rice-fields, and in slowly running rivers. Most species possess a wide area of distribution; a few endemic species occupy a very limited area, *e.g. Ottelia mesenterium* in the lakes of SE. Celebes (fig. 8) and *Blyxa novoguineensis* in the Fly River area of S. New Guinea. Among the widely distributed species there are 2 types *viz: eurytopic species* distributed rather evenly throughout their area, without important discontinuities, *e.g. Hydrilla verticillata*, and *Ottelia alismoides*, and *stenotopic species* which are rare or rather rare in their area, with sometimes very wide disjunctions between the separate localities in which they may, however, occur locally abundant, *e.g. Hydrocharis dubia* (fig. 8), *Blyxa japonica*, and *Blyxa octandra.*

The problem involved in this local preference has been discussed on an earlier occasion in this volume (see p. 317–318) with the ecology of the *Alismataceae.*

Marine Hydrocharitaceae. 'Sea-grasses' are phanerogams, which are confined to sea-water, tolerating a salinity of $3^{1}/_{2}\%$ and more, but which cannot live in brackish water. None has ever been found in continental, salt inland seas or lakes.[1] They are characterized by narrow grass-like leaves, which are not differentiated into a petiole and a leaf blade, the only exception to this rule being that of the genus *Halophila.* All sea-grasses belong to 2 monocotyledonous families, *viz Potamogetonaceae* and *Hydrocharitaceae.* They are very distinct from the other Monocotyledons, obviously representing ancient types, and stand isolated within the families to which they belong.

Their geographic distribution has been studied extensively, particularly by ASCHERSON (in Petermann's Mitth. 17, 1871, 241–248, map 13; in Neumayer, Anl. Wiss. Beob. Reis. ed. 1, 1875, 359–373; ed. 3, 2, 1906, 389–413), OSTENFELD (Proc. R. Soc. Victoria 27, 1914, 179–190; Pflanzenareale 1^3, 1927, 35–38, map 21–24), SETCHELL (Bull. Torr. Bot. Cl. 47, 1920, 563–579; Amer. Naturalist 69, 1935, 560–577, f. 1–10), and MIKI (Bot. Mag. Tokyo 48, 1934, 131–142, f. 1–7).

In the *Hydrocharitaceae* they are represented by 3 genera, all of them tropical, *viz Enhalus* (1 *sp.*), *Thalassia* (2 *spp.*), and *Halophila* (9 *spp.*).

According to SETCHELL *l.c.* these hydrocharitaceous sea-grasses are megatherm, living in sea-water with a minimum temperature of 20° C, tolerating rather large fluctuations above that temperature.

Observations by MIKI *l.c.* confirm this; he found the northernmost localities of *Enhalus acoroides* and of *Thalassia hemprichii* in Japan to coincide with a February water isotherm of 23° C and 21° C respectively.

The only exception to this rule is *Halophila ovalis* which enters the temperate region in both the southern and northern hemispheres; its northern border of distribution in Japan agrees with the 10° C February water isotherm. In southern waters it is distributed as far as Tasmania. But also this species is considered to be megatherm as sexual reproduction is only observed in the tropics!

The distribution of the marine genera of *Hydrocharitaceae* shows a marked disjunction. They occur along the coasts of the Indian and Pacific Oceans from E. Africa to Hawaii and Tahiti, and in the Caribbean. The centre of distribution is situated undoubtedly in the Indo-Malaysian region, where the majority of species is found. This distribution indicates that they are old plant types, originated not later than the early Tertiary. In that epoch the isthmian Central American area was closed. It is improbable that these tropical plants have migrated from the Indo-Pacific region into the Caribbean Sea via South America or South Africa. Migration via the Arctic Sea likewise appears not probable. Their absence in the remaining parts of the Atlantic Ocean and the seas connected with it, points to the fact, that they arrived in the West Indies already before the isthmus of Panama arose in the beginning of the Tertiary. There are two points in favour of this hypothesis. *Halophila decipiens var. pubescens* is widely distributed in the Indo-Pacific region as well as in the Caribbean. The closely related *Thalassia hemprichii* and *Th. testudinum* are separated by the isthmus of Panama. OSTENFELD *l.c.* holds that these species are of common descent from one collective parent species, only after the forming of the Panama barrier.

That land barriers can uphold dispersal of sea-grasses to seas offering favourable conditions for their growth is shown by the Mediterranean which, according to the records, did not contain any *Halophila* before the digging of the Suez Canal. At present, however, *H. stipulacea*, a common species in the western part of the Indian Ocean and the Red Sea has passed the Suez Canal and has settled along the coasts of Greece!

In classifying the marine *Hydrocharitaceae* into geographical groups we get the following survey:

Pantropic	1 *sp.*	East African	2 *spp.*
Indo-Pacific	3 *spp.*	Caribbean	3 *spp.*
Malaysian	3 *spp.*		

Dispersal will take place very slowly for the fruits ripen only below the water surface and the seeds have no buoyancy capacity or other structures for wide-distance dispersal. Dispersal by loosened shoots may be neglected, as they soon die off. There is, however, the possibility that certain fishes, sea mammals (*e.g.* the manatee and the dujong), or turtles act in the transportation of seeds to other regions.

Another limiting factor for the distribution is the fact, that sea-grasses only live in shallow water, where they have sufficient light, and are therefore bound to the coastal waters. The depth of their occurrence is dependent to a large degree on the lucidity of the water, but most species cannot grow beyond a depth of 10 m.

Substratum. The sea-grasses prefer coral-sand, mud and sand in quiet localities, not exposed to the heavy surf. Some species endure a short temporary drying up during low tide, even in the tropics (*Enhalus*). Mostly they form extensive submarine meadows (*Thalassia*, *Enhalus*).

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(1) Among the sea-grasses only the potamogetonaceous *Zostera nana* occurs in such inland localities in the Caspian.

Associates. Both the coarser and the tiny species occur generally gregariously, the coarser ones really forming under-water meadows. Generally they occur in associations and if one species is found others can be expected nearby, each showing a slight preference to certain local conditions (substratum, depth of water, *etc.*). Little is known about these preferences and associations and this is a nice field for research by local residents of tropical coasts.

Flower biology. Though obviously extremely interesting the flower biology of the *Hydrocharitaceae* is unfortunately inadequately known. The studies of Mrs ERNST-SCHWARZENBACH (Ber. Schweiz. Bot. Ges. 55, 1945, 33–69; Phytomorph. 6, 1956, 296–311) are recent valuable contributions. However, of several genera, *e.g. Blyxa*, no observations have been published at all. From the data obtained in several other genera we may infer that futher study will yield extremely interesting results. It has appeared that in one genus different species may belong to different flower-biological groups. Therefore each species should be studied separately.

Self-fertilization in bud, before the opening of the flowers has been recorded for the bisexual flowers of *Blyxa alternifolia* and *Ottelia alismoides.*

According to Mrs ERNST-SCHWARZENBACH (1956, *l.c.*) *cleistogamy* occurs commonly in the Australian *Ottelia ovalifolia*, in which species the entomophilous *chasmogamous flowers* are rather rarely found and only developed under very restricted conditions. She observed many transitional forms.

Besides the two types of *autogamy* just mentioned, there are, in the *Hydrocharitaceae*, three modes of pollen transport, *viz:*

1. *Entomophilous Hydrocharitaceae*, in which pollination is effected by insects, possess conspicuously coloured petals and nectaries. To this group belong *Ottelia*, *Hydrocharis*, *Limnobium* (*L. stoloniferum* excepted), *Stratiotes*, and *Elodea densa* (*cf.* HAUMAN-MERCK, Rec. Inst. Bot. Errera, 9, 1912, 33–36). *Elodea densa* is pollinated by flies. Further field observations are urgently needed.

2. *Anemophilous* flowers, in which pollen is transported by air, are obviously only found in *Limnobium stoloniferum*, according to BOTTINI (Malpighia 4, 1890, 340–348, 369–377). HAUMAN-MERCK assumes (An. Mus. Hist. Nat. Buenos-Aires 27, 1915, 325–331) that water transport is also effective in this species.

3. *Hydrophilous* flowers, in which pollination takes place under, on, or just above the water surface, is a category difficult to define, as both water and air may be involved; for example air currents for moving the floating ♂ flowers along the water surface or short-distance transport of pollen grains through the air.

According to the degree of participation of both media three subtypes can be distinguished *viz*:

a) *Entirely submerged pollination* is found in *Halophila* and *Thalassia.* The pollen grains are globular but remain adhering to one another forming long strings (fig. 18c–d), an adaptation which may be envisaged as increasing their floating capacity. In other plankton organisms increase of surface is attained by development of appendages; in the potamogetonaceous sea-grass *Zostera* the pollen grains are cylindric in shape.

b) *Semi-aquatic surface pollination* takes place with pollen drifting on the water surface and styles which are at least partially in contact with the water. To this subtype belong *Elodea canadensis* (*cf.* ERNST-SCHWARZENBACH, Ber. Schweiz. Bot. Ges. 55, 1945, 54–56), *E. occidentalis* (*ditto*, *l.c.* 53), and *E. callitrichoides* (HAUMAN-MERCK, Rec. Inst. Bot. Errera 9, 1912, 35–37).

c) *Aerial surface pollination* is called the condition that the pollination takes place on the surface of the water but in which both pollen and styles remain dry. To this subtype belong *Hydrilla verticillata* (fig. 1b), *Lagarosiphon muscoides* (ERNST-SCHWARZENBACH *l.c.* p. 56–58), *Vallisneria spp.* (see p. 387), and *Enhalus acoroides* (see p. 404).

In the last two subtypes there are two different modes in pollen transport.

The most spectacular is that of *explosive anthers.* The explosion is a direct consequence of a sudden movement of the flower or the floral parts. In *Elodea occidentalis* and *E. callitrichoides*, for example, it is caused by the sudden opening of the buds, in *Hydrilla verticillata* by the abrupt erection of the anthers. Explosive anthers are also known from some anemophilous plants, for instance *Urtica*, *Parietaria*, *Mercurialis annua*, *etc.* The phenomenon is tied up with reduction in the tissue of the anther wall.

In other species the ♂ and ♀ flowers must come into *contact*, by which pollen is transported directly from the anthers on the styles, for example in *Lagarosiphon muscoides*, *Vallisneria spp.*, and *Enhalus.* In *Elodea canadensis* emission of pollen takes place after contact between the ♀ and ♂ flowers, the pollen being brought to the styles in consequence of surface tension.

It is remarkable that the pollination mechanism in *Hydrocharitaceae* is bound to species rather than to genera; for instance in *Elodea* of which some species are hydrophilous and others entomophilous.

Characters which are obviously bound to hydrophilous pollination consist of the tendency to have tepals instead of a perianth differentiated into sepals and petals and the reduction of the latter (for example in the ♀ flowers of *Elodea occidentalis* and *Vallisneria spp.*). This reduction is apparently a consequence of a specialized function in the opening mechanism of the flowers or for a sheltering capacity prohibiting the wetting of the sexual organs (for example the forming of a 'vessel' of the ♂ flowers in *Elodea spp.*, *Hydrilla*, *Vallisneria*, *Lagarosiphon*, and *Enhalus*).

Another adaptation enabling hydrophilous pollination is the functioning of the stamens or staminodes of several species as 'sailing gear': in *Elodea canadensis* the 3 inner stamens are connate into a column and when opened make a petaloid impression; in *Lagarosiphon muscoides* three staminodes function as a sailing apparatus; in *Hydrilla* the empty anthers function as sails. In the latter case this function has no or only slight significance for the dispersal of pollen.

Finally I want to mention the increased mobility of both ♂ and ♀ flowers in species adapted to hydrophilous pollination. In the species, in which the ovary remains far below the surface, it has a strongly lengthened, filiform-rostrate apex bearing at its tip the perianth and the styles (*Hydrilla*, *Elodea*, and *Lagarosiphon*). In the species in which the ovary comes in anthesis close to the surface of the water, however, it is after anthesis retracted spirally by the coiling peduncle (*Vallisneria*, *Enhalus*, and *Ottelia*). In the ♂ flowers the mobility is still larger by the rupture of the pedicels giving the buds (and flowers) opportunity to rise to and drift freely on the water surface.

Morphology. *Squamulae intravaginales* I have observed in *Hydrilla verticillata*, *Blyxa alternifolia*, and *Halophila decipiens*. They have also been recorded in other *Halophilas* by BALFOUR and in *Enhalus acoroides* by TROLL.

As is known to occur in other aquatic and marsh plants (see vol. 4, p. 258 under *Monochoria* and this volume p. 118 under *Tenagocharis* and p. 324 under *Limnophyton*) individual plants with juvenile foliage may be occasionally fertile and produce flowers and fruit. This form of precocious flowering is found for example in *Ottelia alismoides* (L.) PERS. and *O. ovalifolia* (R.Br.)RICH. (*cf.* ERNST-SCHWARZENBACH, Phytomorph. 6, 1956, 297). In the latter species it seems rather to be the rule. The flowering in a vegetatively juvenile stage is obviously favoured by local ecological conditions retarding the development of mature leaves or leaving no time for their development, *e.g.* growing in deep or swiftly running water or untimely drying out of the spot. In some cases such precociously flowering specimens with leaves still with the juvenile shape have been distinguished as distinct species, but in experimental studies they have appeared to represent only phenotypic stages.

Uses. None of the representatives is of much economic value. Leaves and petioles of *Ottelia alismoides* are used as a vegetable and seeds of *Enhalus* are eaten. The marginal fibre-strands of the leaves of *Enhalus* are sometimes employed for making fishing-nets. Some species may be a pest by their very abundant occurrence in freshwater, for example *Hydrilla verticillata* and *Blyxa alternifolia*. Some species collect mud on the surface of their leaves and may have a purifying effect in polluted waters loaden with silt, for example *Hydrilla* and *Blyxa*.

Some sea-grasses serve as food for dujong, notably the coarser species, *Thalassia*, and possibly *Enhalus*.

Notes. In collecting *Hydrocharitaceae* in the field it should be remembered that flowers must be measured, described, and dried without delay; by their marcescent structure they are very difficult to study from herbarium material; preferably additional material should be preserved in liquid. In some genera, notably *Blyxa*, ripe fruits are necessary for identification. Data on habitat and flower biology are scarce, hence very desirable to investigate in detail.

ARTIFICIAL KEY TO THE GENERA

1. Freshwater plants.
  2. Leaves radical or in rosettes connected by stolons.
    3. Leaves linear (margins parallel), flat.
      4. ♂ Flowers detaching and floating on the water surface. Ovary not long-rostrate. ♀ Peduncle long, coiling after fertilization . . . . **2. Vallisneria**
      4. ♂ Flowers not detaching. Ovary long-rostrate. ♀ Peduncle not spirally contracting . **3. Blyxa**
    3. Leaves lanceolate to suborbicular, crisped (or juvenile) if linear.
      5. Stolons absent. Spathe with 6 ribs or 2–10 longitudinal wings. Leaves without an aerenchym cushion beneath. Leaves submerged . . . . **6. Ottelia**
      5. Stoloniferous. Spathe not ribbed or winged. Floating leaves with a thickened aerenchym cushion beneath.
        6. Petals much broader than the sepals. Aerenchym cushion only on the central part of the blade. **4. Hydrocharis**
        6. Petals much narrower than the sepals, in the ♀ flower often wanting. Aerenchym cushion over the entire surface of the blade . . . . **5. Limnobium**
  2. Leaves on a distinct stem, either in whorls or spiral.
    7. Leaves in whorls of 3–8 . . . . **1. Hydrilla**
    7. Leaves spirally arranged . . . . **3. Blyxa**
1. Marine plants.
  8. Plants coarse. Leaves distichous, in tufts on firm rootstocks, ribbon-like, not differentiated into petiole and blade.
    9. Leaves 30–150 cm by 13–17 mm. Rootstock covered with persistent, nigrescent, stiff strands (fibres). **7. Enhalus**
    9. Leaves 10–30 cm by 4–10 mm. Rootstock without such persistent strands (fibres) . **8. Thalassia**
  8. Plants delicate. Leaves opposite, in spaced pairs on thin stems, ovate to lanceolate, mostly differentiated into petiole and blade; leaf pairs on the lateral shoots 1 or more, sometimes approximate and resembling pseudo-whorls . . . . **9. Halophila**

1. HYDRILLA

L. C. Rich. Mém. Inst. Paris 12, 2 (1812) 9, 61, 73, t. 2 (upper part); B. & H. Gen. Pl. 3 (1883) 450.—*Hydrospondylus* Hassk. Flora 25 (1842) Beibl. p. 33; Cat. Hort. Bog. (1844) 255.—**Fig. 1—3.**

Monoecious or dioecious, caulescent. *Leaves* in whorls of 3–8, sessile, linear to lanceolate, rarely elliptic; midrib conspicuous. *Flowers* unisexual. *Male spathe* subsessile, solitary in the leaf axils, flattened globose, liberating a solitary, small, pedicelled ♂ flower. Sepals 3, strongly convex, imbricate; petals 3, imbricate. Stamens 3, alternating with the petals; anthers erect, latrorsely dehiscent. *Female spathe* sessile, solitary in the leaf axils, cylindrical, top bifid, membranous, containing a solitary ♀ flower. Sepals 3, imbricate, convex; petals 3, imbricate. Ovary cylindric to narrowly conical; beak filiform; styles 3, alternipetalous. *Fruit* cylindrical or narrowly conical. *Seeds* 2–6, oblong-elliptic.

Distr. Monotypic Old World genus.

1. **Hydrilla verticillata** (Linn. *f.*) Royle, Ill. Bot. Himal. (1839) t. 376; Presl, Bot. Bemerk. (1844) 112; Caspary, Monatsber. Ak. Berl. (1857) 40; Jahrb. Wiss. Bot. 1 (1858) 494; Miq. Suppl. (1861) 259; Dalz. & Gibs. Bomb. Fl. (1861) 277; Martens, Preuss. Exp. Ost-Asien (Bot. Teil: Tange) (1866) 144; Benth. Fl. Austr. 6 (1873) 259; Hook. *f.* Fl. Br. Ind. 5 (1888) 659; Aschers. & Gürke in E. & P. Pfl. Fam. 2, 1 (1889) 250, f. 184; Koord. Minah. (1898) 270; Bailey, Queensl. Fl. 5 (1902) 1508; Hemsley, J. Linn. Soc. Bot. 36 (1903) 1; Ridl. Mat. Fl. Mal. Pen. (Monoc.) 1 (1907) 3; Gagnep. Fl. Gén. I.-C. 6 (1908) 4, f. 2; Backer, Teysmannia 22 (1911) 511; Ewart & Davis, Fl. North. Territory (1917) 21; Merr. Sp. Blanc. (1918) 58; En. Born. (1921) 37; Ridl. Fl. Mal. Pen. 4 (1924) 1; Back. Handb. Fl. Java 1 (1925) 59; Onkr. Suiker. (1928) 23, Atlas t. 29; Fischer, Fl. Pres. Madras 8 (1928) 1396; Steen. Arch. Hydrobiol. Suppl. 11 (1932) 273; Trop. Natuur 23 (1934) 39, 40, 108; Coert, Trop. Natuur 23 (1934) 26, f. 10; Burk. Dict. 2 (1935) 210; Masamune, En. Phan. Born. (1942) 9; Ernst-Schwarzenbach, Ber. Schweiz. Bot. Ges. 55 (1945) 36–53, f. 1–13, pl. 1, f. 1–3; Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 203, p. 2.—*Serpicula verticillata* Linn. *f.* Suppl. (1781) 416; Roxb. Pl. Corom. 2 (1802) 33, t. 164.—*H. ovalifolia* Rich. Mém. Inst. Paris 12, 2 (1812) 9, 76, t. 2 (upper part), Miq. Fl. Ind. Bat. 3 (1856) 235.—*Udora verticillata* Spreng. Syst. 1 (1825) 170; Llanos, Fragm. Pl. Filip. (1851) 101; F.-Villar & Naves in Blanco, Fl. Filip, ed. 3, 4^1 (1880) 78.—*Val(l)isneria verticillata* Roxb. Hort. Beng. (1814) 71, *nom. altern., illeg.*; Fl. Ind. ed. Carey 3 (1832) 751.—*H. roxburghii* Steud. Nomencl. 1 (1840) 780, *nomen.*—*Hydrospondylus submersus* Hassk. Flora 25 (1842) Beibl. 2, p. 33; Cat. Hort. Bog. (1844) 250.—*H. najadifolia* Zoll. & Mor. *ex* Mor. Syst. Verz. (1846) 91; Zoll. Syst. Verz. 1 (1854) 69; Miq. Fl. Ind. Bat. 3 (1856)

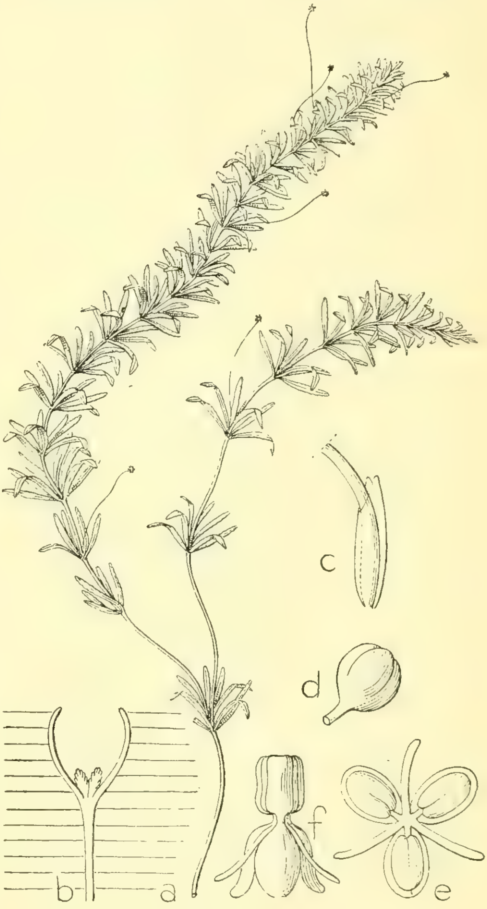

Fig. 1. *Hydrilla verticillata* (L.) Royle. *a.* Habit of ♀ plant, × $^{1}/_{3}$, *b.* mature ♀ flower (schematic vertical section) on the water surface, *c.* sheath and base of peduncle of ♀ flower, *d.* free ♂ flower bud in (oblique) drifting position, *e.* ♂ flower just before anthesis seen from above, each sepal embracing a not yet dehisced anther, *f.* lateral view of a ♂ flower with emptied anthers erected (*b–f* after Ernst-Schwarzenbach).

234.—*H. angustifolia* HASSK. Pl. Jav. Rar. (1848) 117; BL. Mus. Bot. 1 (1849) 82.—*H. wightii* PLANCH. Nouv. Ann. Sc. Nat. III, 11 (1849) 79.—*H. dentata* CASP. Bot. Zeit 12 (1854) 56.—*H. polysperma* BLATTER, J. Proc. As. Soc. Beng. *n.s.* 26 (1931) 356.—**Fig. 1–3.**

Glabrous. *Stems* amply ramified; internodes $^{1}/_{3}$–5 cm. *Leaves* acute, 8–40 by 1–5 mm, green with red-brown dots and dashes, fine-striate, margin sharply serrate-dentate, rarely entire. *Squamulae intravaginales* 2, in the leaf axils, oblong, membranous, transparent, margin dentate to ciliate, to $^{1}/_{2}$ mm long.—*Male spathe* solitary in the leaf axils, but sometimes all leaves of a whorl bearing one, $1^{1}/_{4}$–$1^{1}/_{2}$ mm, provided with subulate appendages, in the centre of the top a minute knob, finally bursting open to liberate the flower. *Pedicels* 1–2 mm. *Sepals* ovate to oblong-elliptic, reflexed, $1^{1}/_{2}$–3 by 1 mm, white or reddish white. *Petals* spathulate, spreading to reflexed, 2–3 by $^{1}/_{2}$ mm, white or reddish white. *Filaments* oblique, slender, very short; anthers linear, 4-locular; pollen grains globular, glabrous, rather large.—*Female spathe c.* 5 mm; apex shortly bidentate, reddish brown, striped. *Sepals* oblong to obovate, scarious, apex rounded, white, sometimes with reddish dots, $1^{1}/_{2}$–3 by $^{3}/_{4}$ mm. *Petals* spathulate, $1^{1}/_{2}$–3 by $^{1}/_{3}$–$^{1}/_{2}$ mm; apex rounded; white, scarious. *Ovary* 3–4 mm; beak $1^{1}/_{2}$–10 cm, with reddish dashes and dots. *Styles* oblique, filiform to subulate, $^{4}/_{5}$–1 mm. *Fruit* softly echinate, 7 by $1^{1}/_{2}$ mm. *Seeds* $2^{1}/_{4}$–$^{3}/_{4}$ mm, testa glabrous, dark-brown.

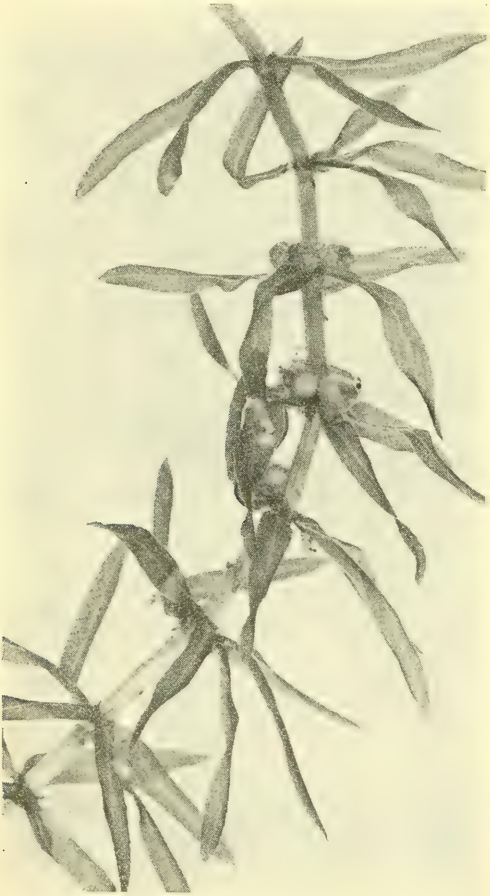

Fig. 2. *Hydrilla verticillata* (L.) ROYLE. ♂ plant with axillary flowers (photo Mrs ERNST-SCHWARZENBACH).

Distr. Widely distributed in the Old World from S. & E. Europe, Africa, S. & E. Asia to Australia; throughout *Malaysia*, very common in W. Malaysia, obviously rather rare in the Moluccas and New Guinea.

Ecol. Often gregarious in ditches, pools, lakes, marshes, wet rice-fields, slow streams, and even in tidal waters. In proportion to the lucidity of the water it goes down to 6–7 m below the water-level, but in such deep waters it does not reach the surface. Also in agitated waters the plant remains bottom-bound. The plants grow very quickly and reproduce both vegetatively and by fruits. Loosened shoots develop into new plants which attach themselves in the mud by fine filiform adventitious roots. Plants produce also subterranean shoots with swollen tips, densely clothed with fleshy, acute or acuminate scale-like leaves. In muddy water the leaves are capable to bind (catch) considerable quantities of mud. From sea-level to 2000 m, *fl. fr.* Jan.–Dec.

Flower biology. Anthesis and pollination have been studied by Mrs ERNST-SCHWARZENBACH (Ber. Schweiz. Bot. Ges. 55, 1945, 36–53) and offer most interesting features.

In the ♂ spathe the pedicel disrupts and the air-filled, ripe bud in rising pushes aside the two tips forming the knob on the spathal apex; this obstacle being passed the bud rises to the surface of the water. At its distal end it is provided with a small part of the pedicel causing the axis of the still closed, drifting bud to make an angle of *c.* 45° with the water surface (fig. 1 d). After having floated for about one hour and a half the bud opens and gets into anthesis in three successive stages, possibly due to repeated changes in the turgescence of its tissues. In the first stage the perianth lobes retract slightly and in the convexity of each sepal a stamen adheres to it (fig. 1 e). During the second stage the sepals recurve and spread out horizontally on the water surface, the petals recurving between the sepals one by one or simultaneously. The third stage follows then after a short interval: a stamen abruptly detaches itself from the hollow sepal, jumping into a horizontal position and in simultaneously opening ejects its pollen around in a sector of 120°. At the same moment its sepal recurves entirely. The same phenomenon happens with the 2nd and 3rd stamen and the sepals to which they pertain. The pollen grains are then situated in a circle of *c.* 20 cm round the opened flower, though slightly irregularly distributed due to the originally oblique position of it. When all stamens are emptied, the position of the flower on the water surface is changed from oblique to erect; it keeps its balance on the recurved perianth and the pedicel fragment; the emptied anthers are erect and function as sails; movements of air may carry these drifting flowers along the water surface (fig. 1 f).

The loosening of the ♂ flowers and their subsequent rising to the surface takes only place after a preceding bright day; it is still not known which factor is decisive here, temperature or light intensity.

In submerged condition the ♀ flower resembles a closed (inversed) bell, on the bottom of which the short styles are inserted; above the latter there is a large air bubble. During the lengthening of the peduncle, the perianth lobes are already sometimes slightly retreating and the air bubble between them is already visible for the naked eye. In reaching the water surface the perianth lobes retreat further forming a wide funnel immersed in the water surface (fig. 1 b) and not projecting above it. Inside this funnel is dry through the hydrophobous quality of the surface tissue. Therefore, the styles are not wetted and project dry into the air contained in the bottom of the inversed perianth bell. The perianth lobes appear to be limp, at least their turgescence capacity is less than the powers involved by surface tension. This is derived from the fact that with surface movements of the water (waves) menacing to wet the flower parts, the then submerging flower attains anew the position it had in the original submerged state, *viz* it closes temporarily with the tepals embracing an air bubble above the dry styles. It opens again when the wave has passed.

From this most remarkable mechanism it follows that the pollen is not carried to the styles by means of water, but must be transmitted directly by aerial transport to the styles. Pollen grains which reach the water surface are lost for reproductive purpose and the same holds for pollen grains which are retained in the opened anthers.

Uses. When it occurs in great quantities it may be used as manure. It is eaten by some fishes.

Vern. *Indische waterpest*, D, *gangèng*, M, S, J, Md, *gagang*, *ganggang*, *gonggèng*, *lukut tjai*, S, *djari amun*, Minangkabau, *arakankasili*, Tondano, *oma*, Palu (Tado dial.); Philippines: *giñga*, Ibn., *ináta*, *lomotlomotán*, Tag., *lúsai*, Mag.

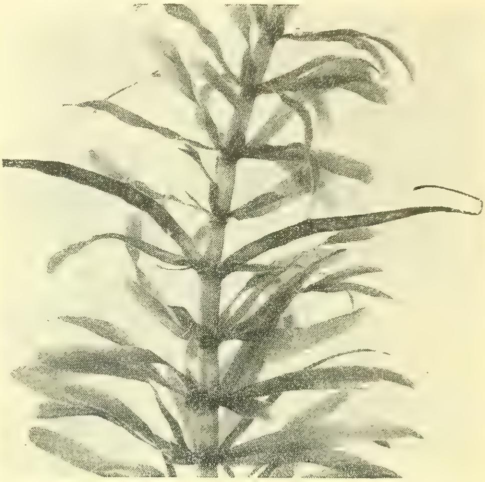

Fig. 3. *Hydrilla verticillata* (L.) ROYLE. ♀ Plant with two fruits developed.

2. VALLISNERIA

MICH. *ex* LINNÉ, Gen. Pl. ed. 5 (1754) 446; Sp. Pl. (1753) 1015; BENTH. & HOOK. *f.* Gen. Pl. 3 (1883) 451.—*Physkium* LOUR. Fl. Coch. (1790) 662, *cf.* MERR. Comm. Lour. (1935) 70.—**Fig. 4**.

Glabrous, dioecious. *Leaves* radical, linear, sheathing at the base, with longitudinal air-channels; apex obtuse, margin faintly dentate or entire; nerves 3–9, parallel, connected by cross-veins, only the midrib reaching the apex, the other nerves gradually joining together near the top. *Male spathe* only shortly peduncled, smaller than the ♀ one, containing many pedicelled flowers which break off and rise to the surface. *Sepals* 3, ovate or oblong-ovate, convex. *Petals* 3, minute. *Stamens* 1–3. *Female spathe* connate, tubular with 2 rounded tops; peduncle very long, spirally contracted after anthesis. *Sepals* 3, ovate or oblong-ovate. *Petals* 3, minute, scarious. Ovary linear, nodding; styles 3, split into 2 lobes. *Fruit* linear, often very long. *Seeds* ∞, oblong to fusiform; testa membranous.

Distr. About 6–10 *spp.* in tropical, subtropical, and the warm-temperate regions, in the Old as well as in the New World.

Ecol. The flower biology of *Vallisneria* has attracted attention long ago; specially the European *V. spiralis* has been the subject of several studies, amongst others by KERNER (Pfl.Leben 2, 1891, 129–131, *cum fig.*).

The ♂ spathe contains a number of flowers which detach in the bud stage, rising to the surface of the water. They remain floating there for some time. The perianth opens abruptly and sepals and stamens recurve but the latter very soon regain an erect position, in *V. spiralis* widely diverging, in *V. americana* closely approximate. The wall of the anthers shrivels and persists on top of the thick filament as a small appendage, to which the pollen grains adhere.

In the erect ♀ flowers the perianth and the three styles emerge from the water surface.

In *V. spiralis* pollen is transported to the styles if one of the two anthers of a floating ♂ flower comes into contact with one of the styles of the ♀ flowers.

In *V. americana* a similar contact is prohibited by the erect position of the stamens and the horizontal position of the ♀ flowers (*cf.* WYLIE, Bot. Gaz. 63, 1917, 135–145; SVEDELIUS, Svensk Bot. Tidskr. 26, 1932, 1–12, f. 1 c–e, 3 a–b; MARIE-VICTORIN, Contr. Inst. Bot. Un. Montr. *no* 46, 1943). In this species pollen transport is performed if, through wave action, the ♀ flower is temporarily submerged. At that moment, through its hydrophobous epidermis and surface tension, a small depression surrounds the ♀ flower in which pit the ♂ flowers slide down. At that stage, in which the ♀ flower is actually submerged, an air bubble is formed round the styles with which the ♂ flowers are pulled along and pollen transfer can take place. The mechanism strikingly resembles that which is described for *Enhalus acoroides*, see p. 404.

Nothing is yet known of the flower biology in *V. gigantea*.

Note. As several characters cannot be observed in herbarium specimens, *e.g.* the position of the stamens and styles during anthesis, it is in collecting *Vallisneria* species desirable to describe the flowers alive.

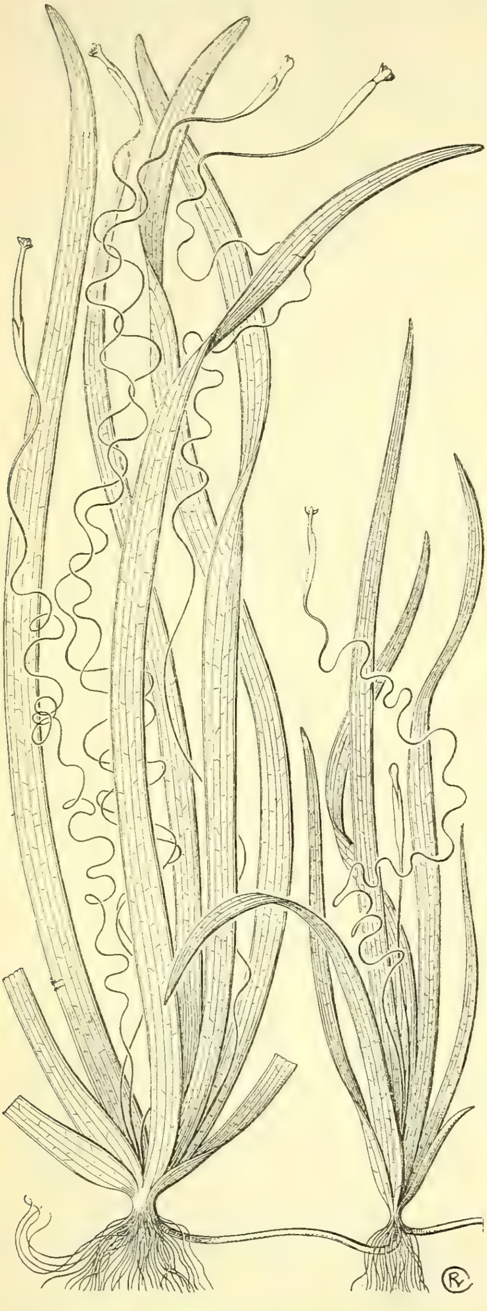

Fig. 4. *Vallisneria gigantea* GRAEBN. with ♀ flowers, × ½ (Herb. Philip. 667).

1. Vallisneria gigantea GRAEBNER, Bot. Jahrb. 49 (1912) 68; MERR. Fl. Manila (1912) 69; HALLIER *f.* Nova Guinea 8 (1913) 915; MERR. Sp. Blanc. (1918) 58; BROWN, Min. Prod. Philip. For. 2 (1921) 247; MERR. En. Philip. Fl. Pl. 1 (1922) 26.—*V. spiralis* (*non* LINNÉ) BLANCO, Fl. Filip. ed. 1 (1837) 781; ed. 2 (1845) 538; ed. 3, 3 (1879) 187; BENTH. Fl. Austr. 6 (1873) 259; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 163; GAGNEP. Fl. Gen. I.-C. 6 (1908) 7, f. 4; (Indian form) KENOYER, J. As. Soc. Beng. 15 (1920) 303–304.—*V. spiralis var. subulispatha* MAKINO, J. Jap. Bot. 7 (1931) 6.—*V. subulisphata* KOIDZ. Act. Phytotax. & Geobot. 3 (1934) 147.—*V. asiatica* MIKI, Bot. Mag. Tokyo 48 (1934) 329, *incl. var. biwaensis* MIKI and *var. higoensis* MIKI.—*V. biwaensis* OHWI, Bull. Nat. Sc. Mus. Tokyo 26 (1949) 1.—*V. higoensis* OHWI, Bull. Nat. Sc. Mus. Tokyo 26 (1949) 1.—**Fig. 4.**

Coarse. Stolons *c.* 10 cm, mostly absent. *Leaves* ribbon-like, 15–100 by (½–)1–2 cm (sizes depending on the depth of the water); margin faintly dentate, thickened; nerves 5–9; parallel with them there are black and brown stripes which are also visible on the scarious sheath. *Female spathe* 12–20 mm, covering the ovary half-way to ¾ times of its length, with longitudinal black stripes; peduncles 3–15, coarse, up to 1 m. *Sepals* ovate, convex, 1¾–4 by 1–2 mm (of which one a little larger than the other ones), obtuse; green to light-brown-violet, with longitudinal black stripes, glabrous, persistent. *Petals* scarious, *c.* ⅓ mm. *Ovary* 17–25 mm, at ⅔ of the length faintly nodding; styles alternating with the petals, *c.* 2 mm, split into

2 broad, flattened, not fringed lobes to near the base, striped. Ovules ∞, *c.* ⅓–¼ mm. *Fruit* greenish yellow with black or red-brown stripes, 6–20 cm, crowned by the sepals. *Seeds* ∞, fusiform to cylindrical, 1½–3 mm long.—*Male plants:* unknown in Mal. material. According to Miki *l.c.*: Spathe oblong; peduncle 2–3 cm long, 2 mm thick. Sepals ovate, reflexed. Stamen 1 (by the fusion of 2), erect. According to Kenoyer, however: Stamens 2, widely diverging.

Distr. From S. and E. Asia (Iraq, India, Indo-China, China, Japan, Korea), through Malaysia to E. Australia as far as Tasmania, possibly also in Melanesia (Guillaumin, Fl. Nouv. Caléd. 1948, 22, *sub V. spiralis*), in *Malaysia:* Philippines (Luzon, Mindoro) and New Guinea.

Ecol. In shallow water (½–2 m depth) of lakes and slow-running streams and rivers; mostly rooting in sandy and gravelly bottoms, but also found on muddy soil; forming dense vegetations; up to 300 m. *Fl. fr.* Jan.–Dec.

Uses. According to Brown *l.c.* young leaves are boiled and eaten as a vegetable.

Vern. *Sabután-buáia*, *cintascintasan*, Tag., *lanteng*, Ibn., *palaipa*, *baláiba*, *bal liba*, Ilk., *mariubariu*, Bik.

Notes. It has appeared impossible to distinguish, in herbarium material, Malaysian material of *V. gigantea* from the specimens collected in India, Japan, and Australia. From the studies by Miki and Kenoyer it might be concluded that the ♂ flowers of Indian and Japanese specimens are different, but they are seldom found in the herbarium.

The differences between *V. gigantea* and other species are rather unsatisfactory and closer study of living material might show that the genus consists of only one racially differentiated species. A final conclusion can only be drawn on the basis of abundant living material from various sources.

V. spiralis L. differs from *V. gigantea* by the relatively narrower entire leaves (to 1 cm), with always only 5 nerves; ♀ flower mostly smaller than that of *V. gigantea*; spathe covering only the base of the ovary; acute sepals; fringed styles; absence of blackish and brown stripes on leaves, ♀ spathe, and sepals (in *V. spiralis* sometimes black or brown dots).

V. neotropicalis Marie-Victorin, a tropical American species resembles *V. gigantea* very much, but differs by the ciliated margins of the leaves; perianth segments larger (sepals 4–5½ by 2–3 mm, ovate or elliptic, obtuse, shortly apiculate; petals *c.* 1 mm); styles split to ⅓ of the length.

3. BLYXA

Noronha *ex* Thouars, Gen. Nov. Madag. 2 (1808) 4; L.C. Rich. Mém. Inst. Paris 12, 2 (1812) 63, 70, 74, t. 4–5; Bth. & Hook. *f.* Gen. Pl. 3 (1883) 451.—*Diplosiphon* Decne in Jacquem. Voy. Bot. (1844) 166.—*Hydrotrophus* Clarke, J. Linn. Soc. Bot. 14 (1875) 8; Bth. & Hook. *f.* Gen. Pl. 3 (1883) 452.—*Enhydrias* Ridl. J. Bot. 38 (1900) 69.—*Blyxopsis* O.K. in Post & Kuntze, Lexic. (1903) 71, *nom. superfl. pro gen. Enhydrias.*—**Fig. 5–7.**

Submerged stoloniferous plants, monoecious or dioecious. *Leaves* linear, spirally arranged, radical or along a 15–60 cm long stem, base sheathing or semi-amplexicaulous, margin minutely dentate, apex attenuate; nerves parallel, midrib prominent. *Spathe* sessile or peduncled, tubular, with 6 longitudinal ribs, bifid at the tip, 1-flowered, or in ♂ spathes of dioecious plants with up to 10 flowers. *Peduncle* flattened or terete in cross-section, with a nod close under the spathe. *Flowers* unisexual or bisexual, ♀ and ⚥ ones sessile, ♂ ones pedicelled. *Sepals* 3, linear or linear-lanceolate, green, persistent. *Petals* 3, linear, longer than the sepals, white, flaccid, fringed. *Stamens* 3, 6 or 9; filaments capillary; anthers linear or lanceolate, bilocular, latrorsely dehiscent. *Ovary* linear, with a long, filiform rostrum, inside with 3 parietal placentas; styles 3, linear, connate at the base. *Fruit* linear or linear-lanceolate; wall membranous. *Seeds* 10–∞, elliptic or fusiform, 1–2 mm; testa glabrous or with 3–8 longitudinal rows of more or less conspicuous tubercles or spines.

Distr. About 10 *spp.* in the Old World tropics from West & Central Africa and Madagascar through South & East Asia and *Malaysia* to North Australia.

Taxon. *Blyxa* has been subdivided by Ascherson & Gürke (E. & P. Pfl. Fam. 2, 1, 1889, 253) into 2 subgenera, *viz subg. Saivala* (Buch.-Ham.) Aschers. & Gürke (dioecious, stamens 6–9) and *subg. Diplosiphon* (Decne) Aschers. & Gürke (monoecious, stamens 3). In my opinion this is an artificial division, as the flower structure is in both subgenera very uniform, except for the number of stamens. Furthermore the monoecism of dioecism appears to be of relative value only, as the ♂ flower in the monoecious species invariably possesses 3 stylodia and ♀ flowers are sometimes provided with one or more stamens.

The *subg. Diplosiphon* has been subdivided into 2 sections by KOIDZUMI (Bot. Mag. Tokyo 31, 1917, 257–258), *viz sect.* '*Acaulis*' and *sect.* '*Caulescens*'. This seems to be a more natural, satisfactory subdivision, but it should be applied to the whole genus, as to *subg. Saivala* one acaulescent and one caulescent species have been referred.

The subdivision of *Blyxa* proposed here is hence:

1. *sect.* **Blyxa.**—*Hydrotrophus* CLARKE, *l.c.*—*Blyxa subg. Diplosiphon sect. Acaulis* KOIDZ. *l.c.* 257.—Leaves radical.—Type: *B. auberti* RICH.

2. *sect.* **Caulescentes** KOIDZ. *l.c.* 258 (*corr. orthogr. mihi*).—*Enhydrias* RIDL. *l.c.*—Leaves on a stem.—Type: *B. japonica* (MIQ.) MAXIM.

Nomencl. The name *S'aiva'la* published by JONES (Asiat. Res. 4, 1799, 275) in his posthumous list of select Indian plants cannot be accepted as a scientific name, although it has been inserted in Ind. Kew. This Sanskrit vernacular name was taken up in WALLICH's Catalogue 5047 for '*Saivala vallisnerioides* B. HAM. *ex* H.B.C.' with the synonym '*Vallisneria 8-andra* ROXB.' It is therefore an illegitimate name.

Note. Species of the *sect. Caulescentes* have been confused by some authors with *Nechamandra alternifolia* (ROXB.) THW. [= *Vallisneria alternifolia* ROXB., *Nechamandra roxburghii* PLANCH., *Lagarosiphon roxburghii* (PLANCH.) BENTH., *Lagarosiphon alternifolia* (ROXB.) DRUCE], which does not occur in Malaysia. Even in the sterile state *Blyxas* are easily recognized by the prominent midrib, *Nechamandra* possessing 4–6 equal, parallel nerves without a prominent one.

KEY TO THE SPECIES[1]

1. Leaves radical (*sect. Blyxa*).
  2. Flowers bisexual. Spathe 1-flowered (rarely 2-flowered). Stamens 3.
    3. Seeds elliptic to ovate, tubercled or echinate.
      4. Seeds with 8 more or less tubercled ribs, without filiform processes . . . . . . **1. B. auberti**
      4. Seeds with 8 rows of blunt spines, at both ends with a 1–5 mm long filiform tail **2. B. echinosperma**
    3. Seeds fusiform, smooth . . . . **3. B. leiosperma**
  2. Flowers unisexual. ♀ Spathe 1-flowered, ♂ one many-flowered. Stamens 9. Seeds with 8 rows of spines, without filiform processes . . . . **4. B. octandra**
1. Leaves arranged along a stem (*sect. Caulescentes*).
  5. Flowers bisexual. Spathe sessile or very shortly peduncled, 1-flowered. Stamens 3.
    6. Leaves 1–2 mm broad. Seeds with 3–6 rows of more or less blunt spines . . **5. B. alternifolia**
    6. Leaves $1\frac{1}{2}$–$3\frac{1}{2}$ mm broad. Seeds smooth . . . . **6. B. japonica**
  5. Flowers unisexual. Spathe long-peduncled; the ♂ one many-flowered. Stamens 9 **7. B. novoguineensis**

1. Blyxa auberti RICH. Mém. Inst. Paris 12, 2 (1812) 19–23, 77, t. 4; ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 253; PERRIER DE LA BÂTHIE, Fl. Madag. fam. 26 (1946) 7, f. ii 1–2.—*Diplosiphon oryzetorum* DECNE in Jacquem. Voy. Bot. (1844) 167.—*B. roxburghi* (*non* RICH. 1812) MIQ. Fl. Ind. Bat. 3 (1856) 237; Suppl. (1861) 259.—*B. octandra* PLANCH. *ex* THW. En. Pl. Zeyl. (1864) 332, *pro specimina.*—*B. oryzetorum* HOOK. *f.* Fl. Br. Ind. 5 (1888) 661; GAGNEP. Fl. Gén. I.-C. 6 (1908) 16; STEEN. Trop. Natuur 18 (1929) 199, f. 1, 2a; Arch. Hydrobiol. Suppl. 11 (1932) 272; Trop. Natuur 23 (1934) 40; BACKER, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 203, p. 3.—*B. griffithi* PLANCH. *ex* HOOK. *f.* Fl. Br. Ind. 5 (1888) 661, *p.p.*—*B. ceylanica* HOOK. *f.* Fl. Br. Ind. 5 (1888) 661; FISCHER, Fl. Pres. Madras 8 (1928) 1397.—*B. malayana* RIDL. Trans. Linn. Soc. II, 3 (1893) 358; Mat. Fl. Mal. Pen. (Monoc.) 1 (1907) 4; Fl. Mal. Pen. 4 (1924) 3; BACK. Handb. Fl. Java 1 (1925) 60; Onkr. Suiker. (1928) 24, Atlas t. 30; BURK. Dict. 1 (1935) 340.—*B. zeylanica* HOOK. *f.* in Trim. Fl. Ceylon 4 (1898) 128.—*B. ecaudata* HAYATA, Ic. Pl. Formos. 5 (1915) 208, f. 77 c–f.—*B. muricata* KOIDZ. Bot. Mag. Tokyo 31 (1917) 258.—*B. coreana* (*non* LÉVEILLÉ) NAKAI, J. Jap. Bot. 19 (1943) 247.—**Fig. 5, 6d–d'.**

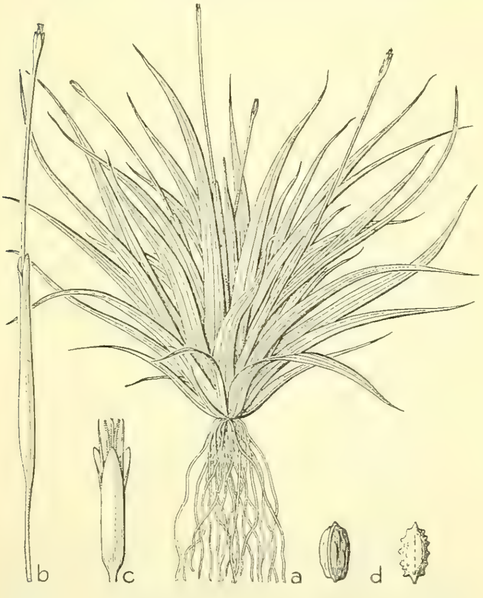

Fig. 5. *Blyxa auberti* RICH. *a.* Habit, × ¼, *b.* ♀ flower with sheath, *c.* flower, *d.* two seeds, × 5.

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(1) Of Asia, Malaysia, and Australia.

Monoecious, acaulous. *Leaves* radical, sheathing at the base, 10–150 by $^{1}/_{2}$–1 cm; nerves 5–9, parallel, connected by very thin cross-veins. Peduncles 1 or more, 10–40 cm, often much longer. *Spathe* 1-flowered, up to 10 cm, tips obtuse. *Flowers* bisexual. *Sepals* linear, 7–15 mm, 1-nerved, apex cucullately contracted, margin scarious. *Petals* 10–12 mm. *Stamens* 3; filaments 3–6 mm; anthers linear-lanceolate, 1–2 mm. *Ovary* as long as the spathe; rostrum 3–10 cm, sometimes longer; styles compressed, 6–10 by $^{1}/_{2}$ mm. *Fruit* linear, 3–6 cm. *Seeds* ∞, elliptic to ovate, 1–2 mm, testa with 8 longitudinal more or less but distinctly tubercled ribs.

Distr. Widely distributed, from Madagascar and India, northwards to Korea and Japan, eastwards via Malaysia to New Guinea and N. Australia; in *Malaysia:* Sumatra, Malay Peninsula, Banka, Java, Moluccas (Tenimber Isl.), and New Guinea, probably common.

Ecol. In stagnant water of pools, marshes, and wet rice-fields, but also in sluggish streaming rivers, in sunny as well as in shaded spots, often abundant, up to 1250 m. *Fl. fr.* Jan.–Dec.

After flowering fruiting follows very rapidly. The seeds germinate without a resting period. Between the old plants often hundreds of minute seedlings are found, the majority of which perish. According to BARTELS (cf. STEEN. *l.c.* 1934) fishes feed on the seeds which they take from the fruits.

The leaves are variable in size and shape. In specimens growing in shallow water the base is often broadened and the plants obtain a compact habit. Specimens from deeper water have long, ribbon-like leaves, which are narrowed at the base. In deep water the peduncle may be very long, and in anthesis the flower just emerges from the water-level. If the peduncle cannot reach the water-level in water that is too deep, cleistogamy has been observed.

Vern. *Sĕsĕrowan, tjatjamardan,* S, *seribanju,* M, *rumput lumut,* M.

Note. RICHARD *l.c.* described *B. auberti* as a dioecious species, as he did not find ♂ flowers in his material. As the stamens are very slender and fugacious he has probably overlooked them. In all specimens from Madagascar I studied, I found exclusively bisexual flowers with 3 stamens. The seeds of the Madagascar specimens cannot be distinguished from those of Malaysian and Asiatic specimens.

The lectotype sheet of *B. griffithi* which I studied at Kew, appeared to represent a mixture of *B. auberti* and *B. octandra.*

2. Blyxa echinosperma (CLARKE) HOOK. *f.* Fl. Br. Ind. 5 (1888) 661; MAXIM. *ex* ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 253, f. 187; FISCHER, Fl. Pres. Madras 8 (1928) 1397; STEEN. Trop. Natuur 18 (1929) 199, f. 2b; *ibid.* 23 (1934) 108; RANGASAMY, J. Ind. Bot. Soc. 20 (1941) 123–134, f. 1–29; BACK. Bekn. Fl. Java (em. ed.)10 (1949) fam. 203, p. 3.—*Hydrotrophus echinospermus* CLARKE, J. Linn. Soc. Bot. 14 (1875) 8, t. 1.—*B. lancifolia* HOOK. *f.* Fl. Br. Ind. 5 (1888) 661.—*B. talboti* HOOK. *f.* Fl. Br. Ind. 5 (1888) 661; FISCHER, Fl. Pres. Madras 8 (1928) 1397.—*B. ceratosperma* MAXIM. *ex* ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 253; NAKAI, J. Jap. Bot. 19 (1943) 248.—*B. delavayi* GAGNEP. Bull. Soc. Bot. Fr. 54 (1907) 538.—*B. octandra* (*non* PLANCH. *ex* THW.) MERR. Philip. J. Sc. 7 (1912) Bot. 73.—*B. shimadai* HAYATA, Ic. Pl. Formos. 5 (1915) 209.—*B. somai* HAYATA, Ic. Pl. Formos. 5 (1915) 210, f. 77 g.—*B. echinospermoides* BLATTER, J. Proc. As. Soc. Beng. n.s. 26 (1931) 354.—*B. bicaudata* NAKAI, J. Jap. Bot. 19 (1943) 249.—**Fig. 6a.**

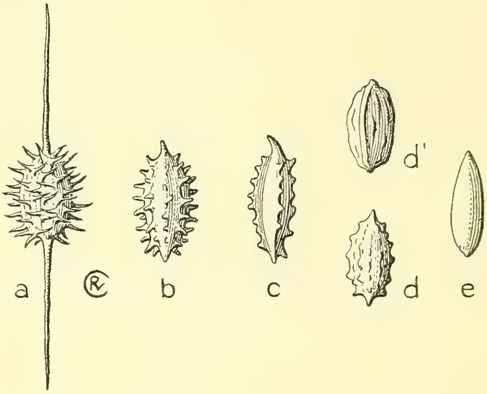

Fig. 6. Seeds of *Blyxas. a. B. echinosperma* (CLARKE) HOOK. *f., b. B. octandra* (ROXB.) PLANCH., *c. B. alternifolia* (MIQ.) HARTOG, *d–d'. B. auberti* RICH. one indistinctly, one more distinctly warty, *e. B. japonica* (MIQ.) Maxim. *ex* A. & G., all × 10 (*a* VAN STEENIS, *b* BRASS 5969, *c* SINCLAIR 10–12–49, *d* DOCTERS VAN LEEUWEN 3796, *d'* BACKER 22908, *e* BRASS 7750).

Monoecious, acaulous. *Leaves* radical, sheathing at the base, 10–120 by $^{1}/_{2}$–1 cm; nerves 5–7, parallel, connected by very thin cross-veins. Peduncles 1 or more, 5–30 cm, sometimes much longer. *Spathe* 1-flowered, rarely 2-flowered, 4–10 cm, tips obtuse with scarious margin. *Flowers* bisexual. *Sepals* linear, 1–3 nerved, 6–8 by 1 mm, margin scarious, apex cucullately contracted. *Petals* 13 mm. *Stamens* 3, filaments 3–6 mm; anthers linear-lanceolate, 1–1$^{3}/_{4}$ mm. *Ovary* as long as the spathe; rostrum 3$^{1}/_{2}$–10 cm, sometimes longer; styles compressed, 7–9 by $^{1}/_{2}$ mm, tip obtuse. *Fruit* linear, 3$^{1}/_{2}$–7 cm. *Seeds* ∞, elliptic to ovate, 1$^{1}/_{4}$–2 by $^{3}/_{4}$–1 mm; testa with 8 longitudinal rows of blunt spines, connected by scarious membranes, at both ends with a 1–5 mm long filiform tail.

Distr. Widely distributed in S. and E. Asia (India, Ceylon, Burma, Indo-China, China, Japan, Korea), southwards via Malaysia to tropical Australia, in *Malaysia:* S. Sumatra, Malay Peninsula, Natuna Isl., S. Borneo, W. Java, Philippines (Palawan, Luzon), Moluccas (Key & Aru Isl.), obviously not uncommon.

Ecol. In the same places as *B. auberti* and sometimes growing together with it, but up till now in Malaysia only found at low altitude, up to *c.* 250 m. The roots are often red by precipitated iron compounds from laterite; this is also observed in other *Blyxas*. *Fl. fr.* Jan.–Dec.

Vern. *Lamon ajĕr*, M, Natuna Isl., *rumput ubanan*, M, Djakarta, *kumpai*, S, Bogor.

Note. *Blyxa talboti* HOOK. *f.* was described as having unisexual flowers; HOOKER *f.* knew only female plants. I have studied the type material at Kew which appeared to contain only fruits with ripe seeds; these appeared to be identical with those of *B. echinosperma*, which settles in my opinion their conspecificy.

3. Blyxa leiosperma KOIDZ. Bot. Mag. Tokyo 31 (1917) 257.

Monoecious, acaulous. *Leaves* radical, sheathing at the base, attenuate, 3–13 by $1\frac{1}{2}$–4 mm; nerves parallel, 1–3. Peduncles 1–3, very short $\frac{1}{4}$–3 cm. *Spathe* 1-flowered, tips obtuse. *Flowers* bisexual. *Sepals* linear, obtuse, 1-nerved, 6–10 mm. *Petals* white, *c.* 14 mm. *Stamens* 3, filaments capillary; anthers lanceolate. *Ovary* 1–3 cm; rostrum 2–4 cm; styles 3–4 mm. *Fruit* linear, $1\frac{1}{2}$–3 cm. *Seeds* ∞, fusiform, $1\frac{1}{2}$ mm; testa smooth, brown.

Distr. Japan and Hainan (Taam-Chau Distr., Noh Pong Shan, TS'ANG WAI-TAK 878, L.U. 16377, 15–9–1927), twice found, but possibly of wider distribution, not yet found in Malaysia.

Notes. The Hainan sheet was *in sched.* wrongly referred to as *B. octandra* (ROXB.) PLANCH.

The species is distinguished from all other acaulous *Blyxas* by its short peduncle and fusiform, smooth seeds which are highly characteristic; they very much resemble those of the caulescent *B. japonica*, and I cannot distinguish between them.

The Hainan specimens are smaller in size than those from Japan.

4. Blyxa octandra (ROXB.) PLANCH. *ex* THW. En. Pl. Zeyl. (1864) 332, *excl. specimina*; ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 253, f. 186; FISCHER, Fl. Pres. Madras 8 (1928) 1397.—*Vallisneria octandra* ROXB. Pl. Corom. 2 (1802) 34, t. 165.—*B. roxburghi* RICH. Mém. Inst. Paris 12, 2 (1812) 23–24, 77, t. 5; BENTH. Fl. Austr. 6 (1873) 258; HOOK. *f.* Fl. Br. Ind. 5 (1888) 660; BAILEY, Queensl. Fl. 5 (1902) 1509; EWART & DAVIS, Fl. North. Terr. (1917) 22.—*B. griffithi* PLANCH. *ex* HOOK. *f.* Fl. Br. Ind. 5 (1888) 661, *p.p.*—**Fig. 6b.**

Dioecious, acaulous. *Leaves* radical, sheathing and narrowed at the base; 40–60 by $\frac{1}{2}$–$1\frac{1}{4}$ cm, sometimes much longer; nerves 5–11, parallel, connected by cross-veins. Peduncles 1 or more, 20–120 cm. *Spathes* with 1 female flower, or 5–10 male flowers, 6–10 cm, tips obtuse or acute, with scarious margin. *Sepals* linear, 9–10 by $1\frac{1}{2}$ mm, 1–3 nerved, reddish tinged, apex cucullately contracted. *Petals* 20–25 mm, sometimes longer, 1-nerved. *Stamens* 9; filaments 2–5 mm; anthers 1–2 mm, lanceolate, attenuate. *Ovary* 6–9 cm; rostrum 8–10 cm, but sometimes longer. Styles *c.* 20 mm, faintly hairy. In ♂ plants 3 stylodia connate at the base. *Fruit* linear, $7\frac{1}{2}$–10 cm. *Seeds* ∞, oblong-elliptic, 1–2 by $\frac{1}{2}$–1 mm, with one end attenuate, the other end obtuse, without tail at either end; testa with 8 longitudinal rows of more or less long (to $\frac{1}{2}$ mm) curved spines.

Distr. Ceylon, India, Burma, Siam, through Malaysia to Australia, in *Malaysia*: S. New Guinea (Middle Fly River, Lake Daviumbu, BRASS 7640 & 7641 and Dagwa, Oriomo River, BRASS 5969).

Ecol. In shallow water, in dense masses, also in shaded small streams. *Fl. fr.* Jan.–Dec.

Note. Sometimes staminodes or well-developed stamens occur in the female flowers. In the material from New Guinea I found a ♀ flower containing one stamen of normal size but the anther appeared to be barren.

5. Blyxa alternifolia (MIQ.) HARTOG, *nov. comb.*—*Hydrilla alternifolia* MIQ. Illustr. (1870) 52.—*Enhydrias angustipetala* RIDL. J. Bot. 38 (1900) 69; Mat. Fl. Mal. Pen. (Monoc.) 1 (1907) 4; WINKLER, Bot. Jahrb. 44 (1910) 518; MERR. En. Born. (1921) 37; RIDL. Fl. Mal. Pen. 4 (1924) 2, f. 160; BURK. Dict. (1935) 924.—*B. angustipetala* MASAMUNE, Trans. Nat. Hist. Soc. Form. 33 (1943) 11, *pro comb., excl. specim.*—**Fig. 6c.**

Monoecious, caulescent. Stems 15–60 cm, ramified. *Leaves* sessile, semi-amplexicaulous, 2–5 cm by 1–$1\frac{1}{2}$ mm; midrib connected by very minute cross-veins with the margin; at the leaf base 2 minute axillary, elliptic *squamulae intravaginales*. *Spathe* axillary, sessile, 1-flowered, $1\frac{1}{2}$–$2\frac{1}{2}$ cm; tips obtuse. *Flowers* bisexual. *Sepals* linear-lanceolate, acute, 1-nerved, pale green, 3–$3\frac{1}{2}$ by 1 mm. *Petals* 1-nerved, silvery white, $5\frac{1}{2}$–7 by $\frac{3}{4}$ mm. *Stamens* 3; filaments 2–$2\frac{1}{2}$ mm; anthers linear to linear-lanceolate, $\frac{3}{4}$–1 mm. *Ovary* $1\frac{1}{2}$–2 cm, rostrum $2\frac{1}{2}$–3 cm; styles 2–$2\frac{1}{2}$ mm. *Fruit* linear-lanceolate, $1\frac{1}{2}$–2 cm. *Seeds* 10–20, fusiform, at the ends very acute, $1\frac{1}{2}$–2 mm; testa with 3–6 longitudinal rows of more or less blunt spines, connected by minute scarious membranes.

Distr. Indo-China (Hue: SQUIRES 242) and *Malaysia:* Central Sumatra (Riouw, Pangkalan Kasai: BUWALDA 6775), Malay Peninsula (Malacca, Perlis, and Singapore), Borneo (Martapura, Pontianak, Kuching & Samarahan).

Ecol. Rare lowland species, but locally not uncommon. *e.g.* in the southern part of the Malay Peninsula and Singapore. It forms thick masses in muddy ponds and ditches and may be a pest, growing with great rapidity, often together with *Hydrilla verticillata*, but by its pale green colour it is rapidly distinguished, according to DUNSELMAN, who found it common in ditches near Pontianak. Self-fertilization often occurs, because the stigmas are frequently covered with pollen grains already in bud. *Fl. fr.* Jan.–Dec.

Note. MIQUEL did not describe the seeds, but in the type material of *Hydrilla alternifolia* I found ripe seeds, which could not be distinguished from those of *Enhydrias angustipetala* which proves them to be conspecific. This and the next species show a great similarity in their vegetative parts and can only properly be distinguished by their seeds.

Vern. *Rumput lumut*, M.

6. Blyxa japonica (MIQ.) MAXIM. *ex* ASCHERS. & GÜRKE, E. & P. Pfl. Fam. 2, 1 (1889) 253; KOIDZUMI, Bot. Mag. Tokyo 31 (1917) 258; NAKAI, J. Jap. Bot. 19 (1943) 245, *cum fig.—Hydrilla ?japonica* MIQ. Ann. Mus. Bot. Lugd. Bat. 2 (1866) 271; Illustr. (1870) 54.—*B. caulescens* MAXIM. *ex* MAKINO, Bot. Mag. Tokyo 4 (1890) 173; MATSUMURA, Ind. Fl. Jap. 2, 1 (1905) 31; NAKAI, Fl. Kor. 2 (1911) 216.—*B. leiocarpa* MAXIM. *ex* MAKINO, Bot. Mag. Tokyo 4 (1890) 416, *nomen nudum.—Enhydrias angustipetala* (*non* RIDLEY) GAGNEP. Fl. Gén. I.-C. 6 (1908) 17, f. 1, C 13–22.—*B. laevissima* HAYATA, Ic. Pl. Formos. 5 (1915) 208, f. 77 a–b.—*Enhydrias angustipetala var. latifolia* RIDL. Fl. Mal. Pen. 4 (1924) 2.—*B. angustipetala* MASAMUNE, Trans. Nat. Hist. Soc. Form. 33 (1943) 11; Fl. Kainant. (1943) 348, *pro specimina, non Enhydrias angustipetala* RIDL.—**Fig. 6e.**

Monoecious, caulescent. Stems 15–60 cm, ramified. *Leaves* sessile, semi-amplexicaulous, 1½–5 cm by 1–3½ mm; midrib accompanied by 6 inconspicuous very fine, parallel veins, connected by very fine cross-veins. *Spathe* axillary, sessile, sometimes very shortly stalked, 1-flowered, 1½–2½ cm, longitudinal ribs sometimes serrulate, tips acute or obtuse. *Flowers* bisexual. *Sepals* linear-lanceolate, 1-nerved, 3–4 by ¾–1 mm, apex acute. *Petals* 6–10 by ½–1 mm, 1-nerved. *Stamens* 3; filaments 1–2 mm; anthers linear-lanceolate, apex attenuate, ¾–1 mm. *Ovary* 1½–2 cm; rostrum 2–3 cm; styles 2½–4 mm. *Fruit* linear-lanceolate, 1½–2 cm by 2½–4 mm. *Seeds* 10–40, fusiform, 1–2 by ¼–½ mm; testa smooth.

Distr. Widely distributed in S. & E. Asia from Bengal and Nepal, northeastwards to Korea and Japan and southwards through Formosa and Malaysia to New Guinea; in *Malaysia* rare: Malay Peninsula (several stations in Perak and the Dindings), Banka (Bakem, Soengei Liat), Borneo (without locality), SE. Celebes (Lepo Lepo near Kendari: BECCARI 9957) and New Guinea (Middle Fly River, Lake Daviumbu: BRASS 7750).

Ecol. Growing in wet sago-swamps, rice-fields, and stagnant pools, exclusively in the lowland, in the Himalayas found up to 1200 m. *Fl. fr.* Jan.–Dec.

7. Blyxa novoguineensis HARTOG, Act. Bot. Neerl. 6 (1957) 47.—**Fig. 7.**

Dioecious, caulescent, ramified. *Leaves* sessile, semi-amplexicaulous, 6–8 cm by 2–3 mm; midrib accompanied by 6–8 parallel inconspicuous veins, connected in their turn by very fine cross-veins. Peduncle axillary, ½ to 15–18 cm, elongating during anthesis. *Spathe* 2½–4 cm, with 5–8 ♂ flowers, tips obtuse. Pedicels 5–7 cm. *Sepals* linear-lanceolate, acute, 1-nerved, green with a dark spot near the apex; 4–5 by 1½ mm. *Petals* 12–15 by 1 mm. *Stamens* 9; filaments 2–3 mm; anthers linear-lanceolate, apex acuminate, 1½–2 by ¼–⅓ mm. Carpel rudiments 3, ovate, 1 mm long, with a 2½–3 mm long slender stylode. Female plants not yet known.

Distr. *Malaysia*: S. New Guinea (Middle Fly River, Lake Daviumbu: BRASS 7638).

Ecol. Very abundant in the lake, in water 1–1½ fathoms deep. *Fl.* Sept.

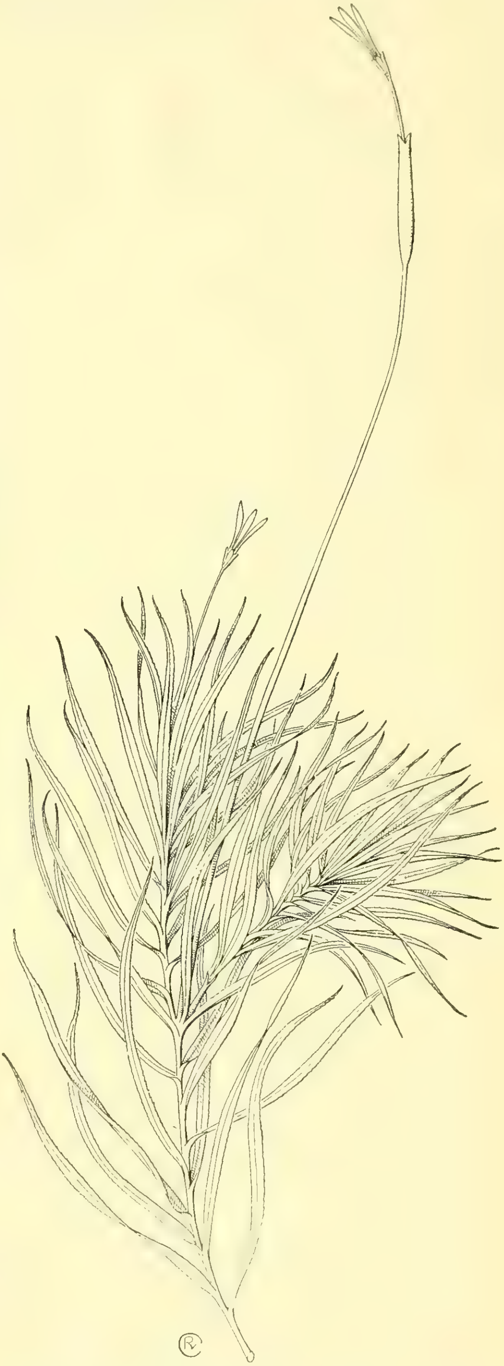

Fig. 7. *Blyxa novoguineensis* HARTOG, ♂ plant, × ⅗ (BRASS 7638, type).

Doubtful

Blyxa javanica HASSK. Tijd. Nat. Gesch. & Phys. 10 (1843) 121, *nom. nud.*; Cat. Hort. Bog. (1844) 34; ZOLL. Syst. Verz. 1 (1854) 69, *nom. nud.*—The material on which HASSKARL based this species no doubt belongs to *Blyxa*, but as it has no fruits it cannot be identified specifically with certainty. ZOLLINGER 1025 (P) is also sterile.

4. HYDROCHARIS

LINNÉ, Gen. Pl. ed. 5 (1754) 458; Sp. Pl. ed. 1, 2 (1753) 1036; BTH. & HOOK. *f.* Gen. Pl. 3 (1883) 452; SOLEREDER, Beih. Bot. Centralbl. 30, i (1913) 94–98.—**Fig. 9.**

Glabrous, monoecious. Stolons originating from the leaf axils, with gemmulae at the top. *Leaves* swimming or emerged; ovate to suborbicular; apex rounded or acute; base more or less cordate or reniform; on the central part of the under-surface of the swimming leaves mostly a coarsely meshed aerenchym-cushion; nerves curved, parallel, joining the marginal nerve, connected by straight, parallel cross-veins, in their turn connected again by very fine veinlets, parallel with the nerves; petiole near the base with 1 or 2 lingulate, transparent, scarious stipules. *Spathal* segments lanceolate, membranous, unisexual; the male spathe peduncled, containing 1–4 flowers, the female one sessile, 1-flowered. Pedicels of the ♂ flowers short, those of the ♀ flowers rather long. *Sepals* 3, elliptic, obtuse, white or greenish white, persistent. *Petals* 3, larger than the sepals, broad-obovate, with broadly rounded apex and cuneate persistent base, shortly unguiculate. *Stamens* 9–12, anthers bilocular, latrorsely dehiscent. *Ovary* elliptic, nearly 6-celled; styles 6, flat, bifid. *Fruit* berry-like, elliptic to globose, with 6 ribs, bursting irregularly at the apex. *Seeds* ∞, elliptic.

Distr. Three species in the Old World, *viz H. morsus-ranae* L. in Europe, Asia Minor, and Algeria, *H. chevalieri* (DE WILD.) DANDY in Central Africa, and *H. dubia* (BL.) BACKER from Asia to Australia.

1. Hydrocharis dubia (BL.) BACKER, Handb. Fl. Java 1 (1925) 64; DANDY, J. Bot. 70 (1932) 328; COERT, Trop. Natuur 23 (1934) 28; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 203, p. 5.—*Pontederia ? dubia* BL. En. Pl. Jav. 1 (1827) 33.—*H. cellulosa* BUCH.-HAM. *ex* WALL. Cat. *no* 5042 (1831–32), *nomen nudum.*—*Monochoria ? dubia* MIQ. Fl. Ind. Bat. 3 (1859) 549.—*H. asiatica* MIQ. Fl. Ind. Bat. 3 (1856) 239; Illustr. (1870) 55; ASCHERS. & GÜRKE in E. & P. Nat. Pfl. Fam. 2 (1889) 258; GAGNEP. Fl. Gén. I.-C. 6 (1908) 8, f. 5; HALLIER *f.*, Nova Guinea 8 (1913) 917; SOLEREDER, Beih. Bot. Centralbl. 30, i (1913) 97; Med. Rijksherb. *no* 21 (1914) 1–2; HAYATA, Ic. Pl. Form. 4 (1914) 23.—*H. morsus-ranae* (*non* L.) F.v.M. Fragm. 6 (1868) 199; BTH. Fl. Austr. 6 (1873) 256; BOISS. Fl. Or. 5 (1881) 5; HOOK. *f.* Fl. Br. Ind. 5 (1888) 662; BAILEY, Queensl. Fl. 5 (1902) 1510; BACKER, Teysmannia 22 (1911) 764.—*Boottia renifolia* MERR. Philip. J. Sc. 4 (1909) Bot. 247; STEEN. Arch. Hydrobiol. Suppl. 11 (1932) 239.—*H. parnassifolia* HALLIER *f.* Nova Guinea 8 (1913) 916; SOLEREDER, Med. Rijksherb. *no* 21 (1914) 1–2.—*H. parvula* HALLIER *f.* Nova Guinea 8 (1913) 916; SOLEREDER, Med. Rijksherb. *no* 21 (1914) 1–2.—**Fig. 9.**

Monoecious, sometimes apparently dioecious. Stolons 15–25 cm; gemmulae curved, subulate, at the base often with rootlets, 9–20 by 2–4 mm. *Leaves* emerged and often swimming, ovate-cordate to broad-ovate, $2^{1}/_{2}$–6 by $2^{1}/_{2}$–$7^{1}/_{2}$ cm; apex obtusely rounded to broad acute; base more or less cordate or reniform, often truncate, sometimes cuneate; on the central part of the under-surface of the swimming leaves a well-developed, projecting, aerenchym-cushion, disappearing in old specimens; nerves 7–9, cross-veins ascending under an angle of 70°–80°, 1–6 mm spaced, veinlets very fine, $^{1}/_{2}$ mm spaced; petiole thickened towards the base, with wide air-channels, $2^{1}/_{2}$–15 cm, septations 3–4 mm spaced. Stipule 1, obtuse, $^{1}/_{2}$–$2^{1}/_{2}$ cm. *Spathe* 1–$2^{1}/_{2}$ by $^{1}/_{2}$ cm; the ♂ one up to $2^{1}/_{2}$ cm peduncled; female spathe often smaller than the male one. Pedicels of the ♂ *flowers* slender, 3–6 mm; those of the ♀ ones 1–$8^{1}/_{2}$ cm, after anthesis recurved, $1^{1}/_{2}$–2 mm thick. *Sepals* 4–8 by $2^{1}/_{2}$–$4^{1}/_{2}$

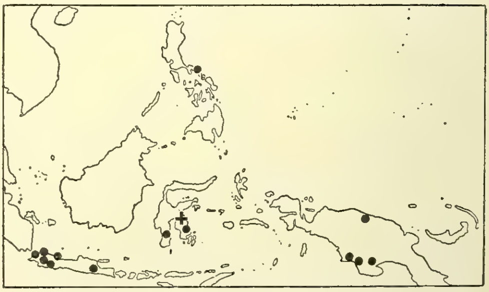

Fig. 8. Localities of *Hydrocharis dubia* (BL.) BACKER in Malaysia (●) and *Ottelia mesenterium* (HALL. *f.*) HARTOG (+).

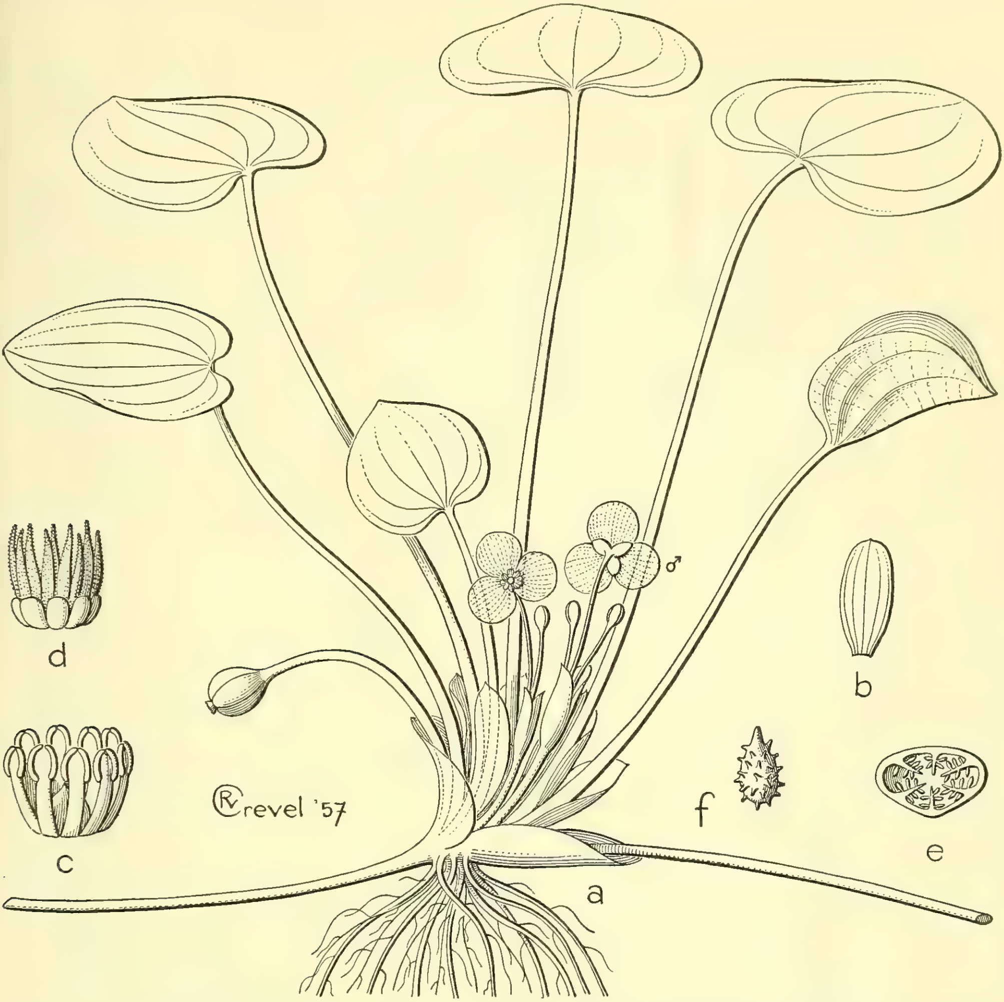

Fig. 9. *Hydrocharis dubia* (BL.) BACKER. *a.* Habit, with ♂ flowers and a fruit, × $^{2}/_{3}$, *b.* sepal, × 2, *c.* androecium, of ♂ flower, × 3, *d.* gynaecium of ♀ flower, × 3, *e.* cross-section of fruit, × 5, *f.* seed, × 7 (*a* BRASS 8161, *b–f* after GAGNEPAIN, Fl. Gén. I.-C. 6)

mm, parallel-striped, with brownish spots. *Petals* white or rarely pale yellow, 8–15 mm; claw yellow. *Stamens* 12, 2 before each sepal and each petal, one before the other; the inner epipetalous stamens are staminodial or have a very small, orange-yellow anther; filaments dilated, yellow, hairy, $3^{1}/_{2}$ mm; anthers oblong, basifix, 1–$1^{1}/_{2}$ mm; connective broad. ♀ *Flower* with 3 pairs of linear, yellow, episepalous staminodes, those of each pair free or connate; before the petals a nectary. *Ovary* oblong-elliptic, 5–6 by $2^{1}/_{2}$ mm; styles split halfway in 2 arms, yellow, hairy; in the ♂ flowers a glabrous, ribbed, yellow, knoblike rudiment of the carpels. *Fruit* 5–10 by 4–8 mm, filled with a tough mucilage. *Seeds* 1–$1^{1}/_{2}$ mm; testa echinate.

Distr. From S. & E. Asia to N. Australia, in *Malaysia:* Java (Bantam: Danu Swamp; G. Sahari-Sentiong in the vicinity of Djakarta; E. of Djakarta: Rawa Těmbaga; Preanger: Pasir Kiamis, Rawa Lakbok; Kediri: Rawa Běning), S. Celebes (SW. Peninsula: Tempé Lake; SE. Peninsula: Aopa Swamp near Kěndari), Philippines (Luzon, Camarines Prov.: Bicol River); New Guinea (Sentani Lake; Okaba; Merauke; Lower Fly River, near Sturt Isl.). Fig. 8.

Ecol. Free swimming, or in shallow water rooting in the bottom, in the latter case with many emerged leaves; in pools and marshes, locally gregarious, for example in the Papuan (*Melaleuca leucadendron*) swamp forest, to 1200 m; *fl. fr.* Jan.–Dec.

Use. Sometimes cultivated in fish-ponds as water cover.

Vern. *Frog-bit*, E, *kikkerbeet*, *duitblad*, D, *ètjèng lalakki*, S, *mangok mangok*, Merauke.

5. LIMNOBIUM

RICH. Mém. Inst. Paris 12, 2 (1812) 32, 66, t. 8; RYDBERG, N. Amer. Fl. 17 (1909) 74; HUTCHINSON, Fam. Fl. Pl. 2 (1934) 31.—*Hydromystria* G. MEYER, Fl. Esseq. (1818) 152; RYDBERG, N. Amer. Fl. 17 (1909) 74.

Monoecious, glabrous. Stolons originating from the leaf axils. *Leaves* radical, swimming or emerged, elliptic or ovate to suborbicular, apex rounded or obtuse, base cuneate, rounded or cordate, under-surface of the swimming leaves covered by an often very thick aerenchym cushion; nerves curved, parallel, joining the marginal nerve, connected by straight, parallel, ascending cross-veins in their turn connected by very fine, parallel veinlets; petiole near the base with a lingulate, transparent, scarious stipule. *Spathe* segments linear-lanceolate, membranous, unisexual; containing 3–9 ♂ flowers or 1 ♀ one; ♂ and ♀ flowers pedicelled. *Sepals* 3, oblong or lanceolate. *Petals* 3, linear-lanceolate, narrower than the sepals and only up to about $1^1/_2$ times as long, wanting or reduced in the ♀ flowers of some species. *Stamens* 6–12; anthers 2–locular, latrorsely dehiscent. *Ovary* elliptic; styles 6, bifid. *Fruit* berry-like, elliptic. *Seeds* ∞, subglobose.

Distr. A few species in America, in the tropical as well as in the temperate regions, in *Malaysia* introduced.

1. Limnobium stoloniferum (G. MEYER) GRISEBACH, Fl. Br. W. Ind. (1861) 506; VAAS, Bĕrita Pĕrikanan 2 (1950) 168.—*Hydromystria stolonifera* G. MEYER, Fl. Esseq. (1818) 153; ASCHERS. & GÜRKE, E. & P. Pfl. Fam. 2, 1 (1889) 258; BOTTINI, Malpighia 4 (1890) 340–348, 369–377; RYDBERG, N. Amer. Fl. 17 (1909) 74; HAUMAN-MERCK, An. Mus. Hist. Nat. Buenos Aires 27 (1915) 325–331.

Leaves swimming, elliptic to ovate, obtuse, $1^3/_4$–$2^1/_2$ by 1–$1^1/_2$ cm, base rounded or cuneate, margin undulate, entire; under-surface covered by a very thick, projecting aerenchym cushion; nerves 5(–7); cross-veins ascending at an angle of *c.* 70°, 2–3 mm spaced; petiole triquetrous, septated, $1^1/_2$–2 cm (in American specimens much longer); stipule 7–8 mm. *Spathe* $1^1/_2$–$2^1/_2$ cm long, the ♂ one containing 1–3 flowers, pedicels 3–6 cm; ♀ pedicels after anthesis recurved. *Sepals* white, obtuse, 4–5 by $1^1/_2$ mm, spreading. *Petals* white, obtuse, 5–7 by 1–$1^1/_4$ mm, ascending, wanting or strongly reduced in the ♀ flower. *Stamens* 6, filaments partly connate into a tube, 2 mm; anthers linear, 2 mm. Staminodes (in ♀ flower) not seen. *Ovary* 5 mm; styles 1 cm, deeply split. *Fruit* 5–6 mm. *Seeds* 1–$1^1/_4$ mm, apiculate, at the basal end a part of the funicle; testa brown, reticulate, with numerous, blunt, spirally ribbed spines.

Distr. South & Central America and the West Indies, in *Malaysia* introduced: W. Java (Tĕgalĕga, S. margin of the town of Bandung, VAAS, *l.c.*).

Ecol. In Java found once in very eutrophic, polluted freshwater fish-ponds (Oct. 1950, leg. K. F. VAAS) together with *Pistia*, *Lemna*, and *Eichhornia*, at *c.* 750 m; water rich in Ca and p_H 7–8. According to BOTTINI *l.c.* the species is anemophilous; HAUMAN-MERCK *l.c.*, however, supposes it to be partly anemophilous and partly hydrophilous.

Note. The description of the floral and fruiting part of the plant has been made after American specimens, as the Malaysian material was sterile.

6. OTTELIA

PERS. Syn. Pl. 1 (1805) 400; BTH. & HOOK. *f.* Gen. Pl. 3 (1883) 453; ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 257; SOLEREDER, Beih. Bot. Centralbl. 30, i (1913) 85–90; DANDY, J. Bot. 72 (1934) 132–139.—*Damasonium* SCHREB. in Linné, Gen. Pl. ed. 8, 1 (1789) 242, *non Damasonium* MILL. (1754).—*Hymenotheca* SALISB. Trans. Hort. Soc. 1 (1812) 268, *nomen nudum*, non F.v.M. (1859).—*Boottia* WALL. Pl. As. Rar. 1 (1830) 51, *non Bootia* BIGEL. (1824); BTH. & HOOK. *f.* Gen. Pl. 3 (1883) 453; ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 255; SOLEREDER, Beih. Bot. Centralbl. 30, i (1913) 90–94.—*Oligolobos* GAGNEP. Bull. Soc. Bot. Fr. 54 (1907) 542.—*Xystrolobos* GAGNEP. Bull. Soc. Bot. Fr. 54 (1907) 544.—**Fig. 10–12.**

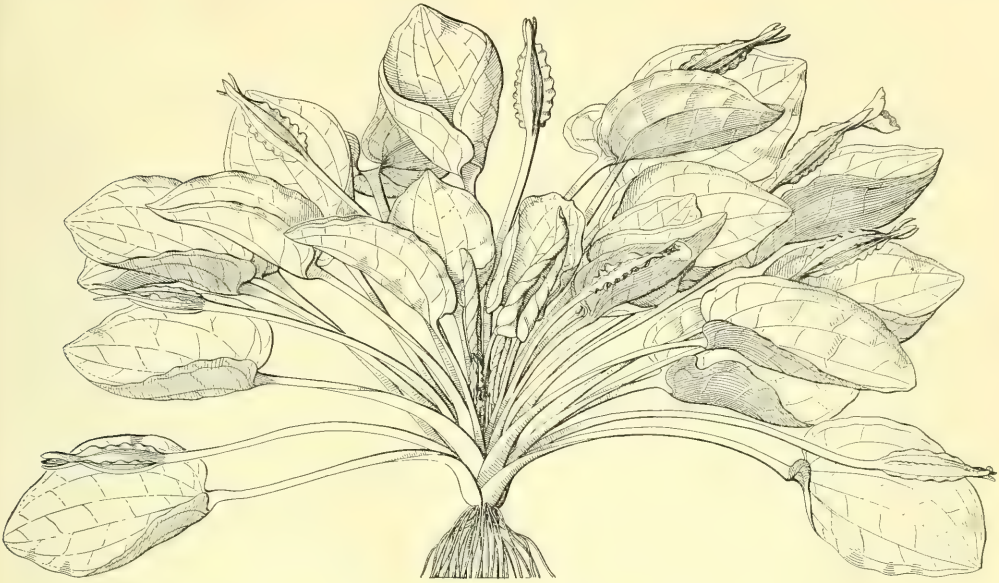

Fig. 10. *Ottelia alismoides* (L.) PERS., × 1/3.

Monoecious or dioecious, glabrous. *Leaves* linear, lanceolate, broad-ovate, suborbicular, cordate or reniform, apex rounded, acute or apiculate, base cuneate, truncate or cordate; nerves 3–11, parallel, straight or curved, connected by fine parallel cross-veins, forming often a very characteristic pattern, midrib sometimes prominent; petiole sheathing at the base, often gradually merging into the blade. *Spathe* peduncled, elliptic or ovate, with 6 more or less prominent ribs or 2–10 wings; ♀ and ⚥ ones 1-flowered, ♂ ones many-flowered. *Flowers* unisexual or bisexual, ♀ and ⚥ ones sessile, ♂ ones pedicelled. *Sepals* 3, linear, oblong or ovate, green with scarious margin, persistent. *Petals* 3, oblong, broad-obovate to orbicular, 2–3 times as long as the sepals, white or coloured. *Stamens* 6–15; filaments filiform, flattened; anthers linear or oblong, latrorsely dehiscent. *Ovary* oblong, narrowed at the top, incompletely divided by the parietal placentas into 6 cells; *styles* 6–15, bifid. (In the ♂ flowers 3 stylodia are present.) *Fruit* oblong, apex attenuate, pericarp thickened. *Seeds* ∞, minute, oblong or fusiform, with rather thick testa.

Distr. About 40 *spp.* almost exclusively distributed in the palaeotropics, extending from Africa through India & SE. Asia to Korea & Japan, *Malaysia* (2 *spp.*), Australia, and New Caledonia, 1 species in Brazil; centres of specific development are found in Central Africa and South China.

Note. I agree with DANDY (J. Bot. 72, 1934, 132–139), that the genera *Boottia*, *Xystrolobos* and *Oligolobos* can not be maintained separate from *Ottelia*. The characters by which these genera were distinguished, *viz* dioecism or the monoecism of the plants, uni- or bisexual flowers, and the number of the flowers in the spathe, though constant for the species, appear to be artificial for grouping of species into genera, subgenera or sections, as by using these characters on the supraspecific level species which are clearly closely allied must be assigned to different genera or infrageneric taxa. DANDY *l.c.* proposed 3 subgenera, based on the structure of the spathe. They are the following:

1. *subg.* **Ottelia** (*Otteliastrum* DANDY). Spathe with 5–10, often very broad wings, sometimes more or less obsolete, and then sometimes difficult to distinguish from *subg. Boottia.*

2. *subg.* **Dipteron** DANDY. Spathe with 2 opposite wings.

3. *subg.* **Boottia** (WALL.) DANDY. Spathe without wings, but more or less prominent ribs are present.

Of the two Mal. species *O. alismoides* belongs to *subg. Ottelia* and *O. mesenterium* belongs to *subg. Boottia.*

In *O. ovalifolia* (R.BR.) RICH. which occurs in New Caledonia and Australia, but has not yet been found in Malaysia, Mrs ERNST-SCHWARZENBACH (Phytomorph. 6, 1956, 296–311) has described the occurrence of cleistogamous flowers.

KEY TO THE SPECIES

1. Leaves broad-ovate or suborbicular with cordate or truncate base, sometimes lanceolate, transparent. Spathe 1-flowered, 5–10-winged. Flowers bisexual, sessile. Stamens 6(–9) . . . . **1. O. alismoides**

1. Leaves linear, strongly crisped. Spathe with 6 entire ribs, ♀ ones 1-flowered, ♂ ones with up to 10 long-pedicelled flowers. Stamens 12 . . . . **2. O. mesenterium**

1. Ottelia alismoides (L.) PERS. Syn. Pl. 1 (1805) 400; RICH. Mém. Inst. Paris 12, 2 (1812) 27–31, 65, 71, 74, 78, t. 7; BLANCO, Fl. Filip. ed. 1 (1837) 461; ed. 2 (1845) 321; ed. 3, 2 (1878) 230; MIQ. Fl. Ind. Bat. 3 (1856) 240; Suppl. (1861) 259; THW. En. Pl. Zeyl. (1864) 332; F.v.M. Fragm. 6 (1868) 199; MIQ. Illustr. (1870) 55; BTH. Fl. Austr. 6 (1873) 257; HOOK. *f.* Fl. Br. Ind. 5 (1888) 662; ASCHERS. & GÜRKE, E. & P. Pfl. Fam. 2, 1 (1889) 257, f. 190; KOORD. Minah. (1898) 271; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 164; BAILEY, Queensl. Fl. 5 (1902) 1510; HEMSL. J. Linn. Soc. Bot. 36 (1903) 3; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 1 (1907) 5; WINKLER, Bot. Jahrb. 44 (1910) 518; BACKER, Teysmannia 22 (1911) 509; HAYATA, Ic. Pl. Form. 5 (1915) 210; EWART & DAVIS, Fl. North. Terr. (1917) 22; MERR. Sp. Blanc. (1918) 59; MERR. En. Born. (1921) 37; BROWN, Min. Prod. Philip. For. 2 (1921) 247; *ibid.* 3 (1921) 169; RIDL. Fl. Mal. Pen. 4 (1924) 3; BACK. Handb. Fl. Java 1 (1925) 63; MERR. Lingn. Sc. J. 5 (1927) 23; BACK. Onkr. Suiker. (1928) 25, Atlas t. 31; FISCHER, Fl. Pres. Madras 8 (1928) 1398; COERT, Trop. Natuur 23 (1934) 28, f. 13; DANDY, J. Bot. 73 (1935) 216; STEEN. Trop. Natuur 23 (1934) 39; BURK. Dict. 2 (1935) 1614; MERR. & METCALF, Lingn. Sc. J. 17 (1938) 567; TÄCKHOLM & DRAR, Fl. Egypt 1 (1941) 124; MASAMUNE, En. Phan. Born. (1942) 9; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 203, p. 4; ERNST-SCHWARZENBACH, Phytomorph. 6 (1956) 306.—*Ottel ambel* RHEEDE, Hort. Mal. 11 (1692) 95, t. 46.—*Stratiotes alismoides* LINNÉ, Sp. Pl. 1 (1753) 535.—*Damasonium indicum* WILLD. Sp. Pl. 2 (1799) 276; ROXB. Pl. Corom. 2 (1805) 45, t. 185; Bot. Mag. (1809) t. 1201; BL. En. Pl. Jav. 1 (1827) 30; SPAN. Linnaea 15 (1841) 477.—*Damasonium javanicum* BL. En. Pl. Jav. 1 (1827) 30.—*O. ensiformis* BLANCO, Fl. Filip. ed. 1 (1837) 460; ed. 2 (1845) 320; ed. 3, 2 (1878) 229.—*O. javanica* MIQ. Fl. Ind. Bat. 3 (1856) 240; Illustr. (1870) 56; GAGNEP. Fl. Gén. I.-C. 6 (1908) 14.—*O. indica* PLANCH. *ex* DALZ. & GIBS. Bomb. Fl. (1861) 278.—*O. japonica* MIQ. Ann. Mus. Bot. Lugd. Bat. 2 (1866) 271; GAGNEP. Fl. Gén. I.-C. 6 (1908) 13.—*O. condorensis* GAGNEP. Bull. Soc. Bot. Fr. 54 (1907) 543; Fl. Gén. I.-C. 6 (1908) 14, t. I B, 7–12; DANDY, J. Bot. 72 (1934) 138.—*O. philippinensis* OSTENF. Philip. J. Sc. 9 (1914) Bot. 259.—**Fig. 10–11.**

Leaves submerged, often partly emerged, broad-ovate, suborbicular or cordate-reniform, thin, light-green, transparent, margin entire, sometimes dentate, 7–22 by $4^1/_2$–21 cm; base shallowly cordate (basal lobes obtuse) or truncate; apex rounded, obtuse, sometimes apiculate; besides the normal leaves linear phyllodes (7–10 by $^3/_4$–1 cm) and lanceolate leaves with an attenuate apex and the base gradually merging into the petiole are also sometimes present; nerves 7–11, curved, parallel, joining the marginal nerve, connected by cross-veins ascending under an angle of 60–70° and 3–8 mm spaced; these in turn connected by veins of the same order, parallel with the nerves, giving the nervation a rhomboid appearance; rhombs divided into a great number of lesser order by many parallel longitudinal and cross-veinlets; within these little rhombs a very fine reticulum; petiole triangular in cross-section, with longitudinal air-channels, at the base with a broadened pale sheath, sometimes denticulate, 8–50 cm, septations 2–5 mm spaced. Peduncle 4–5-angular, 10–30 cm, in fruit sometimes spirally contracted. *Spathe* elliptic to ovate, with 2 acute tips, glabrous, rarely with seriate tubercles, 1-flowered, $2^1/_2$–4(–6) cm; wings 5–10 of which 2 are more developed than the other ones, up to $^1/_2$–1 cm broad, sometimes, however, obsolete, and only visible as ribs, ± flat or crisped, entire, sometimes denticulate. *Flowers* bisexual, sessile. *Sepals* linear or narrow-oblong, apex obtuse, 1-nerved, 10–16 by 2–4 mm. *Petals* obovate with rounded apex, pure white with yellow-spotted base, rarely yellow, obliquely erect, 20–30 mm. *Stamens* 6(–9); filaments with glandular hairs, 4 mm; anthers linear, yellow, basifix, $3^1/_2$–$4^1/_2$ by $^1/_2$–$^3/_4$ mm. *Pollen grains* densely set with numerous, minute tubercles. *Ovary* 2–4 by $^1/_2$–$^3/_4$ cm; styles 6(–9), from near the base split into 2 unequal, papillose or hairy arms which are often adhering together with the flat sides, 6–10 mm. *Fruit* oblong-elliptic, rostrate, crowned by the sepals, 2–4 cm long, bursting irregularly near the top. *Seeds* ∞, fusiform, 1–2 by $^1/_3$–$^2/_3$ mm.

Distr. Widely distributed, NE. Africa and common in SE. Asia, extending from India eastward to China and Japan, southward throughout *Malaysia* to tropical Australia and the Solomon Isl.; recently found introduced as an alien in the North Italian rice-fields.

Ecol. Common in slow streams and stagnant pools mostly at low altitude but up to 700(–1000 m), often abundant forming a gregarious vegetation on the muddy bottom, going down to $1^1/_2$ m depth. In very shallow water the tops of the leaves are emerged, in deeper water only the flower is emerged (floating) during anthesis. After pollination the flower is (often) submerged again by contraction of the coiling peduncle. It is not certain whether insects play a part by the pollination in this species. *Fl. fr.* Jan.–Dec.

Pollination. Mrs ERNST-SCHWARZENBACH observed that the peduncles often do not reach the surface of the water (Phytomorph. 6, 1956, 306–307), in which case self-fertilization takes place in the closed, submerged flowers. After lowering of the water level such pollinated flowers may occasionally still open.

Morph. & taxon. The species is exceedingly variable in vegetative characters, depending largely on the depth of the water in which it grows. Plants in rather deep water have very large broad-ovate, elliptic-ovate or even suborbicular leaves; in less deep water the leaves are smaller, and in very shallow water they are reduced to 5–10 cm length; in the latter case the leaves are ovate with broad-acute apex and cuneate base, while the spathal wings are rather obsolete; this is the form described as a separate species, *O. japonica*. In running water the leaf shape is also very variable; in slow streams leaves are slightly elongated, but in swift running water they become oblong, lanceolate or even strap-shaped. During development from juvenile to mature plants the leaf shape changes in the following sequence: the initial leaves are linear, they are (gradually) followed by lanceolate leaves, then appear elliptic leaves, and finally the broad ovate ones. I have seen all four types of leaves present on a single individual plant. Sometimes young plants develop flowers before the ovate leaves have been formed. Such a (± precociously flowering) form with only lanceolate leaves has been described by GAGNEPAIN *l.c.* from Indo-China as *O. condorensis*. I have seen similar specimens also from the Malay Peninsula (State of Selangor, Ampang, 26–5–'21, HUME 1350). Such phaenotypic forms have no systematic value.

Uses. According to W. H. BROWN (1921 *a*) the fruit is eaten by children; the petioles and leaf blades are used as vegetable. According to him (1921 *b*) the leaves are used in topicals to cure hemorrhoids. It has been claimed that the plant has rubefacient properties.

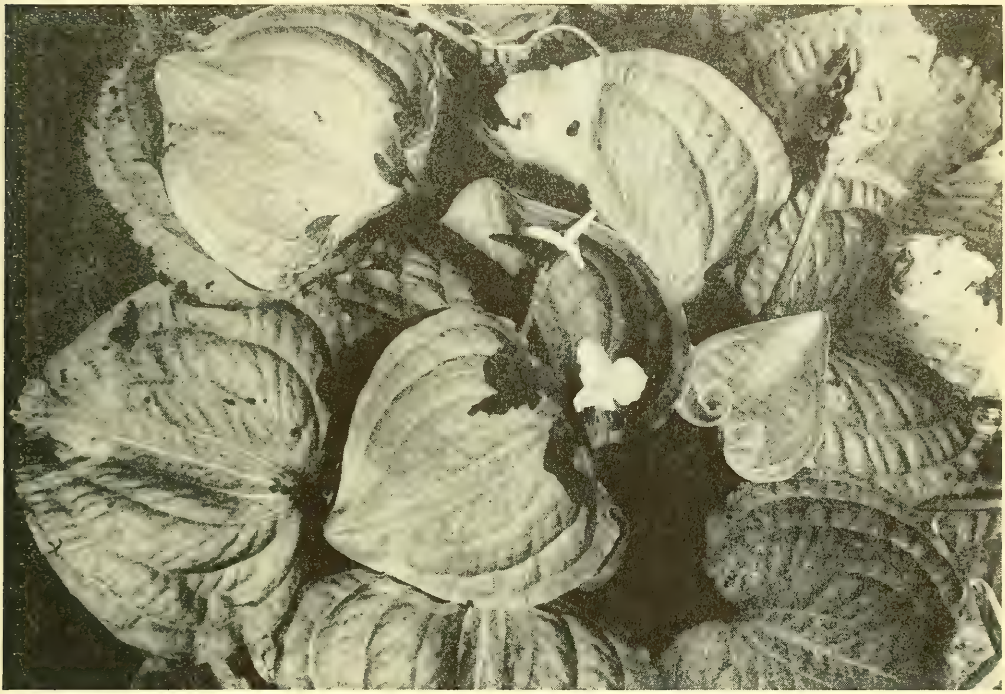

Fig. 11. *Ottelia alismoides* (L.) PERS. in flower and fruit. Kebun Raya Indonesia June 1956 (photogr. F. HUYSMANS).

Vern. *Duikerbloem*, D, *ètjèng hai-hai*, *tjowèhan*, *tjitjikuran*, S, *bengok*, *kĕladi ayĕr*, *kalago*, M, *tundjung birun*, *krangkong*, J, *ganggang*, Borneo, *lawe lawe*, SW. Celebes, *lila lĕlangko*, Tl near Tondano Lake; Philippines: *tangila*, *espada*, Spanish (Philip.), *kalaboa* or *kalabua*, Bulacan & Rizal on Luzon, *lantén-sápa*, Luzon, Bataan, *lanting*, Luzon, Camarines, *tarabang*, Mindoro.

Note. In North Siam and Indo-China a closely related species occurs *viz O. lanceolata* (GAGNEP.) DANDY (*syn. Boottia lanceolata* GAGNEP. & *Boottia alata* GAGNEP.). Because of the vegetative similarity it can only be distinguished in flowering condition by the following characters: dioecious; ♀ spathe 1-flowered, ♂ spathe with many pedicelled flowers; spathes with 6 wings, at the top with 2 obtuse lobes; stamens 9, unequal, the inner ones twice as long as the outer ones, 11–12 mm. This might possibly be found in NW. Malaysia.

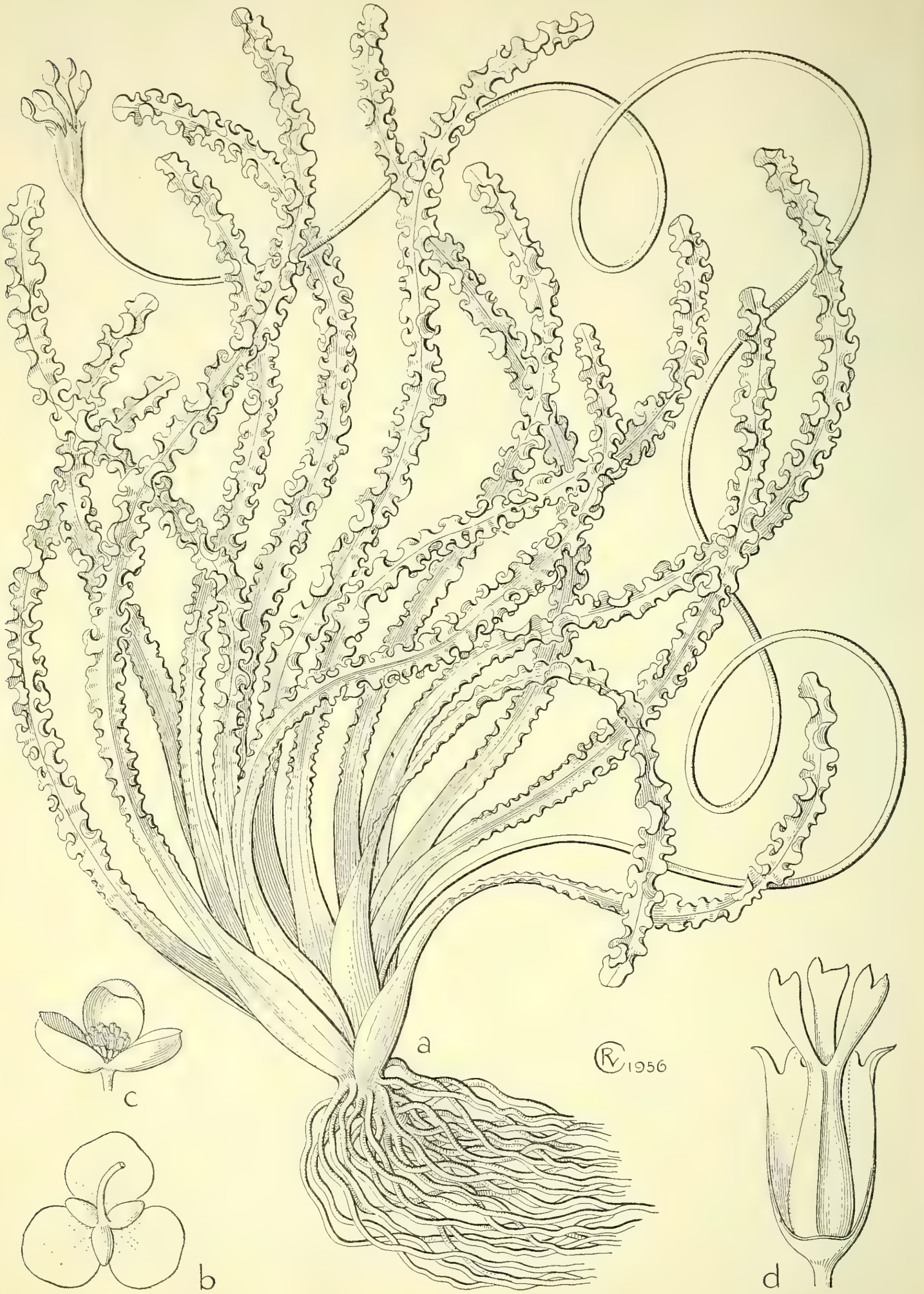

Fig. 12. *Ottelia mesenterium* (HALL. *f.*) HARTOG. *a.* Habit, × 2/3, *b.* ♂ flower, × 2/3, *c.* detail young ♂ bud, petals removed, × 4/3, *d.* ♀ flower, petals removed, × 4/3.

2. Ottelia mesenterium (HALL. *f.*) HARTOG, *nov. comb.—Boottia crispifolia* WARB., *nomen seminudum, ex* SARASIN, Reisen Celebes 1 (1905) 317.—*Boottia mesenterium* HALLIER *f.* Med. Rijksherb. *no* 26 (1915) 7; STEEN. Arch. Hydrobiol. Suppl. 11 (1932) 239.—**Fig. 12.**

Roots simple, cord-like, 1–2 mm thick with constrictions *c.* 1 mm spaced. *Leaves* submerged, long, linear, strongly crisped, glaucous, 15–25 by $^{3}/_{4}$–$1^{1}/_{4}$ cm, gradually decurrent into the petiole and continuing itself as a broad wing on either side of the midrib; margin very fine-serrulate, apex rounded; midrib very thick, broadening towards the base, on either side 1–2 parallel nerves *c.* 1–2 mm distant from the margin, united at the apex, connected by parallel cross-veins, ascending under an angle of 70°–90°, 1–5 mm spaced; petiole sulcate, 10–15 cm, broad, sheathing at the base. Peduncle 50–100 cm, perhaps longer, ribbed, pale green, with longitudinal air-channels. *Spathe* elliptic, $2^{1}/_{2}$–$3^{1}/_{2}$ by 1 cm, with 6 longitudinal, entire ribs, at the top with 6 acute, dentate-serrate lobes. ♀ Spathe with 1 sessile flower, ♂ one with up to 10 pedicelled flowers; pedicels slender, up to 10 cm. *Sepals* elliptic to ovate, convex, obtuse, with 5 nerves, 6–11 by 4–6 mm; those of the female flowers more linear, to 15 mm after anthesis, often split at the top. *Petals* white, obovate, unguiculate, *c.* 3 times as large as the sepals, *c.* 20 mm. *Stamens* 12; filaments 3–4 mm; anthers linear, yellow, bilocular, 2–$2^{1}/_{2}$ by $^{1}/_{3}$–$^{1}/_{2}$ mm. *Stylodia* (in ♂ flower) 3, filiform. *Ovary* lanceolate, gradually narrowing to the top, with 3 conspicuous longitudinal ridges; styles not seen. *Fruit* lanceolate to elliptic, $2^{1}/_{2}$ cm long, with 3 longitudinal ridges and a short acuminate rostrum. *Seeds* fusiform, 2 by $^{1}/_{2}$ mm.

Distr. *Malaysia:* Celebes (Towuti and Matana lakes). Fig. 8.

Ecol. Gregarious in shallow water along the banks of large, deep, ancient lakes, 240–360 m. *Fl. fr.* March–Apr.

Vern. *Tanggula.*

Note. The closest relative of this conspicuous and remarkable plant seems to be *O. crispa* (HAND.-MAZZ.) DANDY, described from the mountains of SW. Szechuan (China), 2600–2800 m. This differs from *O. mesenterium* in having lanceolate to elliptic leaves, 6–10 by $1^{1}/_{2}$–3 cm, with an acute or subcordate base, petiole 6 cm, well set off against the blade, serrate spathal ribs, linear, acute sepals 13 by 2 mm.

The SARASINS mentioned in their narrative a MS-name of WARBURG, whom they had entrusted with their collection of phanerogams; they gave some casual field notes which were not intended (neither by WARBURG nor by the SARASINS) to represent the 'description' of it. As moreover the SARASIN collection is lost in its entirety and HALLIER *f.* gave an ample scientific description in Latin, based on an early TEYSMANN collection of which duplicates are represented in many herbaria, I have found it for scientific reasons not justified to advocate the use of WARBURG's nomen seminudum as a basonym.

7. ENHALUS

L. C. RICH. Mém. Inst. Paris 12, 2 (1812) 64, 71, 74; BENTH. & HOOK. *f.* Gen. Pl. 3 (1883) 454; TROLL, Flora 125 (1931) 427–456.—*Enalus auctt. sphalm.*—**Fig. 13.**

Dioecious, rhizomatous, coarse, marine, submerged plant. *Leaves* few, 2–6, ribbonlike, together enclosed by a flattened, membranous, transparent sheath, apex inaequilateral, faintly serrulate when juvenile; nerves many, parallel, air-channels numerous, septated. ♂ *Inflorescence:* a peduncled spathe consisting of 2 connate blades, the margins of the outer one embracing the inner blade. Flowers small, numerous, pedicelled, on a central stipe, caducous just before anthesis and the mature buds rising to the level of the water. Sepals 3. Petals 3. Stamens 3, alternipetalous; anthers subsessile, 2-locular, latrorsely dehiscing; pollen grains very large. ♀ *Inflorescence* 1-flowered, long-peduncled. Spathe consisting of 2 nearly free blades, one embracing the other with both margins, persistent. Sepals 3. Petals 3. Ovary rostrate, composed of 6 carpels, 1-locular, the 6 parietal placentas far protruding and forming 6 cavities; styles 6, each forked from the base. Ovules ∞, each with 2 integuments, embedded in mucilage. *Fruit* ovate, acuminate. *Seeds* 8–14, obconical, angular, containing starch, embryo containing a large suspensor-cell; the integuments simply stretch so much that they equal the growing embryo; when the fruit is ripe and bursts the testa breaks off around the hypocotyle and remains as a ragged, easily loosened cap on top of the cotyledon.

Distr. Monotypic, Old World tropics from Madagascar as far as Micronesia, Melanesia, and NE. Queensland.

Morph. According to Troll (*vide infra*) ♂ flowers originally cymosely arranged, but through development of accessory buds later irregularly placed and structure difficult to interpret.

1. Enhalus acoroides (L. *f.*) Rich. *ex* Steud. Nom. Bot. ed. 2, 1 (1840) 554; Zoll. Syst. Verz. (1854) 69; Aschers. Linnaea 35 (1868) 158, 175; Nuov. Giorn. Bot. Ital. 3 (1871) 299; Miq. Illustr. (1870) 55; Aschers. in Neumayer, Anl. Wiss. Beob. Reisen ed. 1, 1 (1875) 361; Hemsl. Bot. Chall. 1^3 (1884) 198; Engl. Bot. Jahrb. 7 (1886) 447; K. Sch. Bot. Jahrb. 9 (1887) 193; Aschers. & Gürke in E. & P. Pfl. Fam. 2, 1 (1889) 254; Warb. Bot. Jahrb. 13 (1891) 258; K. Sch. Notizbl. Berl.-Dahl. 2 (1898) 89; Koord. Minah. (1898) 270; K. Sch. & Laut. Fl. Schutzgeb. (1900) 163; Svedelius, Ann. R. Bot. Gard. Perad. 2 (1904) 267–297, t. 24 A, B and 7 fig.; Aschers. in Neumayer, Anl. Wiss. Beob. Reisen ed. 3, 2 (1906) 396; Koord. Exk. Fl. Java 1 (1911) 95; Cunnington, Trans. Linn. Soc. Bot. 7 (1912) 355–371, t. 36; Merr. Int. Rumph. (1917) 84; Sp. Blanc. (1918) 59; Brown, Min. Prod. Philip. For. 2 (1921) 246; Merr. En. Philip. 1 (1925) 27; Back. Handb. Fl. Java 1 (1925) 61; Troll, Flora 125 (1931) 427–456, 15 f.; Steen. Trop. Natuur 22 (1933) 45; Miki, Bot. Mag. Tokyo 48 (1934) 136, f. 3; Burk. Dict. 1 (1935) 924; Guillaumin, Bull. Soc. Bot. Fr. 84 (1937) 257; Ernst-Schwarzenbach, Ber. Schweiz. Bot. Ges. 55 (1945) 61; Guillaumin, Fl. Nouv. Caléd. (1948) 22; Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 203, 3; Steen. Webbia 8 (1952) 434; Zaneveld & Verstappen, J. Sc. Res. 1 (1952) 63.—*Acorus marinus* Rumph. Herb. Amb. 6 (1750) 191, t. 75, f. 2.—*Stratiotes acoroides* Linn. *f.* Suppl. (1781) 268.—*Enhalus koenigi* Rich. Mém. Inst. Paris 12, 2 (1812) 64, 78; Miq. Fl. Ind. Bat. 3 (1856) 237; Suppl. (1861) 259; F.v.M. Fragm. 8 (1874) 219; Hook. *f.* Fl. Br. Ind. 5 (1888) 663; Bailey, Syn. Queensl. Fl. Suppl. 3 (1890) 71; Vorderman, Teysmannia 4 (1893) 705–709; Hook. *f.* in Trim. Fl. Ceyl. 4 (1898) 126; Bailey, Queensl. Fl. 5 (1902) 511; Hemsl. J. Linn. Soc. Lond. Bot. 36 (1903) 3; Ridl. Mat. Fl. Mal. Pen. (Monoc.) 1 (1907) 6; Fl. Mal. Pen. 4 (1924) 4, f. 161; Perrier de la Bâthie, Fl. Madag. fam. 26 (1946) 3, f. I, 1–2.—*Vallisneria sphaerocarpa* Blanco, Fl. Filip. ed. 1 (1837) 780, ed. 2 (1845) 538, ed. 3, 3 (1879) 186.—*Enhalus marinus* Griff. Not. Pl. Asiat. 3 (1851) 175; Thw. En. Pl. Zeyl. (1864) 332.—**Fig. 13.**

Glabrous. Rhizome creeping, up to $1\frac{1}{2}$ cm diam., closely set with cordlike, unramified roots 10–20 cm by 3–5 mm, densely clothed by the persistent fibrous strands of the decayed leaves; air-channels wide, interrupted by *in sicco* prominent 3–4 mm spaced septations. Sheath *c.* 15 cm long. *Leaves* 30–150 by $1\frac{1}{4}$–$1\frac{3}{4}$ cm, with rounded or obtuse apex, often distorted, mostly damaged; nerves 13–19, midrib and intramarginal nerves coarser than the others; *c.* 30–40 air-channels parallel with the nerves, visible outside as a fine striping, with irregularly (4–7 mm) spaced septations; margins thickened by coarse, very tough vascular bundles persistent and nigrescent after the decay of the parenchymatic tissue and remaining attached to the rhizome.—♂ *Peduncle* terete, 5–10 cm, submerged. Spathe broadly ovate-lanceolate, obtuse, 5 by 3 cm, faintly keeled, keel and nerves provided with many long, rough hairs, before anthesis closed, in anthesis gaping at the apex, margins rolled. Pedicels 3–12 mm, unequal, very thin, breaking off *c.* $\frac{1}{3}$–$\frac{1}{2}$ mm below the flowers. *Sepals* clear white, oblong, acute, reflexed, *c.* 2 mm long. *Petals* clear white, ovate, acute, reflexed, broader than the sepals, *c.* $1\frac{3}{4}$ mm long, cuticle very papillose and waxy. *Stamens* white, erect, $1\frac{1}{2}$–$1\frac{3}{4}$ mm long; pollen grains spherical, with very fine-reticulate surface, without intine, 170–175 μ diam.—♀ *Peduncle c.* 40–50 cm, sometimes even longer, after anthesis coiled and contracted, in fruit unrolled again. Spathe oblong-lanceolate, obtuse, strongly keeled, 4–6 by 1–2 cm, keel and nerves with many, long, rough hairs, before anthesis closed, after anthesis gaping at the apex, margins not curled up. *Sepals* reddish, oblong, glabrous, with rounded apex and recurved margins. *Petals* clear white, finally with reddish apex, oblong-linear, 4–5 cm by 3–4 mm, strongly folded but after pollination smooth, with waxy, papillose surface. *Ovary* laterally compressed, densely set with long fringelike hairs; style branches subulate, *c.* 10–12 mm, densely covered with linear papillae except at the tip. *Fruit* ovate, *c.* 5–7 cm, green, lengthwise ribbed, alternating ribs provided with a black, upwards directed hairy fringe continuing in the acuminate apex, irregularly bursting at the apex when ripe. *Seeds* 1–$1\frac{1}{2}$ cm.

Distr. Through the tropical belt of the Indian Ocean (Madagascar, Seychelles, Red Sea, Ceylon, Nicobars, Andamans), common throughout *Malaysia* to the tropical parts of the W. Pacific (Riu-Kiu Isl., Marianes, New Britain, New Ireland, the Solomon Isl., and New Caledonia), and Queensland (Cape York). *cf.* Setchell, Am. Nat. 69 (1935) 562, map.

According to Miki *l.c.* the northern border coincides with the 23° C. February water temperature line.

Ecol. Along shallow sheltered sea-coasts, gregarious and covering large areas with a closed vegetation on sandy and muddy bottoms often mixed with coarser material. The most luxuriant *Enhalus* stands are found in the small depressions on tidal flats between the levels of mean low water and mean low water spring; it goes down, however, to *c.* 4 m depth, flowering only in such places, where it is emerged periodically for a short time during spring-ebb. On reefs it is developed less well. At low tide the leaves lie flabby and nearly exposed on the bottom of shallow pools, all directed seaward by the off-flow of the water. The leaves are mostly covered with a thin film of mud-particles. *Enhalus* is absent from tracts where many rivers debouch into the sea.

Enhalus is associated with other sea-grasses; Troll *l.c.* mentions for example *Halophila ovalis* (see p. 449) as a companion from the Aru Islands. According to Vorderman *l.c.* and Burkill (Gard.

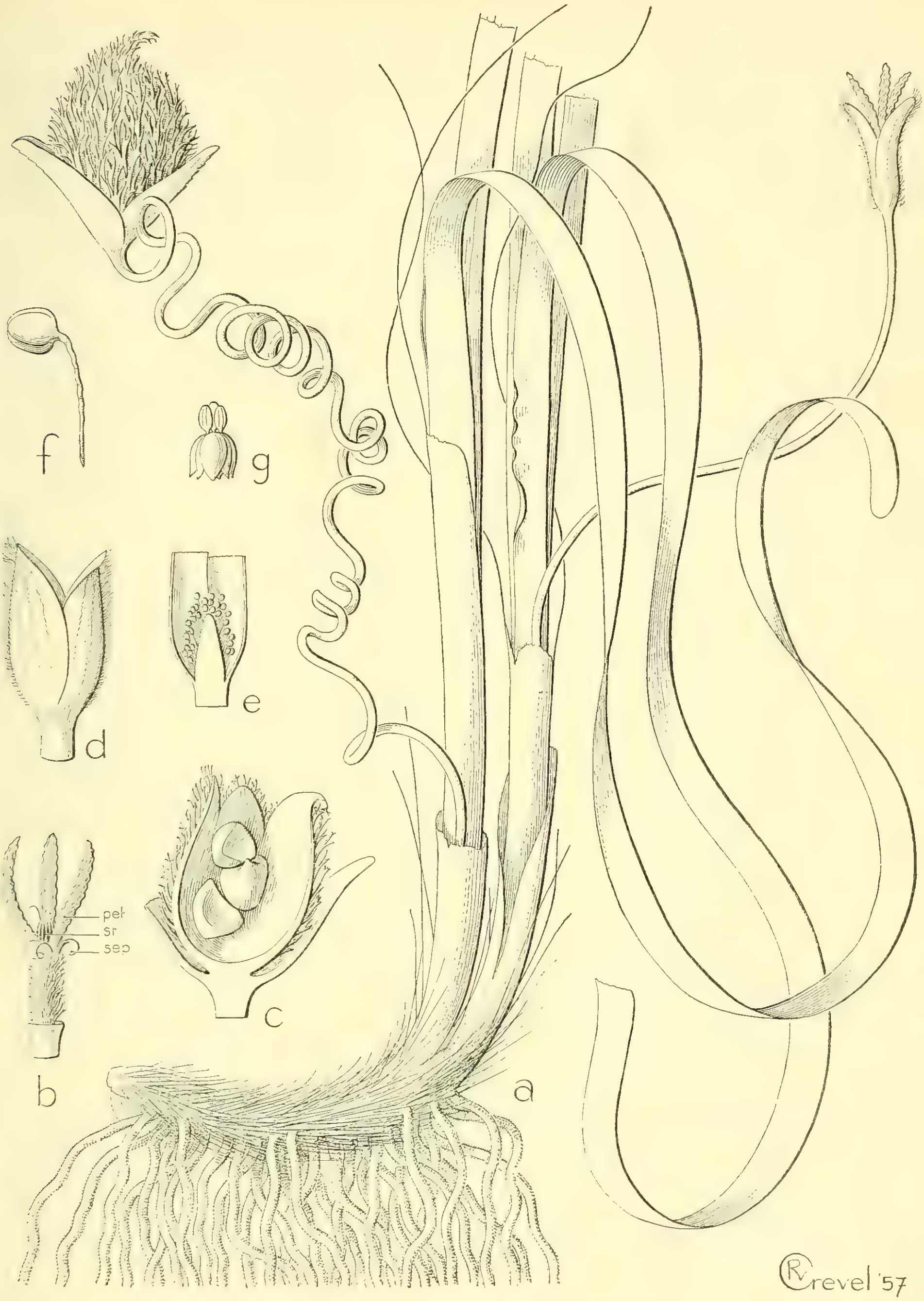

Fig. 13. *Enhalus acoroides* (L.*f.*) RICH. *ex* STEUD. *a.* Habit × 1/2, *b.* ♀ flower, showing *sepals*, *petals*, and *styles*, × 1/2, *c.* longitudinal section of fruit with 3 seeds, × 1/2, *d.* ♂ spathe, × 1/2, *e.* longitudinal section of ♂ spathe with conical receptable and ∞ ♂ flower buds, × 1/2, *f.* ♂ flower bud, × 3 1/2, *g.* opened ♂ flower in drifting position, × 3 1/2 (*a* SINCLAIR 25.11.48, *b–g* after SVEDELIUS *l.c.*).

Bull. S.S. 2, 1918, 444) *Enhalus* is a common food of the manatee *Halicore dujong*; this animal may contribute to the dispersal of *Enhalus*. *Fl. fr.* probably the whole year round.

Flower biology. Of old it was known among fishermen that flowering was periodical and gregarious and coincided with the spring-tides, a few days after new moon and full moon, if these tides occurred during the daytime. Coincidence of sexual reproduction with spring-tides is known to occur in the tropics with several marine animals, *Amphitrite*, *Pecten*, *etc.*, and possibly with some *Algae*.

The remarkable flower biology of *Enhalus*, anthesis and pollination, have been studied in detail by SVEDELIUS, *l.c.* and TROLL, *l.c.* The small ♂ flowers, which occur in great numbers open already in the spathe and during this development the pedicels obviously break. The flowers are liberated only during diurnal low spring-tide, after opening of the spathe. They rise to the surface of the water with the reflexed perianth directed downward and the anthers erect. Through their waxy cuticle the petals are hydrophobous, consequently they crowd together in swarms which move with surface currents and wind.

SVEDELIUS attributed the release of the ♂ flowers to decrease of air-pressure within the ripe bud during the retreat of the sea-water with spring ebb. In TROLL's opinion this reasoning may hold for the opening of the spathe, but it is unlikely that the buds which are enclosed by the latter, are subject to differences in air-pressure causing them to burst. According to TROLL the considerable rise in temperature during low tide, in the *c.* 10 cm deep pools where *Enhalus* abounds, is the decisive factor for the opening of the buds of both the ♂ and ♀ flowers. TROLL could show that the water temperature at spring ebb between 10.00 and 12.00 hours rose from 35,3° C to 39,6° C, that is about 10° C higher than the average water and air temperature in the same place with flood tide. Soil temperatures at 2 cm depth lagged behind about 5° C. It is difficult to prove that the opening mechanism of the flowers is only due to the temperature stimulus, as many factors are changed at exceptionally low tide: the oxygen and carbondioxyde percentages, light intensity, salt concentration, *etc.* Further experiments are needed to single out these separate factors.

When the female flower is in anthesis, the peduncle is sufficiently long to allow the flowers floating on the surface during low water, and during the lowest tide the uppermost part of the peduncle is also on the water surface. By means of the lobes of the spathe the flower is kept floating in a horizontal position *viz* with the axis on a level with the surface. The petals are then extended and float on the surface without being wetted due to the waxy cuticle. As the spathe lobes are more or less strongly recurved they do not prevent the full exposition of the petals. The styles again are not so pushed out, that they are exposed, but are covered both by the basal parts of the petals and by the sepals. By the hydrophobous property of the petals the female flowers 'attract' the free male flowers, and it is often observed, that a drifting female flower is surrounded by numerous males. Pollination can not yet take place, because the styles are covered by the perianth leaves and the anthers rise above the water-level. By rising of the water towards flood the female flowers are submerged; as a result of the surface tension the petals close together catching (sucking in) the male flowers adhering to the margins of the petals.

How pollination takes place within the ♀ flower has not been observed. SVEDELIUS assumed the anthers drop their pollen which is sinking down and can scarcely escape falling upon the styles, which stand vertically and in a circle, owing to the changed position underneath the level of the water. Mrs ERNST-SCHWARZENBACH has given in my opinion a more plausible explanation for the pollination mechanism in assuming the presence of an air-bubble in the submerged ♀ flower due to the hydrophobous quality of the petals covering the styles. Then the pollen can only be transferred by the toppled ♂ flowers within the air-bubble, without touching the water. Free pollen grains, which have been sucked in by the submerged ♀ flowers cannot reach the styles and are of no importance for pollination.

According to SVEDELIUS the pollen grains sink when released in the water, but according to TROLL's observations they are buoyant and can be caught by the female flowers in a similar way as entire flowers.

The embryo which emerges from the fruit is heavier than water; it is sinking down in the mud, where it germinates immediately.

Germination. When the fruit bursts, the exceedingly thin testa also breaks off around the hypocotyl and remains as a ragged easily-loosening cap on top of the cotyledon. Properly the embryo is liberated from the fruit and this represents a form of vivipary. The embryo is heavier than water; it sinks down into the mud and germinates immediately.

Uses. The seeds are edible and RUMPHIUS *l.c.* mentioned their use as food from the Moluccas, VORDERMAN *l.c.* from Bantam (W. Java). The black fibre strands from the leaf margins which persist after the decay of the leaves, are employed in the Moluccas and in New Guinea for making fishing-nets.

Vern. *Latuh*, *latoh*, *djĕlamun*, J, *lamun*, S, *gudir*, Md, *ibusan*, *samoh*, Kangean, *deringu laut*, M, *setul*, Malaya, *buwa setu*, Riouw, *jari amun*, *j. ambun*, Sumatra, *lamu*, Flores, Bima, *bama*, Makasser, *gohungiri*, Halmah. (Tobelo dial.), *gossongi*, *talamut*, Ternate, *lalamut*, Ambon, *lalanuit*, Luku; Philippines: *lamon*, Tag., Bik., *I aai*, Tag., *mariu-bariu*, Bik., *palaipat-baibai*, Ilk., *bariau-bariau*, Kuy.

8. THALASSIA

BANKS *ex* KÖNIG, Ann. Bot. 2 (1806) 96; BTH. & HOOK. *f.* Gen. Pl. 3 (1883) 455; RYDBERG, J. N.Y. Bot. Gard. 10 (1909) 261.—*Schizotheca* EHRENB. [Abh. Berl. Ak. Wiss. 1832, 1 (1834) 429, *nomen*] *ex* SOLMS in Schweinf. Beitr. Fl. Aethiop. 1 (1867) 194, 246; ASCHERS. Linnaea 35 (1868) 159, 177.—**Fig. 14.**

Dioecious, glabrous. Rhizome creeping, terete, consisting of solid parenchymatic tissue with fine longitudinal air-channels; youngest part covered with membranous scales, leaving annular scars. Roots short, not ramified, densely set with fine hairs. *Leaves* 2–6, distichous, close together within a transparent sheath, linear, often somewhat falcate, *in sicco* slightly undulate, with very fine longitudinal air-channels, visible as a very fine parallel striation; parallel with these many short brown dashes; margin entire; base pale; apex rounded, very fine-serrulate; nerves 9–15, parallel, near the apex joining the intramarginal nerves, mutually connected by square cross-veins. Ligule absent. *Inflorescences* peduncled, on the ♂ plants 1–3, on the ♀ plants 1, all 1-flowered. *Spathal* segments of the ♂ plants only on one side connate, those of the ♀ plants on both sides. ♂ *Flowers* on short pedicels, ♀ flowers subsessile. *Perianth* segments 3, elliptic. *Stamens* 3–12, nearly sessile, light yellow, anthers oblong, erect, 2–4-celled, latrorsely dehiscent. Pollen grains sphaerical, yellow, embedded in a gelatinous mass which later becomes a sort of moniliform chain, germinating already before having reached the stigmas of the ♀ flower.

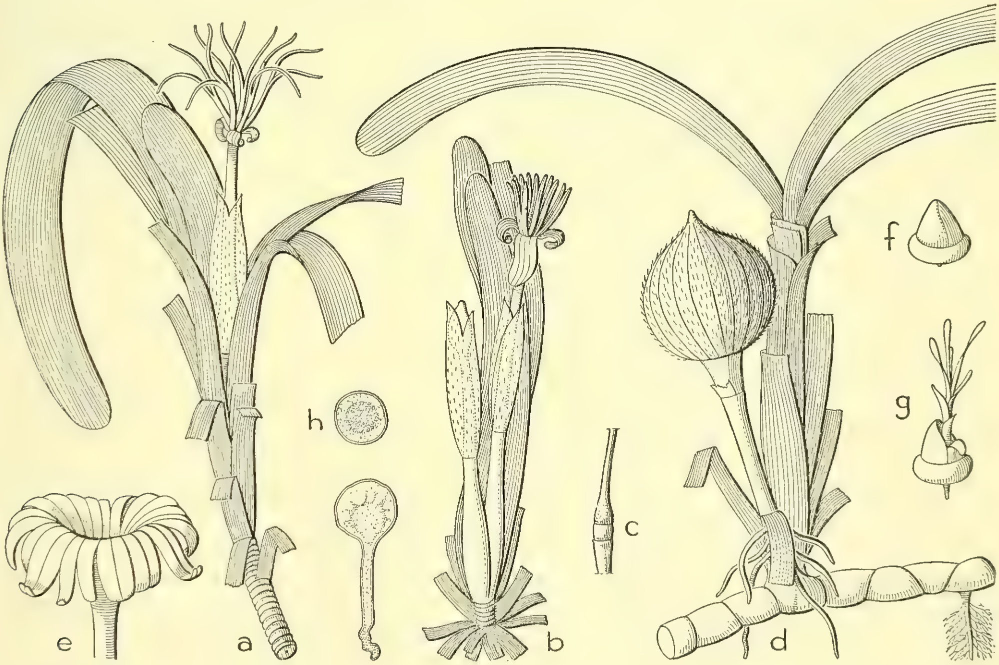

Fig. 14. *Thalassia hemprichii* (EHRENB.) ASCHERS. *a.* Habit ♀ plant, nat. size, *b.* habit ♂ plant bearing 2 flowers, one in anthesis, nat. size, *c.* portion of pistil after fertilization, pedicel articulate below ovary, *d.* ♀ plant with mature fruit, nat. size, *e.* stellately split pericarp of mature fruit, nat. size, *f.* seed, nat. size, *g.* seedling 3 weeks old, nat. size, *h.* mature pollen grain, × 100, *i.* germinated pollen grain, × 100 (after PASCASIO & SANTOS).

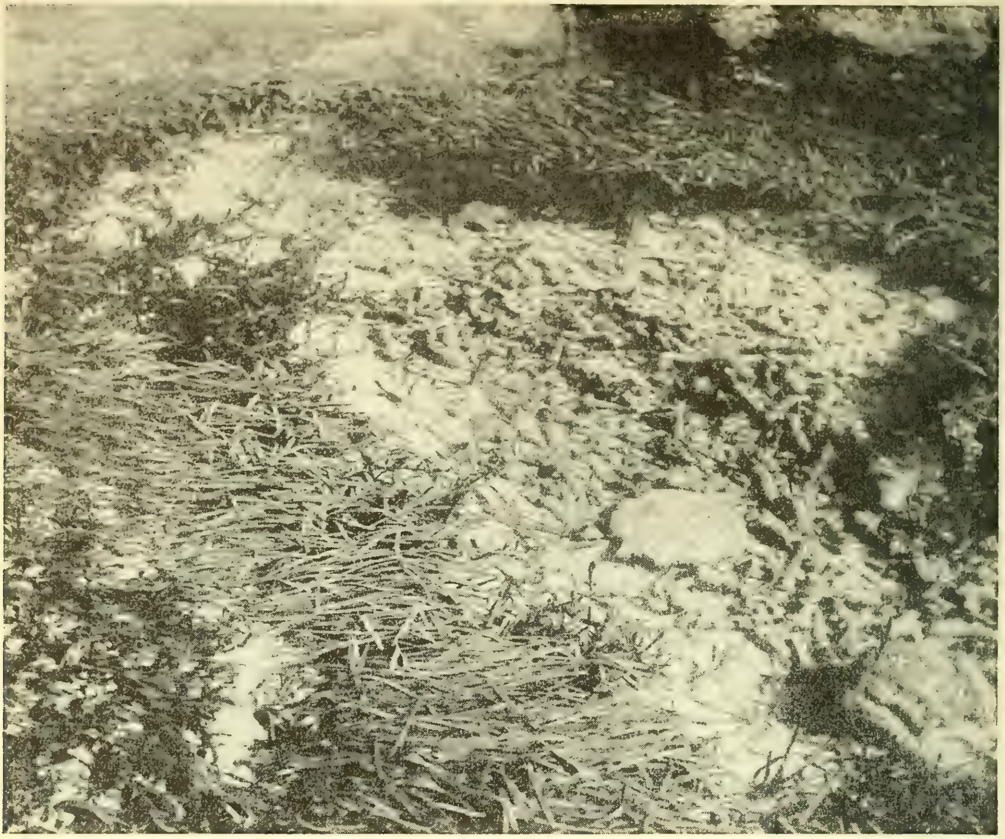

Fig. 15. Stagnant shallow pool *c.* 1 m diam. filled at ebb tide with crystal-clear sea-water, bottom with dead coral fragments; edge of the pool fringed with floating *Thalassia* leaves directed more or less towards the centre of the pool. Udjung Genteng, S. Java.

Ovary softly echinate, 1-celled or imperfectly more-celled, with a rather long, partly persistent rostrum; styles 6–12. *Fruit* globose or elliptic, softly echinate, beaked, the fleshy pericarp bursting with a number of stellately spreading valves. *Seeds* few, conical with a thickened basal portion, the conus corresponding with the cotyledon, the broadened base with the radicle (fig. 14 f); testa thin, fugacious; albumen 0.

Distr. Two closely allied species, one in the tropical parts of the Indian Ocean and the western Pacific, the other in the West Indies.

Notes. Species of *Thalassia* show a marked vegetative resemblance with the *Cymodocea spp.*, but are easily distinguished by the absence of a ligule.

1. Thalassia hemprichii (EHRENB.) ASCHERS. in Petermann's Mitt. 17 (1871) 242; Bot. Zeit 33 (1875) 765; in Neumayer, Anl. Wiss. Beob. Reisen ed. 1, 1 (1875) 361; ENGLER, Bot. Jahrb. 7 (1886) 447; K. SCH. Bot. Jahrb. 9 (1887) 193; ASCHERS. & GÜRKE in E. & P. Nat. Pfl. Fam. 2, 1 (1889) 254, f. 188; HOOK. *f.* in Trim. Fl. Ceyl. 4 (1898) 127; K. SCH. Notizbl. Berl.-Dahl. 2 (1898) 89; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 163; HEMSL. J. Linn. Soc. Bot. 36 (1903) 3; ASCHERS. in Neumayer, Anl. Wiss. Beob. Reisen ed. 3, 2 (1906) 397; MERR. Fl. Manila (1912) 71; Philip. J. Sc. 10 (1915) Bot. 2; En. Philip. 1 (1925) 27; BACK. Handb. Fl. Java 1 (1925) 62; PASCASIO & SANTOS, Bull. Nat. & Appl. Sc. Philip. 1 (1930) 1–19, 5 pl.; STEEN. Trop. Natuur 22 (1933) 45, f.f.; MIKI, Bot. Mag. Tokyo 48 (1934) 136, f. 4; GUILLAUMIN, Bull. Soc. Bot. Fr. 84 (1937) 257; TÄCKHOLM & DRAR, Fl. Egypt 1

(1941) 125; Guillaumin, Fl. Nouv. Cal. (1948) 22; Back. Bekn. Fl. Java (em. ed.) 10 fam. 203 (1949) 4; Steen. Webbia 8 (1952) 435; Zaneveld & Verstappen, J. Sc. Res. 1 (1952) 63; Sinclair, Gard. Bull. Sing. 14 (1953) 35; Dawson, Pac. Sc. 8 (1954) 377, f. 2g; Sinclair, Gard. Bull. Sing. 15 (1956) 27, f. 3.—*Schizotheca hemprichii* Ehrenb. Abh. Berl. Ak. Wiss. 1832, 1 (1834) 429; *ex* Solms in Schweinf. Beitr. Fl. Aethiop. (1867) 194; Aschers. Linnaea 35 (1868) 159.—**Fig. 14.**

Roots with longitudinal air-channels, septations *c.* 1¾ mm spaced; some roots erect, with thickened top. *Leaves* 10–40 cm by 4–11 mm. Male plants with 1–2 inflorescences; peduncles in the ♂ plants *c.* 3 cm, those in the ♀ plants 1–1½ cm, after anthesis elongating to 2–4 cm. *Spathal* segments lanceolate, acute (apices unequal in size), entire, persistent (according to Hook. *f.* in Trimen *l.c.* caducous), 2–2½ by ½ cm, with many short, brown dashes. *Pedicels* of the ♂ flowers 2–3 cm; ♀ flowers subsessile, after anthesis very shortly pedicelled. *Perianth* segments revolute, light brown, 7–8 by 3 mm. *Stamens* 3–12; anthers oblong, occasionally forked, 7–11 by 1–1¼ mm; pollen grains 20–33 µ. *Ovary* conical, 1 cm, its rostrum 2–3 cm; styles 6, at ⅓ from the base split into 2 filiform arms, each on the underside with 2 longitudinal grooves, light brown, after anthesis curling and caducous, 1½–2 cm. *Fruit* globose, rugose, light-green, bursting open with *c.* 20 valves, 2–2½ by 1¾–3¼ cm. *Seeds* 3–9, 8 by 8 mm, the thickened basal portion dark-brown; cotyledon greenish.

Distr. Through the entire tropical region of the Indian Ocean (E. Africa, Seychelles, Red Sea, Ceylon, Andamans, and Cocos Isl.) throughout *Malaysia* to the West Pacific (Riu-Kiu Isl., Indo-China, New Ireland, New Hanover, New Britain, New Caledonia, and Queensland). *cf.* Setchell, Am. Nat. 69 (1935) 563, map.

The northern border coincides, according to Miki *l.c.* with the February water isotherm of 21° C.

Ecol. Common on muddy coral-sand in sheltered, shallow bays, also in pools on tidal flats in open bays, where ocean currents and wave action are not so strong. It forms together with other sea-grasses extensive submarine meadows, wherein it sometimes predominates, *e.g.* at Honduras Bay (Mindoro); there it lives, according to Pascasio & Santos, *l.c.*, together with 6 other sea-grasses, *viz Halophila ovalis*, *H. spinulosa*, *Enhalus acoroides*, *Cymodocea serrulata*, *C. rotundata*, and *Diplanthera uninervis*. It occurs from low watermark, where at ebb-tide it sometimes falls dry, to 5 m depth, depending on the lucidity of the water, but below 3½ m depth it does not form a closed vegetation, and is replaced as dominant species by sterile *Enhalus acoroides*. After storms and in certain monsoons the leaves are often washed ashore in large quantities.

The fruit of *Thalassia hemprichii* ripens below the water surface, and has no buoyancy capacity and it is supposed to be only slowly dispersed by sea currents. As uprooted or otherwise detached plants and shoots soon die, they obviously contribute little to dispersal. Marine mammals and fishes, which feed on the young leaves and fruits, possibly play a role in the dispersal.

The seeds of *Thalassia hemprichii* seem to require a long resting period before they germinate and growth of the seedling is rather slow.

Fl. Dec.–Febr., rarely in other months; *fr.* March–Apr. In Malaysia anthesis is rather rarely observed.

Taxon. The West Indian species, *Th. testudinum* Banks *ex* König, is closely related to *Th. hemprichii*, but differs in some important respects: spathe oblong, with rounded apex and serrulate margin; perianth segments 1 cm long, truncate, and often slightly toothed at the apex; styles 9–12, undivided; fruits elliptic, bursting with 6 valves.

Vern. *Turtle grass*, E, *pama lamun*, M, *isay*, Tag.

Note. If there are two ♂ flowers they do not flower at the same time. The description of the flowers and the fruits has partly been copied from Pascasio & Santos, *l.c.*

9. HALOPHILA

Du Petit-Thouars, Gen. Nov. Madag. 2 (1808) 2; Bth. & Hook. *f.* Gen. Pl. 3 (1883) 455; Balfour, Trans. Proc. Bot. Soc. Edinb. 13 (1879) 336; Solereder, Beih. Bot. Centralbl. 30, i (1913) 43–47.—*Barkania* Ehrenb. Abh. K. Ak. Wiss. Berl. Ph. Kl. 1832, 1 (1834) 429, *nomen.*—*Lemnopsis* Zoll. Syst. Verz. 1 (1854) 74–75; *non* Zipp. 1829, *nomen.*—**Fig. 16–19.**

Monoecious or dioecious. *Stems* creeping, ramified, rooting at the nodes with 1, rarely more unramified roots closely set with fine root-hairs. At the nodes 2 *scales*, one embracing the stem, the other embracing a lateral, often undeveloped shoot, which bears the leaves (rarely with 2 scales below these leaves). *Leaves* opposite, sessile or petioled, linear, lanceolate, oblong-elliptic or ovate, entire or serrulate, rarely hairy; nerves 3, a midrib and on both sides an intramarginal nerve, almost always connected by cross-veins; between the leaves a new shoot appears which again bears scales and 1 or more pairs of leaves, and the inflorescence. *Spathe* sessile, composed of 2 membranous free bracts, one embracing the other, elliptic, obovate to suborbicular, acute, rounded to emarginate or indented, keeled, keel sometimes serrulate; margin entire, rarely ciliate or serrulate. *Flowers* unisexual, solitary, rarely 1 or more ♂ and one ♀ flower in one spathe.—*Male flower* pedicelled; perianth segments 3, imbricate; stamens 3, alternating with the tepals, anthers sessile, 2–4-celled, dehiscent extrorsely; pollen grains in long chains.—*Female flower* sessile, or almost so. *Ovary* elliptic or ovate, 1-celled, at the apex with a long beak crowned by the 3 reduced tepals, styles linear, (2–)3–5. *Fruit* ovate, rostrate, 1-celled; wall membranous. *Seeds* few to numerous, globose or subglobose.

Distr. Consisting of 9 *spp.*, distributed along the coasts of E. Africa & Madagascar, S. & E. Asia to Japan, via Malaysia to the Australian coasts and in the SW. Pacific eastwards to Tahiti, further in the West Indian seas. The majority of the species is found in the Indo-Malaysian area where 5 *spp.* are recorded; 2 others are limited to the western part of the Indian Ocean, while 3 *spp.* occur in the Caribbean, 2 of which are endemics.

Taxon. Although the genus comprises only 9 *spp.*, they show great differences in vegetative structure. Therefore ASCHERSON and OSTENFELD[1] divided the genus in 4 sections or groups, here accepted as sections:

1. *sect.* **Halophila.**—*Sect. Barkania* (EHRENB.) ASCHERS. Nuov. Giorn. Bot. Ital. 3 (1871) 301.—*Typicae* OSTENF. Bot. Tidsskr. 24 (1902) 240; Pflanzenareale 1, 3 (1927) 37.—Lateral shoot short, 1 cm or smaller, often not developed, with only 1 pair of leaf blades at the top. 5 *spp.* (*H. ovalis*, *H. minor*, *H. decipiens*, *H. linearis* HARTOG, *H. stipulacea*). The area of this section coincides with the area of the genus.

2. *sect.* **Microhalophila** ASCHERS. Nuov. Giorn. Bot. Ital. 3 (1871) 302.—*Pusillae* OSTENF. Bot. Tidsskr. 24 (1902) 240; Pflanzenareale 1, 3 (1927) 37.—Lateral shoot 1–2 cm, with 6–10 leaf blades at the top, petiole with a broad sheath. 1 *sp.* (*H. beccarii*).

3. *sect.* **Aschersonia** HARTOG, *sect. nov.*—*Spinulosae* OSTENF. Bot. Tidsskr. 24 (1902) 240; Pflanzenareale 1, 3 (1927) 37 *p.p.*—Lateral shoot long, with 15–20 pairs of sessile, distichous leaves. 1 *sp.* (*H. spinulosa*). *Ramuli foliis 10–20 paribus, folia sessilia, disticha.*

4. *sect.* **Americanae** (OSTENF.) OSTENF. Pflanzenareale 1, 3 (1927) 37; Bot. Tidsskr. 24 (1902) 240.—Lateral shoot halfway or higher up with 2 scales and at the top 2 or 3 pairs of pseudoverticillate leaves. 2 *spp.* (*H. baillonis* ASCHERS. and *H. engelmanni* ASCHERS., both confined to the West Indies).

KEY TO THE SPECIES

1. Lateral shoot with at most 5 pairs of petioled leaves at the apex.

  2. Lateral shoots short, 1 cm or smaller, often not developed, with only one pair of leaves; petiole not or unequal-sided sheathing; midrib joining the intramarginal nerve, cross-veins present.

    3. Scales up to 8 mm long, leaves ovate or elliptic. Petiole not sheathing.

      4. Lateral shoots scarcely or not developed, glabrous. Leaf margin entire. Dioecious.

        5. Leaf blades 10–40 mm, with 12–25 pairs of cross-veins at an angle of 45–60° . **1. H. ovalis**

        5. Leaf blades 7–14 mm, with 3–8 pairs of cross-veins at an angle of 70–90° . . **2. H. minor**

      4. Lateral shoots $^{1}/_{2}$–10 mm, hairy. Leaf margin serrulate. Monoecious . . . **3. H. decipiens**

    3. Scales large, 12–17 mm, bright white, leaves linear. Petiole unequal-sided sheathing **4. H. stipulacea**

  2. Lateral shoots longer, 1–2 cm, with 6–10 leaf blades at the top; petiole with a broad sheath; midrib crossing the intramarginal nerve, reaching the apical margin; cross-veins absent . **5. H. beccarii**

1. Lateral shoots with 10–20 pairs of sessile distichous leaves . . . . **6. H. spinulosa**

1. Halophila ovalis (R.BR.) Hook. *f.* Fl. Tasm. 2 (1858) 45; ASCHERS. Linnaea 35 (1868) 173; Nuov. Giorn. Bot. Ital. 3 (1871) 301; in Neumayer, Anl. Wiss. Beob. Reis. ed. 1, 1 (1875) 367; Bot. Zeit. 33 (1875) 764; BENTH. Fl. Austr. 7 (1878) 182; BALFOUR, Trans. Proc. R. Soc. Edinb. 13 (1879) 290, pl. 8, 9 f. 11–13, 17; 10 f. 27–31; 11 f. 33–36, 40–41, 43–56; 12 f. 57–60, 62–89; F.-VILL. Nov. App. (1882) 298; BOISS. Fl. Orient. 5 (1882) 2, *incl. var.* β *major* (ZOLL.) BOISS.; HEMSLEY, Bot. Chall. 1^3 (1884) 198; ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 249, f. 182; WARBURG, Bot. Jahrb. 18 (1893) 185; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 163; BAILEY, Queensl. Fl. 5 (1902) 1512; OSTENF. Bot. Tidsskr. 24 (1902) 260; ASCHERS. in Neumayer, Anl. Wiss. Beob. Reis. ed. 3, 2 (1906) 395; MAKINO, Bot. Mag. Tokyo 26 (1912) 209; DOMIN, Bibl. Bot. 85, 1 (1915) 255; MERR. Philip. J. Sc. 10 (1915) Bot. 2; OSTENF. Dansk Bot. Ark. 2, 6 (1916) 38; MERR. En. Philip. 1 (1922) 26; BACK. Handb. Fl. Java 1 (1925) 58; OSTENF. Pflanzenareale 1, 3 (1927) 37, map 23; PASCASIO & SANTOS, Nat. Appl. Sc. Bull. Un. Philip. 1 (1930) 4; STEEN. Trop. Natuur 22 (1933) 45, f. b; MIKI, Bot. Mag. Tokyo 48 (1934) 138, f. 5, 6; SETCHELL, Am. Nat. 69 (1935) 564, map; GUILLAUMIN, Bull. Soc.

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(1) OSTENFELD (1902) distinguished 'Abschnitte' and not sections.

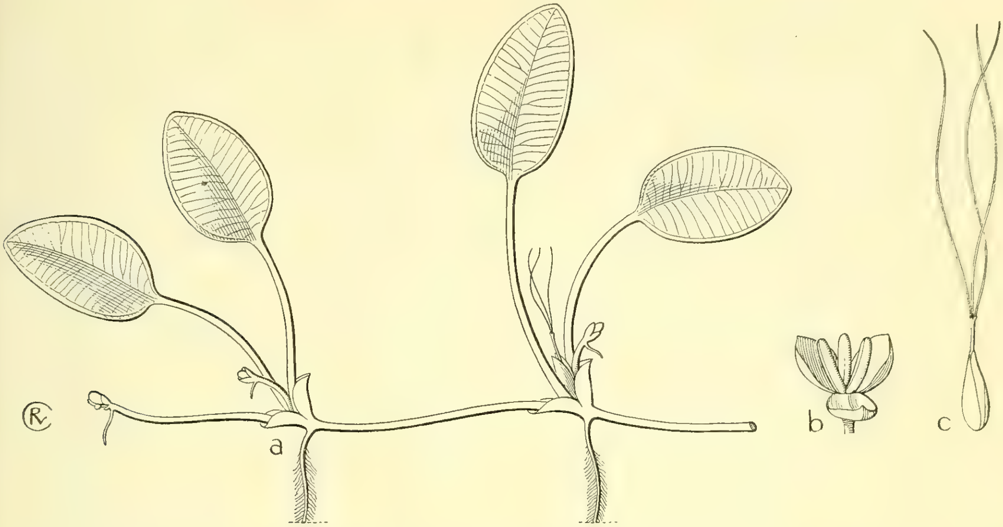

Fig. 16. *Halophila ovalis* (R.Br.) Hook. *f. a.* Habit, nat. size, *b.* ♂ flower, *c.* ♀ flower, × 3 (*a* Westenberg 5, *b–c* after Balfour *l.c.*).

Bot. Fr. 84 (1937) 257; Täckholm & Drar, Fl. Egypt 1 (1941) 123; Guillaumin, Fl. N. Caléd. (1948) 22; Back. Bekn. Fl. Java (em. ed.) 10, fam. 203 (1949) 2; Steen. Webbia 8 (1952) 434; Zaneveld & Verstappen, J. Sc. Res. 1 (1952) 63; Dawson, Pac. Sc. 8 (1954) 376, f. 1 d–f.—*Caulinia ? ovalis* R.Br. Prod. Fl. Nov. Holl. 1 (1810) 339.—*H. ovata* (*non* Gaud.) Aschers. Sitz. Ber. Ges. Naturf. Freunde 1867 (1868) 3; F.v.M. Fragm. 8 (1874) 219; Hook. *f.* Fl. Br. Ind. 5 (1888) 663; in Trimen, Fl. Ceyl. 4 (1898) 128; Ridl. Mat. Fl. Mal. Pen. (Monoc.) 1 (1907) 6; Gagnep. Fl. Gén. I.-C. 6 (1908) 2, f. 1; Ridl. Fl. Mal. Pen. 4 (1924) 4; Troll, Flora N.F. 25 (1931) 427; Perrier de la Bâthie, Fl. Madag. fam. 26 (1946) 4, f. I, 3–5.—*Kernera ? ovalis* Schult. Syst. Veg. 7 (1829) 170.—*Lemnopsis major* Zoll. Syst. Verz. 1 (1854) 75.—*H. major* Miq. Fl. Ind. Bat. 3 (1856) 230.— *H. euphlebia* Makino, Bot. Mag. Tokyo 26 (1912) 208.—**Fig. 16.**

Dioecious. *Stems* thin, easily breaking; at the nodes one, sometimes more roots; internodes 1–5 cm. *Scales* transparent, suborbicular or obovate, convex or doubled, faintly keeled, apex emarginate, base more or less auricled, 3–8 mm. *Leaves* oblong-elliptic to ovate, glabrous, 1–4 by ½–2 cm; apex rounded, base obtuse, truncate, rounded or acute; margin entire, only 1 pair on a scarcely or not developed shoot; cross-veins 12–25 pairs ascending at an angle of 45–60°, joining the intramarginal nerve, very thin, near the base often forked; midrib at the top united with the intramarginal nerves; petiole 1–4½ cm. *Spathe* broadly lanceolate, acute, 3–5 mm. *Male flower:* perianth segments elliptic, spreading, convex, transparent, white with a dark stripe in the middle, obtuse or faintly apiculate, 4 by 2 mm, pedicel 1 cm. Anthers oblong, 2–4-celled. *Female flower:* ovary ovate, 1–1½ mm, beak 3–3½ mm, styles 3, 13–17 mm. *Fruit* globular, 3–4 mm; wall membranous, beak 3 mm. *Seeds* 20, subglobose, 1 mm; testa tuberculate and reticulate.

Distr. From the coasts of E. Africa & Madagascar through the entire Indian Ocean and Red Sea, through Malaysia as far as Samoa, Tonga and Tahiti, and the Sandwich Isl. southwards to S. Australia and Tasmania, northwards to Japan, according to Miki *l.c.* as far as the February water isotherm of 10° C at 37° N. Lat.; in *Malaysia* widely distributed: Malaya (States of Kedah and Perak, Singapore), Philippines (Palawan, Bancoran, Biliran, Mindoro, Cebu, Zamboanga), Riouw Arch., Java (Krakatau, islands near Djakarta, Bondowoso, Kangean Islands), Lesser Sunda Islands (Bali, Sumbawa, Flores, Timor), Celebes (Biaro, Kendari), Moluccas (Aru & Key Isl.), and New Guinea (Sorong, Kelana, Boniara).

Ecol. In sheltered localities on sandy as well as on muddy bottoms in which the plants may often be buried almost completely, also on coral-reefs, mostly gregarious. During low water some specimens may come into contact with the air, others going down as far as 5 m below the lowest ebb-mark. The species is well tolerant against pollution of the water; from such waters we even know very luxurious specimens. *H. ovalis* is mostly accompanied by other sea-grasses, *e.g. Enhalus acoroides, Thalassia hemprichii* or *Diplanthera uninervis. H. ovalis* is the only hydrocharitaceous sea-grass which occurs far beyond the tropics on both the S. and N. hemispheres. In the temperate S. Australian waters it reproduces exclusively vegetatively. From Japan, where it reaches the 10° C February water isotherm only female flowers are known, but also seeds (Miki *l.c.*). Possibly the reproduction is (only here?) parthenogenetical. Setchell (Bull. Torr. Bot. Cl. 47, 1920, 570–571) assumes that in these temperate regions sexual reproduction occurs, but only during that part of the year when the temperature of the coastal water is high enough for flowering and fruiting. Also in the tropics anthesis takes place rarely: nearly all Malaysian material I have examined was sterile. *Fl. fr.* Sept.–Oct. (BALFOUR *l.c.*).

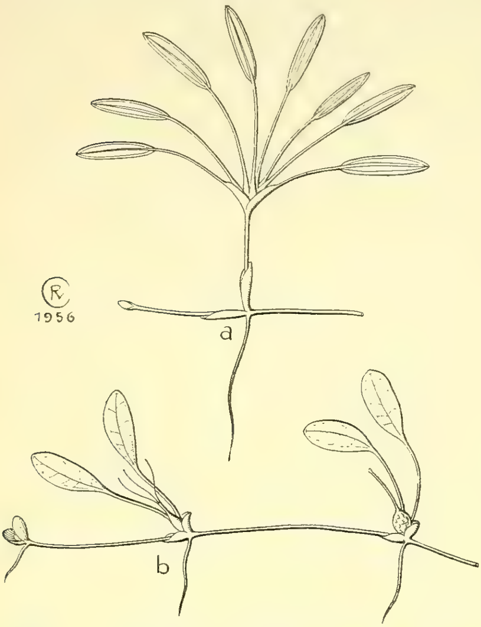

Fig.17. *a. Halophila beccarii* ASCHERS., nat. size (MERRILL vii–1911), *b. Halophila minor* (ZOLL.) HARTOG, nat. size (MERRILL 1098).

Note. Closely allied to *H. minor* from which it is easily to distinguish by the larger size, the greater number of cross-veins, and their smaller angle with the midrib.

In the Firenze Herbarium there is a collection labelled 'Insulae Sandwich GAUDICHAUD 1839'. This is apparently the first record from Hawaii; the species has not been mentioned in HILLEBRAND's Flora of Hawaii, but SETCHELL mapped it to occur there.

2. Halophila minor (ZOLL.) HARTOG, *nov. comb.*—*H. ovata* GAUD. in Freycin. Voy. Bot. (1829) 430, t. 40 f. 1, *nomen illegitimum, excl. syn. Caulinia ovalis* R.Br.; OSTENF. Philip. J. Sc. 4 (1909) Bot. 67–68; MERR. Fl. Manila (1912) 70; En. Philip 1 (1925) 26; OSTENF. Pflanzenareale 1^3 (1927) 37, 38, map 23; FISCHER, Fl. Pres. Madras 8 (1928) 1398; STEEN. Trop. Natuur. 22 (1933) 46, f. c; SETCHELL, Am. Nat. 69 (1935) 564, map; STEEN. Webbia 8 (1952) 434.—*H. ovalis* α *ovata* BALFOUR, Trans. Bot. Soc. Edinb. 13 (1878) 335.—*Lemnopsis minor* ZOLL. Syst. Verz. 1 (1854) 75.—*H. lemnopsis* MIQ. Fl. Ind. Bat. 3 (1856) 230.—**Fig. 17b.**

Dioecious. *Stems* thin, easily breaking, with 1 root at the nodes, internodes 1–3 cm. *Scales* transparent, convex or folded, suborbicular to transversely elliptic, acute, rounded or emarginate at the apex, auricled at the base, 2–4 mm. *Leaves* oblong-elliptic to ovate, obtuse or sometimes pointed at the apex, base obtuse or shortly cuneate and acutely decurrent into the petiole, entirely glabrous, translucent-green, 7–14 by 3–5 mm, only 1 pair on a scarcely or not developed shoot; cross-veins 3–8(–11) pairs ascending at an angle of 70–90°, joining the intramarginal nerve; midrib united at the top with the intramarginal nerves; petiole terete, ½–2 cm. *Spathe* obovate to suborbicular, apex acute to acuminate, keeled, transparent, 2½–3 mm. *Male flower* unknown. *Female flower:* ovary ovate, 1½–2 mm, beak 2–5 mm; styles 3, 6–11 mm. *Fruit* elliptic, ovate to globose 2–4 mm; pericarp membranous; beak 2–6 mm. *Seeds* ± 20, subglobose, brown-yellow, ½ mm.

Distr. SE. Asia, from W. India (Madras) to the Gulf of Siam and through Malaysia to the western Pacific Islands (Marianes); in *Malaysia* rare, but widely distributed: Malay Peninsula (Singapore), Riouw Arch., Philippines (Luzon: Manila Bay), Lesser Sunda Islands (Flores), S. Celebes (Salayer), Moluccas (Ambon), New Guinea (Geelvinkbaai, Wariap, Sorong). This species has not yet been found in Java or adjacent islets; BACKER's record (Bekn. Fl. Java 10, 1949, fam. 203, p. 2) was based on a wrongly identified specimen of *H. decipiens.*

Ecol. Growing in sheltered localities on sandy bottoms, often very abundant, quite exposed at low tide. Obviously an annual plant disappearing after having fruited. Sometimes associated with other sea-grasses, specially with *Diplanthera uninervis. Fl. fr.* March–May.

Note. Easily distinguished from the closely related *H. ovalis* by the smaller size and the smaller number of cross-veins and the larger angle they make with the midrib.

3. Halophila decipiens OSTENF. Bot. Tidsskr. 24 (1902) 260 *cum* f.; ASCHERS. in Neumayer, Anl. Wiss. Beob. Reis. ed. 3, 2 (1906) 395; GAGNEP. Fl. Gén. I.-C. 6 (1908) 4; OSTENF. Pflanzenareale 1^3 (1927) 37, 38, map 23; STEEN. Trop. Natuur. 22 (1933) 46.—*H. baillonis* (*non* ASCHERS. 1874) HOLM, Bih. Kongl. Svensk Vet. Ak. Handl. 9, 13 (1885) 1–18, pl. 1–3; ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 249; ASCHERS. in Neumayer, Anl. Wiss. Beob. Reis. ed. 3, 2 (1906) 395; RYDBERG in N. Amer. Fl. 17 (1909) 67; BOWMAN, Science 43 (1916) 245; Pap. Mich. Ac. Sc. 2 (1922) 5, pl. 2; OSTENF. Pflanzenareale 1^3 (1927) 37, 38, map 23.—*H. ovata* (*non* GAUD.) BACKER, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 203, p. 2.—**Fig. 18.**

Monoecious. *Stems* thin, easily breaking, with 1 root at the nodes, internodes 1–4½ cm. *Scales* transparent, scarious, obovate, doubled, keeled, 3–7 mm, outside hairy, apex incised, base amplexicaulous. *Leaves* oblong-elliptic, obtuse or rounded, cuneate at the base, green, at one or both sides faintly covered with short, rigid, unicellular hairs, very fine-serrulate, 10–23 by 3–6 mm, only 1 pair on a 1–10 mm long shoot; cross-nerves 6–9 pairs, ascending, joining the intramarginal nerve; midrib united at the top with the intramarginal nerves running at *c.* ½ mm distance from the margin; petiole 3–15 mm, triquetrous. *Spathe* ovate, acuminate, keeled, scarious, transparent, 3–4 mm, at the margin ciliate, at the keel with fine serrulate teeth, at the outside hairy or not, tearing at the top as the fruit is ripening, containing 1 ♂ and 1 ♀ flower, spathe segment enclosing the female flower embracing the other. *Male flower:* perianth segments oblong-elliptic to ovate, obtuse, convex, 1–1½ mm long; anthers *c.* 1 mm, pollen grains elliptic; pedicel 3 mm; after anthesis the complete flower with its pedicel caducous. *Female flower* subsessile; ovary ovate, 1 mm, beak 1–2 mm; styles 3, 2½ mm. *Fruit* broad-elliptic, 2½ by 1½ mm; beak 1½–2 mm; pericarp scarious, transparent. *Seeds c.* 30, ovate, ⅕ mm.

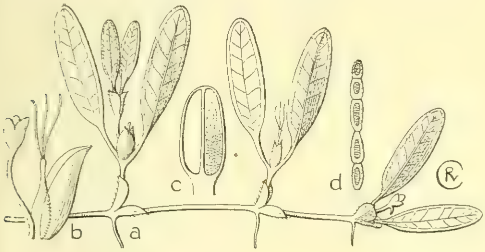

Fig. 18. *Halophila decipiens* OSTENF. *a.* Habit, nat. size, *b.* ♂ and ♀ flower, *c.* anther in section with pollen grains in chains, *d.* part of such a chain of pollen grains (*a* partly after OSTENFELD, *b–d* after HOLM).

Distr. Rare, but very widely distributed in the tropical parts of the Indian Ocean (Seychelles, India near Bombay, Ceylon near Chilaw, Gulf of Siam), the Pacific (Great Barrier Reef and Tahiti), and in the Caribbean, twice found in *Malaysia:* W. Java [P. Dapur (NW. beach), N of Djakarta: WESTENBERG 1, April 1938, Bo, L] and S. Moluccas (Aru Isl.: MOSELEY, Sept. 1874, K, L).

Ecol. A species confined to deep water, collected at 5–30 fathoms depth on coral-sand. *Fl. fr.* observed Jan.–April, Sept.–Nov., probably the whole year round.

Anat. I found *squamulae intravaginales* in the axils of the leaves, scales, and spathal leaves. They are nearly sessile, elliptic to oblong-ovate, diaphanous, ¾ mm.

Notes. After the character of the indument of the leaves and the spathal leaves two varieties can be distinguished:

var. **decipiens.**

Leaves hairy on one side only, spathal leaves glabrous.

Distr. Seychelles, Bombay, Gulf of Siam, Java, Aru Isl., Great Barrier Reef.

var. **pubescens,** *nov. var.*—*H. baillonis* (*non* ASCHERS. 1874) HOLM, *l.c.*

Laminae utrinque pubescentes, lateribus externis foliarum spathae pubescentibus.

Distr. Ceylon, Tahiti, Caribbean Sea.

4. **Halophila stipulacea** (FORSK.) ASCHERS. Bot. Zeit. 25 (1867) 94; Sitz. Ber. Ges. Naturf. Fr. Berl. 1867 (1868) 3; Linnaea 35 (1868) 172, 199, *pro maj. parte*; Sitz. Ber. Ges. Naturf. Fr. Berl. 1869 (1870) 4; in Neumayer, Anl. Wiss. Beob. Reis. ed. 1, 1 (1875) 367; BALFOUR, Trans. Proc. R. Soc. Edinb. 13 (1879) 336, pl. 9 f. 14–15, 18, pl. 10 f. 19–26, pl. 11 f. 32, 37–39, 42, pl. 12 f. 61; ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 249, f. 183; OSTENF. Pflanzenareale 1^3 (1927) 37, 38, map 24; TÄCKHOLM & DRAR, Fl. Egypt 1 (1941) 122.—*Zostera stipulacea* FORSK. Fl. Aeg.-Arab. (1775) 158.—*Thalassia stipulacea* KÖNIG, Ann. Bot. 2 (1805) 97.—*Zostera bullata* DELILE, Fl. Egypt. (1813) 145, pl. 53 f. 6.—*H. madagascariensis* STEUD. Nom. ed. 2, 1 (1840) 720.—*Thalassia bullata* KUNTH, En. 3 (1841) 120.—*Barkania stipulacea* ZANARDINI, Mem. Ist. Venet. 7 (1857) 225.—*H. balfourii* SOLEREDER, Beih. Bot. Centralbl. 30, i (1913) 47.

Dioecious. *Stems* 1–2 mm thick, at the nodes with one root; internodes 1–2 cm. *Scales* elliptic or obovate, white, 12–17 by 6–10 mm, folded, incised along the keel, the 2 apical lobes obtuse. *Leaves* linear to oblong-elliptic, green, glabrous, papillose or faintly hairy, obtuse, cuneate at the base, serrulate at the margin, occasionally bullate, 3–6 cm by 2½–8 mm, only 1 pair on a scarcely or not developed shoot; cross-veins ascending at an angle of 45°, joining the intramarginal nerves; midrib united at the top with the intramarginal nerves; petiole ½–1½ cm, at the base with an unequal-sided sheath. *Spathe* ovate, acute, keeled, hairy; margin at one side glabrous, the other side ciliate. *Flowers* not seen. *Fruit* elliptic, 5 mm; beak 6 mm; pericarp membranous. *Seeds* 30–40, globose, at both sides apiculate.

Distr. E. Africa, Madagascar, Seychelles, Mauritius, Red Sea, Bahrein Isl., Madras (India: Pamban, Oct. 1922 leg. M.O. PARTHASARTHY IYENGAR *no* 133 A), immigrated into the Aegean Sea according to FRITSCH (Verh. Zool. Bot. Ges. Wien 45, 1895, 104).

In the Rijksherbarium there is a specimen said to have been collected 'near Donai in Sumatra, July 1909'. Apart from the fact that no place 'Donai' is known in Sumatra, the specimen was acquired with the collection D'ALLEIZETTE which is notorious for wrongly localized specimens. There is no doubt whatever that it came from the western part of the Indian Ocean, possibly collected by somebody who, returning from the East, collected it *en route* in the Suez Canal zone where the species is common in the Bitter Lakes area where old, obviously dead, encrusted leaves are sometimes conspicuously bullate.

Ecol. Preferring localities which are always submerged and subjected to a constant current.

5. **Halophila beccarii** ASCHERS. Nuov. Giorn. Bot. Ital. 3 (1871) 302; in Neumayer, Anl. Wiss. Beob. Reis. ed. 1, 1 (1875) 368; Bot. Zeit. 33 (1875) 765; ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 249; TRIMEN, J. Bot. 27 (1889) 166; HOOK. *f.* in Trim. Fl. Ceyl. 4 (1898) 129; BECC. For. Born.

(1902) 360; OSTENF. Bot. Tidsskr. 24 (1902) 240; ASCHERS. in Neumayer, Anl. Wiss. Beob. Reis. ed. 3, 2 (1906) 393; MERR. Philip. J. Sc. 7 (1912) Bot. 228; Fl. Manila (1912) 70; En. Born. (1921) 37; En. Philip. 1 (1922) 25; OSTENF. Pflanzenareale 1^3 (1927) 37, 38, map 24; MASAMUNE, En. Phan. Born. (1942) 9; STEEN. Webbia 8 (1952) 435; DAWSON, Pac. Sc. 8 (1954) 376, f. 1a–c.—**Fig. 17a.**

Monoecious. *Stems* thin, at the nodes with 1 root; internodes 1–2 cm. *Scales* embracing the stem, one 4–6 by 1½ mm, the other 2–3 mm. *Leaves* lanceolate, broad-acute at the apex, cuneate at the base, 6–11 by 1–2 mm, glabrous, brown when dry, entire, 6–10 very closely together on a 1–1½ cm long erect shoot; midrib broad, reaching the margin in the apex; intramarginal nerves originating from the midrib just above the base and joining again just under the apex, cross-veins absent; petiole 1–2 cm, sheath 3–4 mm long with a strongly broadened scarious margin. *Spathe* oblong-lanceolate, acute, convex, entire, 2½ mm, containing 1 ♂ and 1♀ flower. ♂ *Flowers* not seen, ♀ *ones* only partly; ovary 1 mm, beak 2 mm; styles 2 or 3; ovules 2–4. *Fruit* ovate, recurved after anthesis, pericarp membranous. *Seeds* 1–4, ovate, acute, inflated, ½–1 mm, testa reticulate.

Distr. Obviously very rare, from the coast of SE. Asia (Ceylon: Batticalva; Burma: Akyab; Indo-China: Nha Trang, Song-Hong-Méo near Quang-Yen) to *Malaysia:* Borneo (Sarawak: near the mouth of Bintula River, BECCARI 3666) and the Philippines (Luzon: Manila Bay). An early record of ASCHERSON (Bot. Zeit. 33, 1875, 765) for Ambon is doubtful, as he omits it in his later works.

Ecol. In shallow brackish water, in inundated muddy localities near river-mouths (Sarawak) or in fish-ponds (Luzon), covering the bottom, and abundant locally.

6. Halophila spinulosa (R. BR.) ASCHERS. in Neumayer, Anl. Wiss. Beob. Reis. ed. 1, 1 (1875) 368; BENTH. Fl. Austr. 7 (1878) 183; ASCHERS. & GÜRKE in E. & P. Pfl. Fam. 2, 1 (1889) 249; OSTENF. Bot. Tidsskr. 24 (1902) 240; BAILEY, Queensl. Fl. 5 (1902) 1512; ASCHERS. in Neumayer, Anl. Wiss. Beob. Reis. ed. 3, 2 (1906) 395; MERR. Philip. J. Sc. 10 (1915) Bot. 2; OSTENF. Dansk Bot. Ark. 2, 6 (1916) 40, f. 25–31; MERR. En. Philip. 1 (1922) 26; OSTENF. Pflanzenareale 1^3 (1927) 37, 38, map 24; PASCASIO & SANTOS, Nat. Appl. Sc. Bull. Un. Philip. 1 (1930) 4; HENDERSON, Gard. Bull. S.S. 5 (1931) 240; STEEN. Trop. Natuur 22 (1933) 44, f. d; CLASON, Trop. Natuur 23 (1934) 120; BACK. Bekn. Fl. Java (em. ed. 10, fam. 203 (1949) 2; STEEN. Webbia 8 (1952) 434; SINCLAIR, Gard. Bull. Sing. 15 (1956) 30, f. 1E–F.—*Caulinia ? spinulosa* R.BR. Prod. Fl. Nov. Holl. (1810) 339; F.v.M. Fragm. 8 (1874) 219, 283.—*Kernera ? spinulosa* SCHULT. Syst. Veg. 7 (1829) 170.—*H. stipulacea* (FORSK.) ASCHERS. Linnaea 35 (1868) 172, 199, *pro min. parte.*—**Fig. 19.**

Dioecious. *Stems* at the nodes with 1 *c.* 10 cm long root; internodes 1–5 cm; scars of fallen leaves 3–13 mm spaced. *Scales* elliptic or ovate, with acute, obtuse or incised apex, keeled, membranous, 3–6 mm, soon caducous. *Leaves* 10–20 pairs, distichously arranged along a 5–18 cm long shoot, sessile, oblong-linear, serrulate, rounded, glabrous, 10–23 by 2–5 mm, *in sicco* brown, base semi-amplexicaulous, at one side with an incurved broadening; cross-veins 4–5 pairs, very fine, square, joining the intramarginal nerves; midrib united at the top with the intramarginal nerves. *Spathe* membranous, outer segment with an acute and an obtuse keel, near the apex faintly serrulate; inner segment with one keel and a long-pointed apex, *c.* 6–7 mm. *Male flower* shortly pedicelled, perianth segments elliptic, reflexed, obtuse, with an inconspicuous nerve, 3–4 mm; anthers 4-locular, 1½ mm, after anthesis caducous. *Female flower* subsessile; ovary ovate, 3–4 mm, beak 5–6 mm; styles 3–5, 10–12 mm. *Fruit* ovate, compressed, 4–6 mm, beak 3–5 mm; pericarp membranous. *Seeds* 20–30, globose, smooth, transparent, *c.* ½ mm.

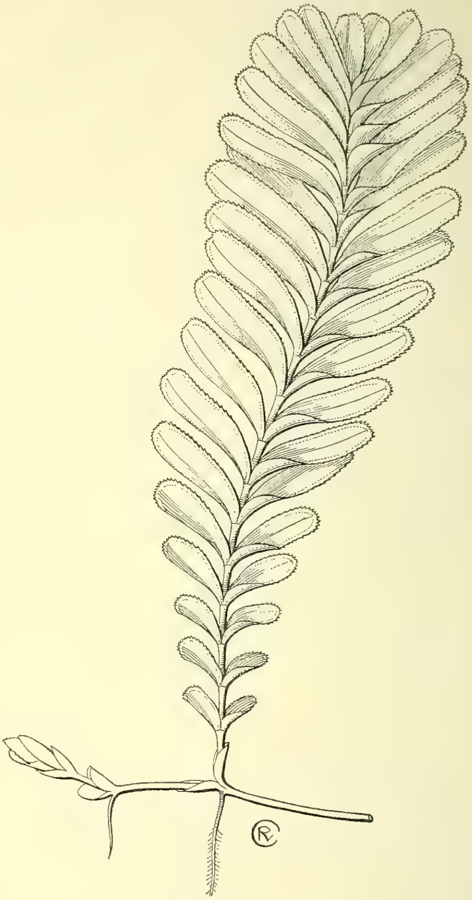

Fig. 19. *Halophila spinulosa* (R. BR.) ASCHERS. Habit, nat. size (SINCLAIR SF 40535).

Distr. Along the NE. & W. coasts of Australia, not found south of 30° S. lat., in *Malaysia:* Malay

Peninsula (Singapore and adjacent islands, Johore Baru), Riouw Arch. (P. Penyangat), W. & E. Java (Anjer near Sunda Straits, and N. Baluran), Philippines (Luzon: Quinalasag Isl., Manila, Camarines; Mindoro; Mindanao), and New Guinea (Warbusi, Geelvinkbaai, Torres Straits).

Ecol. In shallow water on coral-reefs, but also in deeper water to 6 fathoms, on mud or sandy mud. Sometimes associated with other sea-grasses. PASCASIO & SANTOS *l.c.* mention the species from the submarine meadows of *Thalassia hemprichii*, SINCLAIR collected it among *Enhalus* in Johore. *Fl. fr.* March—Oct.

Notes. Leaf-bearing shoots sometimes with 1–2 lateral shoots, in most cases originating from the axil of the lowest pair of leaves. The first pair of leaves of the lateral shoot consists of entire scales, in the axils of which sometimes again buds are found, which may produce new lateral shoots and one root.

On the scars of fallen leaves sometimes 2 scales occur, between which a lateral shoot develops. The delimitation of scales and leaf blades is not always very clear; as mentioned above specially on the lateral shoots transitions may occur. On a fruiting plant from New Guinea, which had lost its leaves, I found on each leaf scar near the top to 6 mm long scales with an incised apex, between which again innovations of sympodial shoots were visible.

The description of the ♂ flowers has been copied from OSTENFELD (1916).

Dubious

Epigynanthes BL. *ex* NEES, Flora 8 (1825) 679, *nomen nudum*; ENDL. Gen. Pl. (1837) 232 *sub no* 1664, *nomen.*—This name was reduced to *Hydrilla* by Ind. Kew.; I have not found any sheet with a label corroborating this reduction.

E. blumei HASSK. Cat. Hort. Bog. (1844) 53, *nomen nudum*. I have not found this name on the label of any sheet of the Rijksherbarium or Herbarium Bogoriense.

Excluded

Lemnopsis mnioides ZIPPEL, Flora 12 (1829) i, 285, *nomen nudum*; Alg. Konst- & Letterbode 1 (1829) 297, *nomen nudum*, is according to HALLIER *f.* Med. Rijksherb. Leiden 1 (1910) 40, *cf.* Fl. Mal. I, 4 (1949) 68 = *Utricularia orbiculata* WALL.

BATIDACEAE (P. van Royen, Leyden)

1. BATIS

P. Browne, Hist. Jamaic. 1 (1756) 356; Linné, Syst. Nat., ed. 10, Holm. (1759) 1289, *non* 1380 *auctores*; *l.c.* Hal. Magd. ed. (1760) 1289; van Royen, Nova Guinea, *n.s.* 7 (1956) 187–195, f. 1, 2, t. 11.

Dioecious or monoecious small shrubs with thick woody roots. *Leaves* simple, opposite, sessile, fleshy, with a distinctly saccate, colourless base. Stipules minute. *Flowers* unisexual, either solitary and terminal or axillary, or in small axillary spikes. ♂ *Flowers* subtended by bracts, enclosed in a membranous spathella which opens with one or two transverse or radial slits giving rise to 2–4 lobes. Tepals 4, valvate. Stamens 4, alternitepalous; anthers dorsifixed, introrse, dehiscing lengthwise with 2 slits. Sometimes an abortive gynaecium present. ♀ *Flowers* merely consisting of a naked ovary, in the axil of leaves when solitary, in the axil of cordate bracts when growing in spikes, 2-carpellate, 4-celled by one true and one false septum; ovules 1 in each cell, basal, anatropous, with a long funicle. Stigmas 2, sessile, distinctly papillate. *Fruit* a septicidal berry dehiscing with 2 valves, either solitary or many united together with the bracts into a connate, spikelike whole. *Seeds* with a large, straight embryo, exalbuminous.

Distr. The *Batidaceae*, consisting of one genus with two species, show a remarkably discontinuous area, *viz B. maritima* L. growing along the Atlantic and Pacific coasts of tropical America, the Hawaiian and Galapagos Islands, while *B. argillicola* has hitherto only been found in South New Guinea. As the distribution of the species is still rather insufficiently known and they are confined to littoral districts it has been found advisable to include both of them in the key given below.

Ecol. The Malaysian species, *B. argillicola* is found on littoral, rarely flooded, saline clay plains around Merauke in southern New Guinea, behind the mangroves where it occurs sometimes gregariously over large areas though it is sometimes also found solitary on the edge of the mangroves and of bushes scattered over the plains. It seems not to be entirely restricted to clayey soils as it is also found on sandy banks along small creeks in open connection with the sea but out of reach of normal high tide. For a full description of the habitat of this species *cf.* van Royen, Nova Guinea *n.s.* 7 (1956) 176–180, f. 1, t. 9. *Fl.* Aug.–Oct. (end dry season), *fr.* Dec.–Jan. (wet season).

B. maritima, the American species, is also found on saline clay plains, but these appear to be regularly flooded by the tides.

Taxon. Opinions on the taxonomic affinity of the *Batidaceae* have varied. Scopoli (1777) referred them to the *Amentiferae*, followed by von Wettstein, who arranged them close to *Salicaceae*. Lindley compared them with *Empetraceae* and in an other publication with *Urticaceae*. Pulle raised the family to the rank of an order related to *Rhoeadales*.

Kunth (1817) was the first to point to their close relationship with *Chenopodiaceae* and this opinion has been accepted by Bentham, Dammer, Bessey, Hallier *f.*, and Hutchinson. The flower structure is considered similar to that found in *Chenopodiaceae* and *Amaranthaceae*. According to Erdtman the pollen structure shows a resemblance to that in *Gyrostemonaceae*, a family closely related to *Aizoaceae* and sometimes merged with it. The presence of stipules, first reported by Johnson (1935) is matched with their presence in *Caryophyllaceae*. There seems, therefore, ample support for placing the *Batidaceae* among *Centrospermae*.

Morph. The morphological evaluation of the tepals in the ♂ flowers is disputed. They have mostly been regarded as representing staminodes. I have tried to demonstrate (1956), supported by anatomical data, that there is little evidence in favour of their staminal origin.

KEY TO THE SPECIES

1. Monoecious. Flowers and fruits solitary, in the axil of leaves or terminal, bracteate. Spathella of ♂ flowers consisting of two membranous, fused parts. Tepals of the ♂ flowers gradually tapering from the middle towards the base. Connective of anthers shield-like produced above the cells. Fruits free. **1. B. argillicola**

1. Dioecious. Flowers and fruits in spikes, in the axil of bracts and inflorescences axillary. Spathella of the ♂ flowers consisting of one membranous structure. Tepals of the ♂ flowers abruptly narrowed below the middle. Connective of anthers not produced. Fruits united into a connate, spikelike whole. **B. maritima L.**

1. Batis argillicola VAN ROYEN, Nova Guinea, *n.s.*, 7 (1956) 176–180, f. 1, t. 9; *ibid* p. 187–195, f. 1, 2, t. 11.—**Fig. 1.**

Shrub up to 70 cm, glabrous, innovations covered with numerous, white, elliptic lenticels. *Leaves* linear, 4–15 by 1–2 mm, submucronate to acute, saccate base *c.* 1 by 1 mm. Stipules very minute, one at either side of the leaf base. ♂ *Flowers* terminal or axillary, borne on brachyblasts consisting of a few leaves and one or more flowers, subtended by two sheathed bracts up to 4 by 2 mm, enclosed by a membranous spathella which splits radially and is often crested and saccate at the base, ultimately caducous. Tepals 4, spathulate, membranous, 1½–2½ by ½–1 mm, obtuse or truncate. Stamens 4, alternate with the tepals, 2–2½ mm long; filaments linear, winged, in bud with incurved apex; anthers elliptic, *c.* 1 mm, connective distinctly produced. *Ovaries* axillary, sessile, obliquely ovoid-ellipsoid, 4–7 by 1½–3 mm, glabrous, the 2 adaxial cells smaller than the abaxial ones. *Fruits* markedly oblique, up to 11 by 5 by 5 mm, the abaxial cells much larger than the adaxial ones. Ripe seeds not yet known.

Distr. *Malaysia:* New Guinea.

Ecol. On saline clay plains which are rarely flooded by seawater, but sometimes also along gulleys in open connection with the sea.

Vern. *Haha*, *ahake*, Marind dial.

Excluded

Batis hermaphroditica BLCO, Fl. Filip. (1837) 791 = *Pothos hermaphroditicus* (BLCO) MERR., *cf.* MERR. Sp. Blanc. (1918) 90 (*Araceae*).

Batis spinosa ROXB. Hort. Beng. (1814) 71, *non* Fl. Ind. ed. Carey 3 (1832) 762, based on *Cudranus bimanus* RUMPH. Herb. Amb. 5, p. 22, t. 15 f. 2 = *Cudrania cochinchinensis* (LOUR.) KUDO & MASAM. Ann. Rep. Taihoku Bot. Gard. 2 (1932) 27 (*Moraceae*).

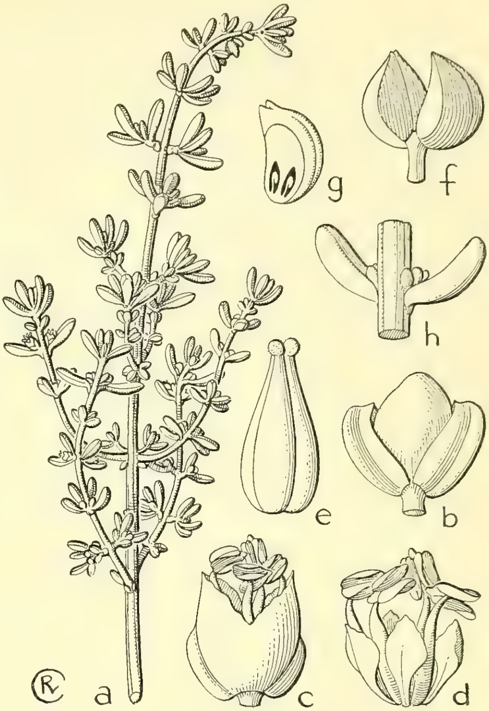

Fig. 1. *Batis argillicola* VAN ROYEN. *a.* Twig with ♂ flowers, *b.* juvenile ♂ flower, *c.* ♂ flower still enclosed by two bracts and spathella, *d.* ♂ flower after removing bracts and spathella, *e.* ♀ flower, *f.* two immature fruits, *g.* immature fruit after removing lateral wall of two cells, *h.* leaves with axillary ♂ flowerbuds (a × 1, b–e × 6, *f–h* × 2, a–e and h after VAN ROYEN 4828, f–g after BOENDERMAKER *s.n.*).

RESTIONACEAE (K. Bakker, Leyden)

The delimitation of the family as it is now generally accepted has been liable to changes. Moreover, representatives of other families have occasionally been confused with *Restionaceae*.

In habit *Restionaceae* are very like *Cyperaceae*, specially *Rhynchosporoideae*, and grow in similar habitats. They can be distinguished from the latter by open leaf-sheaths, the pendent, apically inserted ovules, and the absence of peculiar 'cone-cells' in the epidermis ('Kegel-Zellen', *cf.* KÜKENTHAL in Fedde, Rep. 53, 1944, 89).

According to ERDTMAN (Pollen-morph. & Plant Taxon. p. 377) the pollen grains are ± similar to those found in *Centrolepidaceae* and *Gramineae*. They are ± different from those of the *Cyperaceae*, *Eriocaulonaceae*, and *Juncaceae*.

HUTCHINSON (Fam. Fl. Pl. 2: 185, 192) refers the *Restionaceae* to *Juncales* along with *Juncaceae* (ubiquist), *Centrolepidaceae* (Antarctopacific), and *Thurniaceae* (Africa).

They differ from *Juncaceae* by their pendulous ovule, dorsifixed anthers, and often unisexual, mostly dioecious flowers.

Centrolepidaceae are different by the absence of a perianth and mostly present leaf-blades.

As BENTHAM already remarked (Fl. Austr. 7: 209) *Restionaceae* show a remarkable diversity in flowers and sometimes in sexual forms when dioecy prevails. He says: 'The great dissimilarity in habit and inflorescence between the males and females of some species often renders even their generic determination very difficult or uncertain from dried specimens where only one sex is present or the sexes are mismatched. In some cases indeed the males of species belonging to different genera are more like each other than those of congeneric species, and, notwithstanding the copious materials before me, there are still some species in which I may not have correctly matched the two sexes, and in several others one sex is still inknown'.

Several species are inadequately known in this respect, as is illustrated by *L. elatior* of which ♂ flowers are described here for the first time.

Geographically *Restionaceae* are almost restricted to the southern hemisphere and are specially frequent both in numbers and species in the savannahs and other open areas of arid countries. In certain areas they may be gregarious and take the place of grasses in the vegetation. They are specially centred in extratropical S. Africa and Australia, a few occur in Tasmania and New Zealand, 1 in Chile, 1 in SE. Asia, 1 in Madagascar, and 1 in Nyasaland. About 30 genera and *c.* 300 species have been recognized. Two genera are bicontinental, *viz Restio* and *Leptocarpus* (if its African species are not segregated as a separate genus *Calopsis* KUNTH as is done by GILG (Bot. Jahrb. 13, 1891, 524), UEBERFELD (*op. cit.* 60, 1926, 175), and GILG-BENEDICT (in E. & P. Pfl. Fam. ed. 2, 15a, 1930, 22)).

The Malaysian area is extremely poor in representatives though ecologically suitable habitats should not be rare.

The family is subdivided into 2 tribes, *Haplantherae* and *Diplantherae*, characterized respectively by anthers containing one or two cells. The more primitive *Diplantherae* are restricted to Australia.

1. LEPTOCARPUS

R.BR. Prod. (1810) 250, *nom. cons.*; MAST. in DC. Mon. Phan. 1 (1878) 329; BENTH. Fl. Austr. 7 (1878) 230.—**Fig. 1.**

Perennial herbs; rhizome covered by often partly caducous, imbricate scales, (in Mal. *spp.*) covering a dense woolly pubescence. *Stem* simple or branched, terete, hollow except at the nodes. *Leaves* almost always consisting of open, stem-clasping bladeless sheaths, without ligule, distichous, firm, closely appressed to the stem, with overlapping basal margins, persistent, sometimes with a scarious margin and an elongated apex. Male and female inflorescences nearly similar or very different, in some species the spikelets of both sexes very small and clustered along the branches of a long panicle (*§ Homoeanthesis*), in others the males pedicellate and paniculate or clustered, the females sessile and clustered or spicate (*§ Diplanthesis*). *Flowers* mostly dioecious, rarely monoecious or even bisexual. Both sexes in spikelets with imbricate glumes, often densely clustered in fascicles. *Tepals* 4–6 or sometimes rather indefinite (partly barren bracts?), variously shaped.—♂ *Flowers:* stamens 2 or 3, rarely 1; filaments ligulate to filiform, free, delicate; anthers 1-celled, dorsifix, introrse, apiculate; rudimentary ovary, when present, very

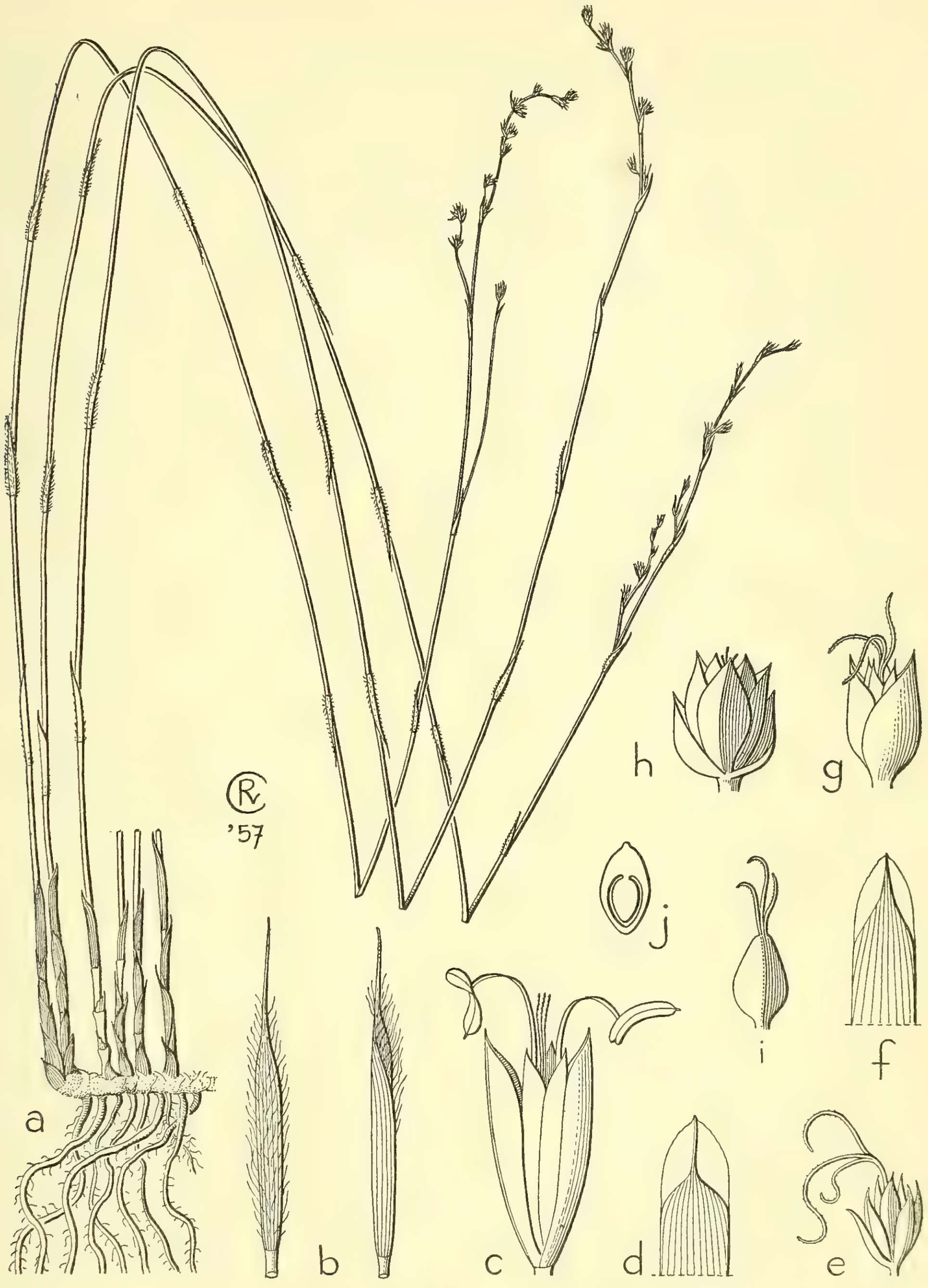

Fig. 1. Habit and details of Malaysian *Leptocarpus*.—*L. barbatus* BAKKER. *a.* habit, × 2/3, *b.* two sheaths, one nearly glabrous by caducous hairs, × 3, *c.* ⚥ flower, × 13.—*L. elatior* R.BR. *d.* apex of sheath (scarious margin sometimes partly disappearing), × 3, *e.* ♀ flower, × 13.—*L. disjunctus* MAST. *f.* apex of sheath, × 3, *g.* young ♀ flower, × 13, *h.* ♀ flower with fruit, × 13, *i.* fruit, × 13, *j. ditto*, in longitudinal section (a–c BUWALDA 5531, d–e VAN ROYEN 4885, f–g GWYNNE VAUGHAN, h–j SINCLAIR S.F. 39983).

small.—♀ *Flowers:* staminodes 3 or none, ovary superior, 1-celled with 1 pendulous orthotropous ovule; styles 3 (or sometimes 2?), filiform, delicate, free or united at the base, the free parts entirely stigmatic. *Fruit* narrow oblong-elliptic, ovoid or obovoid, with a thin pericarp opening on one side, or with a thicker pericarp splitting at the angles. *Bisexual flowers* with an ovary and a varying number of stamens (1–3).

Distr. About 40 *spp.*, distributed mainly in South Africa (*c.* 25), Australia and New Zealand (*c.* 12), Chile (1), in *Malaysia* 3 *spp.*, one of which also in Indo-China & Hainan and another also in Queensland. Fig. 2.

Notes. The concept 'floral bract' is used here for the mostly rather small glume just below the flower or, in the case of several-flowered spikelets where such glumes are not to be recognized, the glume from the axil of which the spikelet springs. This glume is often appressed to the flower and may be confused with a 7th perianth-segment (in ♀ flowers of *L. elatior*), but it may be distinguished from the perianth-segments (tepals) by its size and lower insertion. BENTHAM (Fl. Austr. 7: 209) has used the term 'floral bracts' in a slightly other sense, *viz* for the upper sheaths under the inflorescence and its branches which are usually shorter, broader and sometimes spathe-like and more open than the sheaths of the stem. BENTHAM (*op. cit.* 231) remarks: 'The males of some species are scarcely to be distinguished from those of some species of *Restio*, but the females are readily recognized'.

In a number of specimens the ovaries or fruits are swollen and appear to contain a mass of blackish granules, apparently due to a fungus. This disease is, according to BENTHAM (*op. cit.* 236), observed in several *Restionaceae*.

KEY TO THE SPECIES

1. Sheaths with a beard-like but detersile pubescence, specially along the non-scarious margin; top acuminate, ending in a long needle up to 7 mm. Flowers 2–2$^{1}/_{2}$ mm long . . . **2. L. barbatus**
1. Sheaths glabrous, with a scarious margin. Flowers smaller, seldom up to 2 mm.
  2. Firmer central part of each sheath with an acute, acuminate top across the scarious margin. Tepals of ♀ flowers *c.* $^{2}/_{3}$–$^{3}/_{4}$ mm broad. Anthers *c.* $^{3}/_{4}$–1 mm long. . . . . **3. L. disjunctus**
  2. Firmer central part of each sheath with a blunt, mucronate top; dark mucro across the apical scarious margin. Tepals of ♀ flowers *c.* $^{1}/_{5}$–$^{1}/_{4}$ mm broad. Anthers *c.* $^{1}/_{2}$–$^{3}/_{4}$ mm long **1. L. elatior**

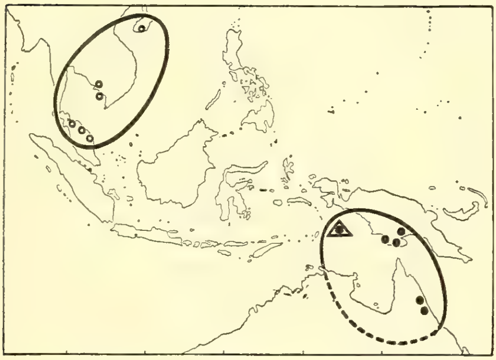

Fig. 2. Distribution of Malaysian *Leptocarpus* species: *L. disjunctus* MAST. (SE. Asia, localities indicated), *L. elatior* R.BR. (Queensland & Papua, localities dotted), *L. barbatus* BAKKER (triangle).

1. Leptocarpus elatior R.BR. Prod. (1810) 250; STEUD. Syn. 2 (1855) 260; MAST. in DC. Mon. Phan. 1 (1878) 343; BENTH. Fl. Austr. 7 (1878) 236; BAILEY, Queensl. Fl. (1902) 1724.—**Fig. 1d–e.**

Mostly dioecious, sometimes monoecious with some bisexual flowers. *Stems c.* 1–1$^{1}/_{2}$ m high, up to *c.* 3 mm diam., with few branches, with very fine reddish ribs; internodes apically increasing in length, up to *c.* 12 cm, generally glabrous but sometimes with a short detersile pubescence. *Sheaths* brownish, *c.* 1–1$^{1}/_{2}$ cm, lengthwise ribbed, with a *c.* 1–3 mm broad scarious margin, ribs on the central firm part arcuately converging towards the blunt, mucronate, 2–3 mm long apex extending through the scarious margin; both the dark mucro and the apical portion of the scarious margin may partly or wholly disappear through withering. *Panicle* lax, *c.* 6–20 cm long. Flowers in small clusters along the 1–4 cm long branches; axis 1 mm diam., or thinner, terete but near the nodes sometimes triangular-flattened or subsulcate; internodes $^{1}/_{2}$–3 cm.—♂ *Flowers* in chestnut-coloured clusters, *c.* 2–5 mm diam. Floral bract broadly-elliptic or slightly obovate, towards the acuminate apex somewhat irregularly erose, brownish striate with darker midrib, *c.* 1–2 by $^{3}/_{4}$–1 mm. Tepals 4(–5); 2 outer ones opposite, folded, slightly keeled and boat-shaped, dark-brown; when flattened obovate-spathulate, apex short-acuminate, *c.* 1–1$^{1}/_{2}$ mm by $^{2}/_{5}$–$^{1}/_{2}$ mm; 2(–3) inner ones opposite, flatter, elliptic, not keeled, apex blunt or broad-acute, lighter brown, midrib less discernable, *c.* 1–1$^{1}/_{3}$ by $^{1}/_{3}$ mm. Stamens 2, opposite the inner tepals, connate at the base; filaments 1–2 mm, strap-shaped, in young flowers very short; anthers 1-celled, the cell curling over the top of the filaments to the outside, elliptic, rather dark in the upper part of the back in the median line, top short-apiculate; *c.* $^{1}/_{2}$–$^{3}/_{4}$ by $^{1}/_{4}$ mm.—♀ *Flowers* in chestnut-coloured clusters *c.* 2–5 mm diam., densely branched. Glumes of different order all narrowly ovate, acuminate, brownish-striate, margin somewhat scarious. Floral bract *c.* 1 mm long, somewhat smaller or larger than the tepals, appressed to the flower. Tepals 6, free, very narrowly elliptic or lanceolate, acute or acuminate, chestnut-coloured, *c.* 1–1¼ by ⅕–¼ mm. Ovary narrowly ellipsoid, *c.* ½ by ⅙ mm. Styles 3, free or sometimes connate at the base, *c.* ¾–1 mm, sometimes (Brass 8730) longer (1½–2½ mm). *Fruit* reddish-brown, ovate-oblong, triquetrous, acute, *c.* ¾ mm, sometimes (Brass 8730) 1 mm long and more elliptic.—⚥ *Flowers* (found in the type specimen Brown 5875, Brass 1915, and in Brass 8730 beside ♀ flowers) provided with an ovary with rather long styles and 1(–3 in Brass 1915 from N. Queensland) stamen(s).

Distr. N. Australia, round the Gulf of Carpentaria and NE. Queensland, in *Malaysia:* South New Guinea (Wassi Kussa River near Tarara: Brass 8702, 8730; Lower Fly River near Gaima: Brass 8354; Merauke: Anta (exp. Wentholt) 31, van Royen 4885), and S. Moluccas (P. Trangan, near Cape Popjetu: Buwalda ?5499, 5501). Fig. 2.

Ecol. In grass fields (Buwalda 5499, 5501), under trees among moderate high grasses (van Royen 4885), common in *Melaleuca* swamp-forests (Brass 8730), occasional in wet soil of savannah-forest (Brass 8702) and associated with sedges in extensive open marshes in savannah-forest (Brass 8354).

Vern. *Tanu*, Merauke.

Note. In the type specimen (Brown 5875) some ⚥ flowers have been detected, which were apparently overlooked by Brown, Masters, and Bentham.

The collection Buwalda 5499 differs slightly by the hairy stems but the material is insufficient for further critical examination.

2. Leptocarpus barbatus, *nov. sp.*—**Fig. 1a–c.**

Vaginae 1–2 cm longae, nervosae, nervis apicem versus prominulis convergentibus, in acumen subulatum usque ad 7 mm longum marginibus non scariosum sensim angustatae, per totam superficiem praesertim secus margines pilis longis barbiformibus evanescentibus indutae. Bracteae prope apicem scariosae pilosae. Flores 2–2½ mm longae.

Monoecious or also with bisexual flowers. *Stems c.* 80 cm high, up to 2 mm diam., little-branched, brownish-green through reddish grooves on green background; internodes increasing in length from the base to the top. *Sheaths* 1–2 cm, light brown, somewhat darker at the base, caused by reddish-brown spots on green background, with apically converging prominent ribs; apex acute and up to 7 mm aciculate; entire surface, specially along the margins, beard-like, rather detersile pubescent; sheath axils provided with a dense tuft of long, soft hairs. *Panicle* very loose, *c.* 10 cm long. *Flowers* in small clusters up to 3 mm, in the sheath axils and along the branches; axis less than 1 mm diam.; internodes ½–5 cm.—♂ *Flowers* with 2–3 stamens or with 2 stamens and a rudimentary ovary.—⚥ *Flowers* with 1–2 stamens and an ovary.—♀ *Flowers* with an ovary. Stamens occasionally reduced. All flowers with 4–6 tepals. Some flowers reduced and not developing. *Floral bracts* of different shape and size, mostly elliptic and somewhat boat-shaped; top often long-acuminate and aciculate; margin specially near the top rather scarious and fimbriate; surface often covered with a detersile, beard-like pubescence. *Tepals* in all flowers very variable: 2 outer ones keeled, spathulate, brownish-striate, *c.* 2–2½ mm; 2–4 inner ones flatter, oblong-elliptic, acute, brownish striate, *c.* 2 mm. *Filaments* strap-shaped, *c.* 2½–3 mm; in young flowers very short; anthers 1-celled; cell oblong-elliptic, up to 1 mm long, rather dark in the upper part of the back in the median line, apex shortly dark-apiculate, in anthesis curling over the top of the filaments with the apiculate apex pointing downwards. Older *ovaries:* 1-celled, triquetrous, oblong-rectangular, light-brown, with a somewhat darker apex, *c.* 1 by ⅓ mm; styles 3, *c.* 1½ mm, delicate. *Capsule* obovate, *c.* 1 mm.

Distr. *Malaysia:* S. Moluccas (Aru Islands: P. Trangan, Cape Meroor: Buwalda 5531, A, Bo, K, L, type). Fig. 2.

Ecol. Sandy lowland savannahs.

3. Leptocarpus disjunctus Mast. J. Linn. Soc. Bot. 17 (1879) 344; Ridl. Fl. Mal. Pen. 5 (1925) 136.—*Cladium vaginale* (*non* Benth.) Camus, Fl. Gén. I.-C. 7 (1912) 153.—*L. sanaensis* Masamune, Trans. Nat. Hist. Soc. Taiwan 33, *no* 232 (1943) 14, *ex descr.*; Fl. Kainant. (1943) 394.—**Fig. 1f–j.**

Dioecious or monoecious with some bisexual flowers. *Stems c.* ½–1 m high, up to *c.* 3 mm diam., sparsely branched, with very fine reddish ribs; internodes only slightly increasing in length towards the apex, up to *c.* 7 cm. *Sheaths* brownish, *c.* 1½–2¼ cm long, lengthwise ribbed, with a *c.* 1–3 mm broad, partly or wholly caducous scarious margin; ribs on the central firm part straightly converging towards the acute-acuminate, up to *c.* 5 mm long apex, extending through the scarious margin. *Panicle* lax, *c.* 5–15 cm long. *Flowers* ♂, ♀ or ⚥, in small chestnut-coloured clusters along the *c.* 1–4 cm long branches; internodes *c.* ½–3 cm.—♂ *Flowers c.* 2 mm long. *Floral bract* narrowly ovate, *c.* 2–2½ by 1 mm. Tepals 4–6, 2 outer ones opposite, folded, slightly boat-shaped, dark-brown, *c.* 1¾–2 mm long; 2–4 inner ones narrowly elliptic, somewhat shorter and flatter than the outer ones, lighter brown, *c.* 1½ mm long. *Stamens* 3, filaments strap-shaped, up to 2 mm, anthers 1-celled, *c.* ¾–1 by ⅓ mm, top distinctly brownish apiculate, upper part of the back in the median line reddish-brown. Rudimentary ovary sometimes present.—♀ *Flowers c.* 1–1½ mm long. Tepals 6–7, elliptic, narrowed towards the base, top acute, margin slightly fimbriate, *c.* 1–1½ by ⅔–1 mm, in young flowers all folded, enclosing the small, triquetrous, ellipsoid, *c.* ⅓ mm long *ovary*; styles 3 or less by abortion, connate in their lower half, *c.* 1–2 mm long. *Fruit* ellipsoid, *c.* 1 by ½ mm, enclosed by the flattened tepals. *Seed c.* ½ by ⅖ mm.

Distr. Hainan (Sana, Yurin, *cf.* Masamune), Cochin-China (Phu Quoc Isl.: Godefroy-Lebeuf

908, 928 type), Cambodia (Mt de l'Eléphant: Poilane 23177), Lower Siam (Songkhla = Singora: Annandale *s.n.*, Gwynne Vaughan *s.n.*, Kingdon Ward S.F. 37516), and *Malaysia:* Malay Peninsula (Kuala Trengganu: Holttum S.F. 17372; between Kuala Dungun and Kuala Marang: Sinclair S.F. 39983; Kresag: Vesterdal *s.n.*). Fig. 2.

Ecol. Locally common on sandy places, specially along the seashore.

Uses. According to Pierre natives of the isle of Phu Quoc use the stems for making mats, *etc.*

Excluded

Restio pilisepalus Steud. Syn. 2 (1855) 256; F.v.M. Descr. Not. 2 (1885) 18, based on a plant of D'Urville collected in Waigeou Island (S. Moluccas, near New Guinea) is, according to Masters (in DC. Mon. Phan. 1, 1878, 301) and Ind. Kew. a *Cyperacea.* It could be traced at Paris and = *Costularia pilisepala* (Steud.) Kern.—J. H. Kern.

'Twee fraaije Restiaceën, welke op den G.-Diëng voorkomen, zijn in mijn herbarium nog niet bestemd' says Junghuhn (Java, 2nd Dutch ed., 1, 1853, 542); *cf.* also Koorders (Exk. Fl. Java 1, 1911, 270). According to Backer (Handb. Fl. Java 3, 1925, 6) Junghuhn merely had in mind some *Eriocaulons.*

Restio articulatus Retz. Obs. 4 (1786) 14 = *Lepironia articulata* (Retz.) Domin.

CENTROLEPIDACEAE (Ding Hou, Leyden)

Plants small, annual or perennial, densely tufted, often of moss-like habit, some species forming cushions. *Leaves* radical or densely distichous on short, branched stems, narrowly linear, canaliculate, provided with a broadly membranous, sometimes apically auricled, mostly 1-nerved sheath. *Scape* simple, accrescent, the base surrounded with 1 to 3 sheath-like, hyaline, reduced leaves. *Inflorescences* terminal, head- or spikelet-like, 2–3-bracteate (in some extra-Mal. genera ∞-bracteate); bracts distichous, each enclosing 1 to 11 flowers. *Flowers* hermaphrodite or unisexual, usually subtended by 1 to 3 hyaline glumes; sometimes a few barren and reduced. *Perianth* none. *Stamens* 1 to 2; filament(s) filiform; anther(s) dorsifixed, versatile, oblong or linear, 1- to 2-celled, introrse, lengthwise dehiscing. *Carpels* 1 to many, superior, connate or free, collateral or superposed in 1 or 2 rows; styles free or connate at the base; stigmas linear and simple. *Ovule* solitary and pendulous from the apex in each carpel, orthotropous. *Fruiting carpels* resembling enlarged carpels, in the case of 2 collateral carpels resembling an ovary (fruit); pericarp membranous; carpels or cells dehiscent lengthwise with a lateral (outward) slit or more rarely with 2 loculicidal valves. *Seed* minute, ovoid or ellipsoid, areolate, with farinaceous albumen.

Distribution. Genera 5, with about 30 *spp.*, chiefly distributed in Australia and New Zealand, a few in *Malaysia* (2 genera with 4 species), southeastern Asia and South America. Fig. 2.

Ecology. Partly eurytherm, partly microtherm plants, in Malaysia one species (expected) in the lowlands, the other three representatives only in the subalpine to alpine zone between 2100 and 4000 m, on rocks, in bogs, on heaths, and other non-forested country, mostly gregarious.

Notes. The family *Centrolepidaceae* is a typical element of the Australasian region, centering in South Australia and Tasmania, with one genus shared by Papua, Tasmania, New Zealand, and Fuegia (*Gaimardia*). Most genera consist only of one or a few species; the largest genus *Centrolepis* extends from New Zealand to Tonkin and Hainan.

The 'radiating' of several Australasian-Subantarctic genera through Malaysia to the SE. parts of the Asiatic continent, where they are then represented by one or a few stray species, and these mostly in the mountains, as shown by *Centrolepis*, occurs in several other genera, *viz Corybas*, *Dacrydium*, *Drosera subg. Ergaleium § Polypeltes*, *Halorrhagis*, *Lagenophora*, *Leptocarpus*, *Microtis*, *Myoporum*, *Nertera*, *Pratia*, *Stylidium*, and others.

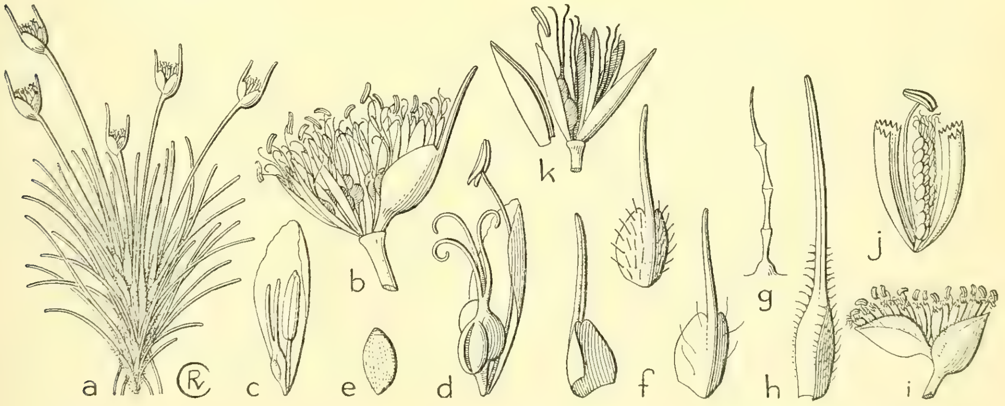

Fig. 1. *Centrolepis* species in Malaysia.—*C. fascicularis* Labill. *a.* Habit, nat. size, *b.* head with outer bract removed, × 3, *c.* young flower, × 7, *d.* deflorate flower, × 7, *e.* seed, × 10, *f.* three outer bracts, showing the variation in hairiness in one collection, *g.* single hair, × 25, *h.* leaf, × 2.—*C. banksii* (R.Br.) R. & S. *i.* Head, × 3, *j.* flower, × 7.—*C. philippinensis* Merr. *k.* Head with outer bract removed, × 3 (*a–h* van Steenis 9072, *i–j* Balansa 177, *k* Merrill 6160).

The taxonomic relations of the *Centrolepidaceae* are generally accepted with the *Restionaceae* and *Eriocaulonaceae*, from both of which they differ by the absence of a perianth. HUTCHINSON *l.c.* inserts them in his *Juncales* with *Thurniaceae*, *Juncaceae*, and *Restionaceae*. This is also corroborated by the structure of the pollen, according to ERDTMAN (Pollen Morph. 1952, 105), who finds similarity with *Restionaceae*.

The morphology of the inflorescence is a particularly interesting one, specially that of the gynaecium which has in the *Centrolepis* species with many carpels a unique structure of superposed ovaries (fig. 1j). Taking into consideration the remarkably reduced inflorescence, one wonders whether what is accepted generally as a 'flower' is not really itself a reduced spikelet of naked ♂ and ♀ flowers, the 2 rows of carpels imitating the 2 rows of flowers within each bract, and repeating a similar 'contraction'. This would then account for the superposed position of the carpels.

HIERONYMUS accepted the flowers contained in each bract to represent a cincinnus, accepting a cymose inflorescential type, but BENTHAM assumed a secund (*i.e.* racemose) type of inflorescence.

There is a remarkable tendency in *Centrolepis* to unite the carpels and to reduce their numbers and also to reduce the number of flowers in each bract. Accepting this tendency, the *Centrolepis* species with many flowers in each bract and many carpels in each flower would morphologically represent the most primitive condition, and *Gaimardia* the most reduced, derived state.

Within the general scheme there seems to be variability in the inflorescences of a single plant. The number of what is here called 'glumes' (by others 'scales') may vary behind (below) each flower (1–3), and there may be one before (above) the flower. The outermost flower may be ♀ by absence of the stamen, or ♂ by absence of the carpels, or it may be barren and represented by a glume only. This variation contributes to the fact that the distinction of the genera is less satisfactory than desirable for which I refer to the discussion under *Gaimardia*. *cf.* fig. 6.

Sincere thanks are due to Dr TURRILL for entrusting me with the Papuan material which he had formerly under study and to Mr J. H. KERN for assistance in drawing the diagrams.

KEY TO THE GENERA

1. Stamen 1. Carpels 2 to 20, free or united and superposed in 1–2 rows. Bracts 2. Annual or perennial. **1. Centrolepis**

1. Stamens 2. Carpels 2, connate and collateral. Bracts (2–)3. Perennial . . . . . . **2. Gaimardia**

1. CENTROLEPIS

LABILL. Nov. Holl. Pl. 1 (1804) 7, t. 1; BENTH. Fl. Austr. 7 (1878) 202.—*Devauxia* R.BR. Prod. (1810) 253.—*Alepyrum* R.BR. *l.c.*—*Alepyrum* HIERON. Abh. Naturf. Ges. Halle 12 (1873) 217, *non* R.BR.—*Pseudalepyrum* DANDY, J. Bot. 70 (1932) 32.—**Fig. 1–5.**

Plants annual or perennial. *Leaves* radical or distichous, eligular. *Inflorescences* a head consisting of 2 opposite, inequilateral, 1–11-flowered bracts. *Flowers* hermaphrodite, sessile, if several, alternate and inserted in 1 or 2 rows, flowering in a centrifugal sequence; each flower consisting of 1–3 glumes, 1 stamen and 2–20 carpels. *Glumes* 1 to 3, hyaline, unequal in length, erose at the apex, monostichous and dorsal, very rarely opposite (ventral and dorsal). *Stamens* 1, dorsal (in the median) between the carpels and the glumes; anther 1-celled, dorsifixed near the base. *Carpels* 2 to 20 to a carpophore, sac-like, superposed in 1 or 2 rows, free or connate, the pairs transversal; style one to each carpel, terminal, free or united at the base, twisted or curled at the tips, adaxial, apical part papillose, stigmatic. *Fruiting carpels* dehiscing with a lengthwise, lateral (outward) slit.

Distr. About 20 *spp.* chiefly distributed in Australia, Tasmania, and New Zealand, through *Malaysia* (New Guinea, Celebes, the Philippines, N. Borneo, and N. Sumatra) to SE. Asia (NE. Siam, Viet Nam, and Hainan).—Fig. 2.

Ecol. Lowland up to *c.* 4000 m, in marshy places, humid sandy grounds, open heaths, and on rocks, in Malaysia exclusively above 2100 m.

I have examined and photographed the two mountain species in North Sumatra and Central Celebes in the field and have observed that both start as small pin-cushions which may occur scattered, but in other cases fuse together in a cushion or turf, which may be later invaded by seedlings of other plants (fig. 3–4). Isolated tufts will grow and increase in size but in reaching a diameter over *c.* 10–20 cm, the central part of the cushion will decay (or mummify) into a bare hole, thus bringing about the remarkable ring-shaped cushion of which a specimen is shown in fig. 5. I have observed the same phenomenon in several other high mountain plants in Malaysia, notably *Oreobolus* and *Monostachya*, with which *Centrolepis* is often associated in Malaysia. It occurs also in other caespitose plants in Europe and is obviously due to the polarity of the stems causing centrifugal growth with natural decay of the older, central (distal) parts. This puts the cause of the formation of the rings on the same level with those popularly known as 'fairy circles' in toadstools, rather than assuming that the central part of the plant decays because in this portion either necessary trace minerals are exhausted or the decayed matter contains self-poisoning substances. Field experiments should be made to ascertain the non-poisonous nature of the bare central part in the rings.—VAN STEENIS.

Notes. In 1810 R. BROWN (Prod. p. 253) established the genus *Alepyrum* with three species and stated that it differed from *Devauxia* (= *Centrolepis*) only by absence of a glume and a uniflorous spathe (here called bract). He already expressed doubt whether it deserved generic status ('*an ideo separatae?*'). HOOKER *f.* in 1853 (Fl. Nov. Zel. 1, p. 268) and 1857 (Fl. Tasm. 2, p. 77–78) described four more species in *Alepyrum*.

In 1873 HIERONYMUS, in his monograph of *Centrolepidaceae* (Abh. Naturf. Ges. Halle 12, p. 209, 217), reduced the three original species of *Alepyrum* to *Centrolepis* retaining in *Alepyrum* only *A. pallidum* HOOK. *f.*, which had originally been described as *Gaimardia pallida* HOOK. *f.* (Fl. Antarct. 1847, 86); the other *Alepyrums* described by HOOKER *f.* were referred to other genera, two of them to *Centrolepis* and one to *Aphelia*.

In the 2nd edition of the 'Pflanzenfamilien' (vol. 15a, 1930, 27–33) GILG-BENEDICT, following HIERONYMUS, chiefly used vegetative characters to separate *Centrolepis* LABILL. from *Alepyrum* (*non* R.BR.) HIERON. and *Gaimardia* GAUD.: *Centrolepis* was defined as annual, *Alepyrum* and *Gaimardia* as perennial.

HIERONYMUS's use of the name *Alepyrum* for a monotypic genus based on HOOKER's *A. pallidum* is illegitimate and DANDY (J. Bot. 70, 1932, 330–331) proposed a new name, *Pseudalepyrum*, for *Alepyrum sensu* HIERONYMUS, including 4 species and 2 varieties.

In his 'The Families of Flowering Plants' (vol. 2, 1934, 187–190) HUTCHINSON essentially followed the classification of HIERONYMUS and GILG-BENEDICT, but did not mention *Pseudalepyrum* DANDY.

The floral characters of *Alepyrum pallidum* HOOK. *f.*, the type of *Pseudalepyrum* DANDY, leave no doubt, however, of its congenericy with *Centrolepis* and CHEESEMAN has rightly transferred it to the latter genus (Man. New Zeal. Fl. 1906, 757). It is one of the perennial species.

I have further checked the types of original descriptions and drawings of all other species assigned to *Pseudalepyrum* and have found that they all clearly belong to *Centrolepis*.

No subdivision has been proposed for *Centrolepis*. The species have mostly been claimed to be annual, an opinion still maintained by GILG-BENEDICT (*l.c.* 31 *in clav.*) and by HUTCHINSON (Fam. Fl. Pl. 2, 1934, 187), but it appears that whereas *C. banksii* is doubtless annual and unbranched, the two other species recorded here from Malaysia are distinctly perennial, strongly branched cushion plants (fig. 3–5).

The morphological resemblance of the species, both in vegetative and floral structure, is so obvious that this single vegetative character does not deserve generic evaluation. It is recommended to a future monographer of the genus to examine whether it might conveniently serve for a natural subdivision of the genus.

KEY TO THE SPECIES

1. Leaves radical. Glumes usually 2 in each flower, opposite. Carpels 10–20, distinct, superposed in two rows. Styles free, unequal in length. Annual . . . . **1. C. banksii**
1. Leaves distichous on a short but distinct and usually branched stem. Glumes usually 1, rarely 2 or 3 in each flower, on one side. Carpels 2 or 3, united, superposed in one row. Styles united at the base, equal in length. Perennial.
   2. Inner bract short-stalked, outer one with a distinct awn 2–5 mm long . . . **2. C. fascicularis**
   2. Inner bract sessile, outer one obtuse or rarely with an obscure awn up to $1^1/_2$ mm long. **3. C. philippinensis**

1. Centrolepis banksii (R.BR.) R. & S. Syst. 1 (1817) 44; BENTH. Fl. Austr. 7 (1878) 207.—*Devauxia banksii* R.BR. Prod. 1 (1810) 253.—*C. hainanensis* MERR. & METCALF, Lingn. Sc. J. 16 (1937) 185, fig. 3.—*C. miboroides* GAGNEP. Not. Syst. 6 (1938) 177.—*C. asiatica* MERR. *ex* GAGNEP. Fl. Gén. I.-C. 6 (1942) 1229, t. 116 (10–15), *nom. illeg.*—**Fig. 1i–j.**

Annual, unbranched, 3–8 cm tall. *Leaves* 15–25 mm, tip acute; sheath 4 mm long, glabrous, ciliate. *Scapes* 2–7 cm. *Bracts* each obtuse, ciliate, and 6–11-flowered; outer bract ovate, 3–4 mm long, sessile, inner bract suborbicular, $2^1/_2$–3 mm long, short-stalked. *Glumes* 2, opposite, oblong or linear, 2–3 mm long. Filament 3 mm. *Carpels* 10–20, distinct, adnate laterally to a carpophore; styles free, unequal in length, 1–3 mm, the lower most one the longest.

Distr. Viet Nam (Balansa 177), Hainan (S.K. LAU 3348), and Australia (Northern Territory: R.L. SPECHT 411, 466; Queensland). Fig. 2.

Ecol. Lowland, in marshy ground, sandy meadows, and rice-fields after harvest.

Notes. This species has not yet been found in Malaysia but according to its geographical distribution and ecology it might well be found there locally. A similar disjunct (equiform) area is known of *e.g. Philydrum lanuginosum* B. & S. (*cf.* vol. 4,

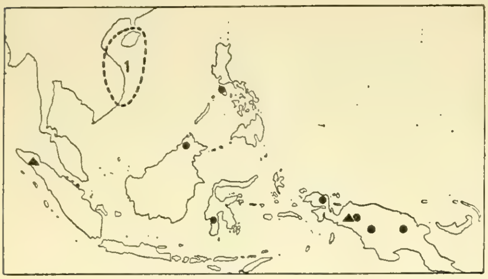

Fig. 2. Distribution of the genus *Centrolepis* in Malaysia. *C. banksii* (R.BR.) R. & S. (interrupted line in SE. Asia, also in Australia), *C. philippinensis* MERR. (dots), *C. fascicularis* LABILL. (triangles, also in Australia).

p. 5) and I can find no structural differences between this species and *C. strigosa* R. & S. *l.c.* p. 43, the only difference being the hispid indument of the bracts in the latter. This character has been found to vary in single collections of *C. fascicularis* and is obviously of minor value.

2. Centrolepis fascicularis LABILL. Nov. Holl. Pl. 1 (1804) 7, t. 1; BENTH. Fl. Austr. 7 (1878) 207.—**Fig. 1a–h, 3–4, 7.**

Perennial, forming pin-cushions, cushion-rings, or caespitose plants; branchlets rooting. *Leaves* 15–25 mm, tip acute to obtuse; sheath 4–5 mm long, slightly auriculate, ciliate, hispid on the outer surface. *Scapes* 4–8 mm. *Bracts* each 2–8-flowered, densely hispid to glabrous on the outer surfaces, ciliate, with a distinct awn 2–5 mm long; outer bract sessile, 3–4 mm long, inner bract short-stalked, 3–4 mm long *Glumes* usually 1, rarely 2 or 3, on one side of the flower, obovate or oblong, 2–3 mm long. Filament 3–4 mm. *Carpels* 2 or 3, united; styles united at the base, *c.* 2½ mm.

Distr. Australia (Queensland and New South Wales: BOORMAN 203, JOHNSON & CONSTABLE 26366), in *Malaysia:* N. SUMATRA (Gajo Lands: Mt Ngo Lembuh: VAN STEENIS 9072 and Mt Losir: VAN STEENIS 8577) and W. New Guinea (Wissel Lakes: EYMA 4778; Mt Wilhelmina: BRASS & MEIJER DREES 9760, Lake Habbema, BRASS 9173). Fig. 2.

Ecol. Swampy ground, wet quartzite rocks, and in sandy and peaty open heaths, 1900-3460 m.

Notes. In Australian and New Guinean specimens the bracts are densely hispid, whereas those in Sumatran specimens vary from slightly hispid to entirely glabrous.

A related species *C. cambodiana* HANCE is found in the hills of Cambodia, Laos, and NE. Siam; it differs by 5–7 carpels, hairy leaves, and larger size of the plants.

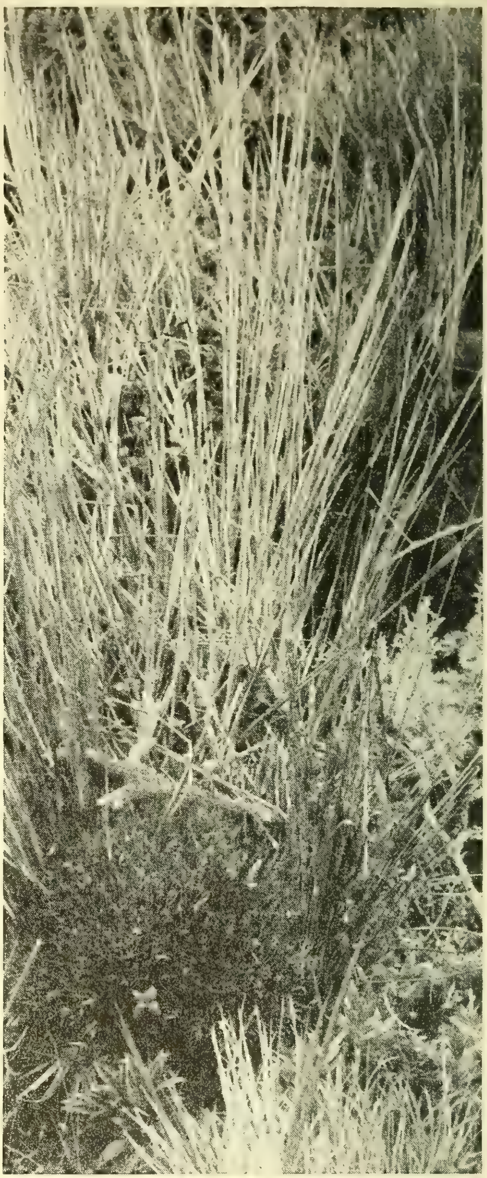

Fig. 3. *Centrolepis fascicularis* LABILL. on summit of Mt Losir, Gajo Lands (N. Sumatra), *c.* 3440 m. Tuft on stony ridge, pierced by stems of *Scirpus subcapitatus* THW. and with some seedlings of other herbs, above a creeping stem of *Lycopodium*, right a white patch of a *lichen.*

3. Centrolepis philippinensis MERR. Philip. J. Sc. 2 (1907) Bot. 264; TURRILL, J. Linn. Soc. Bot. 42 (1914) 172; MERR. En. Philip. 1 (1923) 191; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 182.—*C. novoguineensis* GIBBS, Arfak (1917) 99; HATUSIMA, Bot. Mag. Tokyo 56 (1942) 422.—*C. kinabaluensis* GIBBS, *op. cit.* 99, footnote; MERR. En. Born. (1921) 109; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 181.—**Fig. 1k, 5.**

Perennial. Pin-cushions or cushion-rings *c.* 3 cm

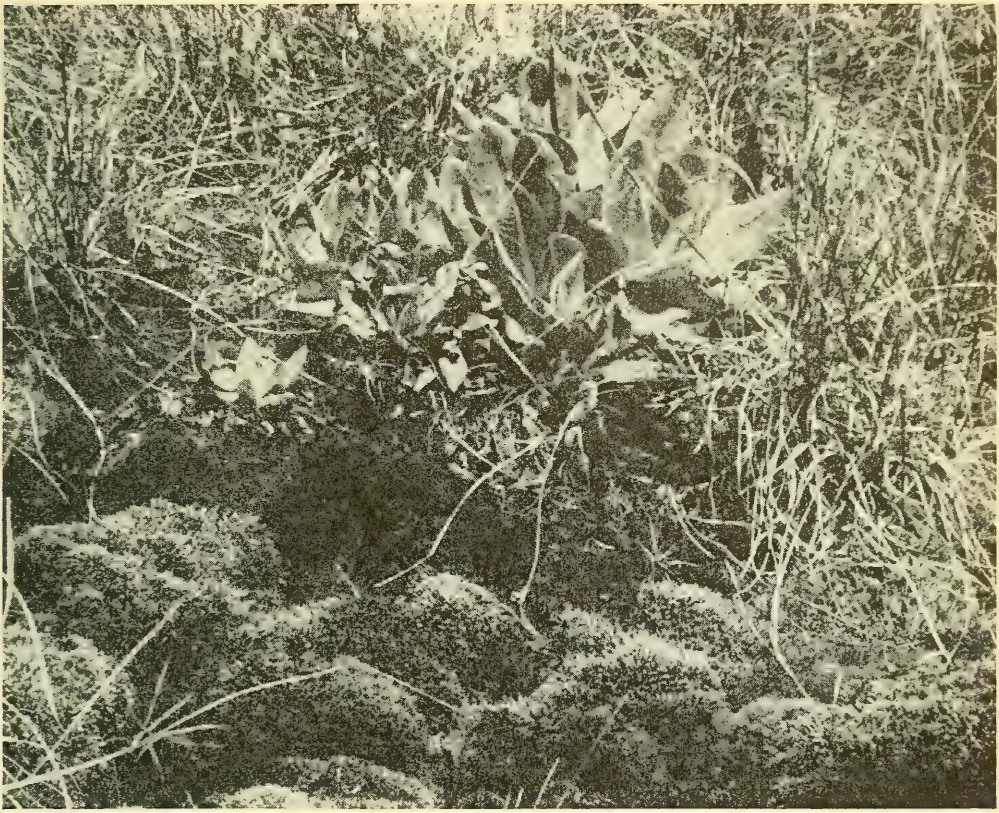

Fig. 4. *Centrolepis fascicularis* LABILL. near summit of Mt Kemiri, Gajo Lands (N. Sumatra), *c.* 3200 m. Solid tufted mat in moist place with juvenile rosettes of *Primula prolifera* between *Cyperaceae* behind.

high, with rooting branchlets. *Leaves* 7–15 mm long, obtuse; sheath 3–6 mm long, glabrous or nearly so, with a few hairs on the outer surfaces. *Scapes* 10–18 mm. *Bracts* 2, similar in shape, $3^1/_2$–5 mm long, each 1–2-, rarely 3–4-flowered, sessile, ovate, obtuse, rarely with an obscure awn up to $1^1/_2$ mm long, usually glabrous, rarely with a few hairs on the outer surfaces. *Glumes* 1, rarely 2 or 3, on one side of the flower, 2–3 mm long. Filament 2–4 mm long. *Carpels* usually 2, rarely 3 or 4, united; styles united at the base, 2–3 mm.

Distr. *Malaysia:* Borneo (Mt Kinabalu: GIBBS 4207, CLEMENS 10625, 27776 = 28940, 32415, 51404), Philippines (Mindoro, Mt Halcon: MERRILL 6160), Celebes (Latimodjong Range, Mt Rante Mario: EYMA 763, 764), New Guinea (Mt Arfak: GIBBS 5566, KANEHIRA & HATUSIMA 13645, GJELLERUP 1171; Mt Doorman: LAM 1713a, 1745; Mt Goliath: DE KOCK 27; Mt Wilhelm, HOOGLAND & PULLEN 5755). Fig. 2.

Ecol. Marshy grounds on sand, open clay slope, cracks in granite, 2100–4000 m. Often associated with other cushion or pin-cushion plants of *Oreobolus* and *Monostachya* (fig. 5).

2. GAIMARDIA

GAUD. Ann. Sc. Nat. Paris 5 (1825) 100; in Freyc. Voy. Bot. (1826) 418.

Plants perennial, densely tufted and forming cushions. *Stems* branched. *Leaves* glabrous, slightly ligular. *Inflorescences* spikelet-like, (2-)3-bracteate. Fertile *flowers* 1–2, hermaphrodite, with or without a hyaline dorsal glume, a third one represented by barren glumes or absent. *Stamens* 2, alternating with the carpels; anther versatile, 1-celled. *Carpels* 2, collaterally connate, transverse or median; styles 2,

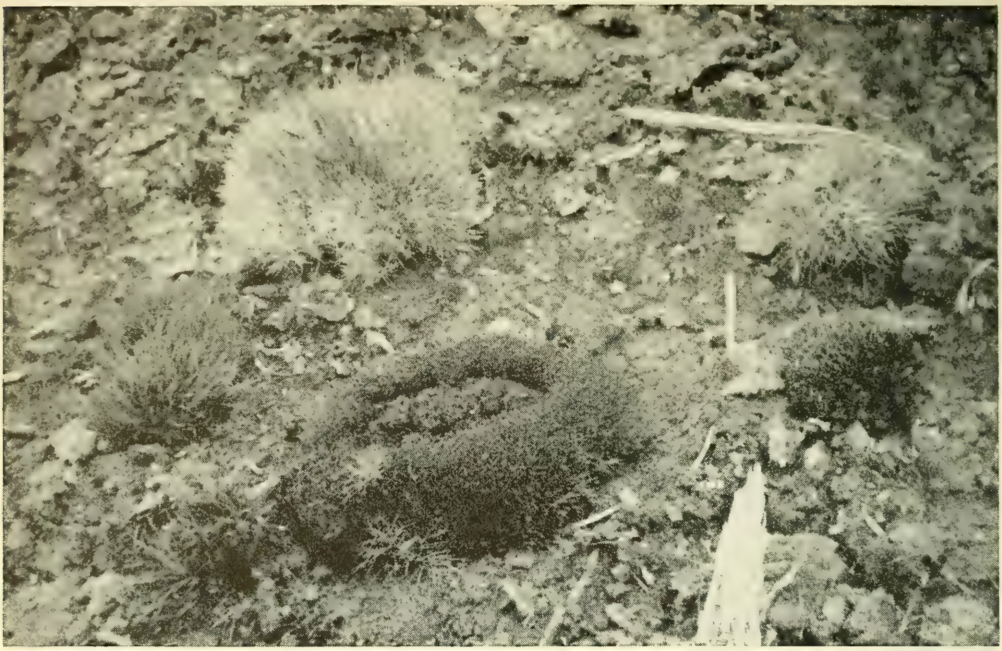

Fig. 5. *Centrolepis philippinensis* MERR. near summit of Mt Rante Mario, Latimodjong Range (SW. peninsula of Celebes), *c.* 3300 m. Ring-shaped tuft (*c.* 15–20 cm diam.) and solid young tuft (right, dark coloured) of *Centrolepis*, left solid young tuft of *Oreobolus* (dark coloured), behind two solid pale-coloured tufts of *Monostachya oreoboloides.*

united at the base, twisted or curled at the tips, adaxial apical part papillose-stigmatic. *Fruiting carpels* dehiscing along the outer side of each carpel or ovary or loculicidally dehiscing with two valves.

Distr. Two or 3 species distributed in antarctic South America, New Zealand, and Tasmania, in *Malaysia* only once found in New Guinea.

Ecol. Distinctly microtherm, in the tropics in marshy or boggy places on the high mountains.

Notes. *Gaimardia* shows a striking similarity with the perennial species of *Centrolepis.*

If only the type species, *G. australis* GAUD. is considered the floral differences are obvious *viz* in *Gaimardia* 3 bracts, solitary flowers (only the terminal one fertile), the pair of carpels in the median line, 2 anthers in the transverse line (fig. 6g), carpels connate and collateral forming a true ovary, dehiscing with 2 valves.

These characters do not all hold for *G. setacea*, however, in which the (1–)2 basal flowers are fertile and the upper one is generally reduced or barren, the 2 carpels arranged in the transverse line, and the 2 stamens nearly in the median line (the anterior one slightly obliquely inserted) (fig. 6b–f).

Moreover, as alluded to under *Centrolepis*, individual variations occur in a single specimen: in *G. australis* the reduced lowest flower may be absent or represented by 1 or by 2 glumes, in the Papuan material the lowest flower may have a dorsal glume or not. Slight variations occur also in the New Zealand material of *G. setacea*; see the diagrams fig. 6b–f. Besides the Papuan plant does not well show 2 fruit valves but the carpels dehisce with a lateral (outward) slit as in *Centrolepis.*

The Papuan plant thus breaks down several differential characters, which possibly indicates its ancient affinity.

The only generic differences now left between *Gaimardia* and *Centrolepis* have been mentioned in the key to the genera and consist principally in the occurrence in *Gaimardia* of 2–3 bracts, 2 stamens in each flower and 2 connate, collateral carpels forming an ovary. Whether this is sufficient for a distinct generic status must be left to a future monographer of the family.

A third species, *G. fitzgeraldi* F.v.M. & RODWAY (in Rodway, Fl. Tasm. 1903, 233, pl.) has been described from Tasmania. The type specimen is neither at Kew nor in the University Herbarium at

Hobart. I have seen a sheet at Kew, without collector's name and field note, which has been authenticated by RODWAY. I have also received fragments collected in Tasmania and kindly sent by Miss W. M. CURTIS, which agree with the description. *G. fitzgeraldi* is very similar to *G. setacea* in floral parts, but differs from the latter vegetatively in that the setae are longer and twisted at the tip; besides the leaf sheath is densely woolly.

A fourth species has been described by PAX from Bolivia, *viz G. boliviana* PAX (in Fedde, Rep. 5, 1908, 225), based on BUCHTIEN 836. The type of it could not be located, but from the Hamburg Herbarium I obtained a later specimen from the same locality of the same collector BUCHTIEN 9359 (also represented at Kew & Stockholm) which proved to represent the juncaceous *Distichia muscoides* NEES & MEYEN! According to Dr ASPLUND (Stockholm) there is no doubt whatsoever that the type also represents this juncaceous plant, which agrees with the inadequate original description by PAX. Dr ASPLUND told us that there are many errors in PAX's paper and that all species and genera described by him there were assigned to either wrong genera and families respectively, except for the two *Acalyphas* (*sic*).

KEY TO THE SPECIES

1. Inflorescence with (1–)2(–3) flowers in spaced bracts. Apex of the leaves acicular. Carpels transverse; dorsal stamen in the median line, anterior stamen inserted obliquely. Axis flattened. Spikelet caducous above the lowest glume. Fruit opening with 2 lateral slits. Fig. 6a–f . . . **1. G. setacea**
1. Inflorescence with a single terminal flower above 2 barren ones. Apex of the leaves blunt. Carpels in the median line; stamens transversely inserted. Axis ± terete, faintly angular. Spikelet persistent. Fruit 2-valved. Fig. 6g. Fuegia and New Zealand . . . . . **G. australis** GAUD.

1. Gaimardia setacea HOOK. *f.* Fl. Nov. Zel. 1 (1853) 267; Handb. N.Z. Fl. (1867) 295; CHEESEM. Man. N.Z. Fl. (1906) 758.—*G. sp., cf.* TURRILL *ex* GIBBS, J. Ecol. 8 (1921) 104.—**Fig. 6.**

Plant 6–8 cm tall. *Leaves* 10–18 mm long, the apex acicular and transparent about $^1/_2$–1 mm long; sheath glabrous 4–7 mm long; ligule obtuse *c.* 1 mm long. *Scape* 1–2$^1/_2$ cm. *Bracts* convolute, appressed, each enclosing one flower, sometimes the upper one empty or with an imperfect flower. Lower glume 3 mm long, second glume *c.* 2$^1/_2$–3 mm, third glume *c.* 1 mm, internodes of the rhachis 1$^1/_2$–2 mm. *Fruiting carpels* 2 or 1 by abortion, longitudinally dehiscent along the outside of the carpel.

Distr. New Zealand (Port Preservation, LYALL *s.n.*, K, authenticated sheet; Wellington, W. R. B. OLIVER *s.n.*, K), Tasmania (Mt Field National Park, Miss W. M. CURTIS *s.n.*, Hobart, L), in *Malaysia:* Mt Wichmann, S of Mt Wilhelmina, PULLE 1035).

Ecol. In boggy places forming large green cushions, 3000 m, *fl.* Febr. 1913.

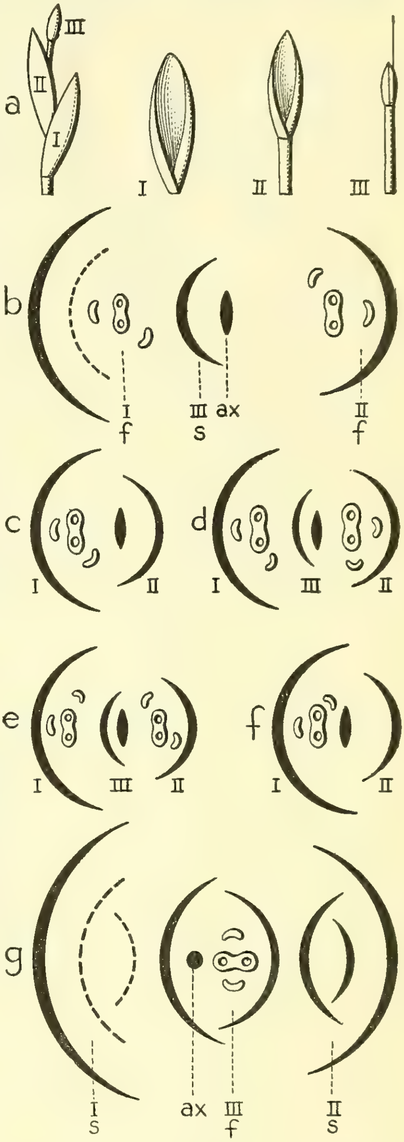

Fig. 6. Diagrams of *Gaimardia* species.—*a–f. G. setacea* HOOK. *f.*—*g. G. australis* GAUD.—In all diagrams I, II, and III indicate first, second, and third glume respectively: *f* = fertile, *s* = sterile; *ax* means axis (black); a flower consists of a 2-celled ovary and 2 stamens; glumes which may be either present or absent drawn in dotted lines (*a–b* PULLE 1035 from Papua, *c–d* two different heads of LYALL *s.n.*, type (?) from New Zealand, *e–f* two different heads from OLIVER *s.n.* from New Zealand, *g.* VERVOORT 363 from Chile).

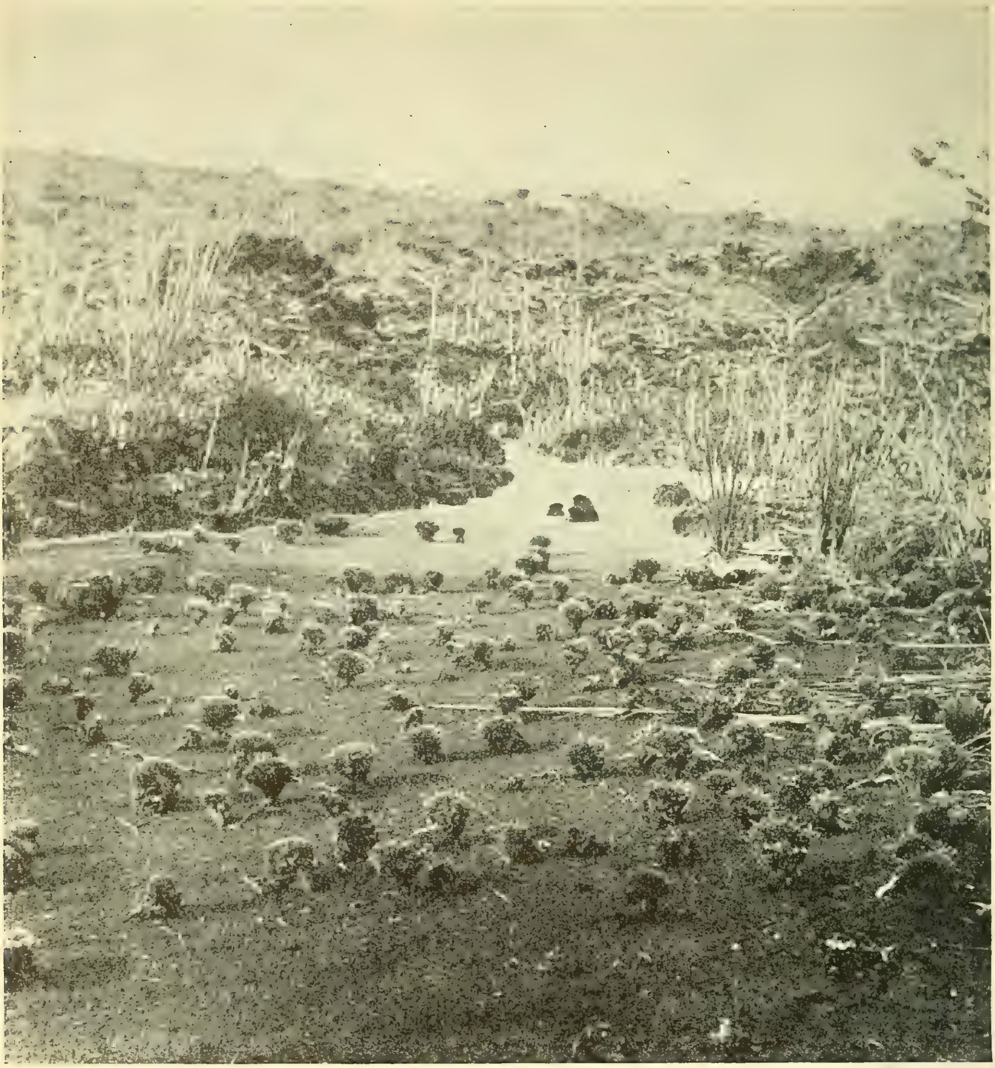

Fig. 7. *Centrolepis fascicularis* LABILL. on podsolized white quartzsand covered by a thin layer of brown mud with small grains on the surface, near Egogitugapa, above Kugapa, near Lake Paniai (Wisselmeren area, New Guinea), *c.* 1900 m. Obviously the toadstool-like tufts, c. 10 cm high, have originated from cushions by surface erosion through which the tuft became stalked; EYMA records cushions and fairy rings from the same locality. On the 'padang soil' associates were *Xyris*, *Burmannia*, *Gahnia*, *Lycopodium*, *Styphelia*, *Vaccinium*, *Rhododendron*, *Sphagnum*, and lichens; the surrounding low forest consists of *Libocedrus* and another conifer, in which large *Myrmecodia*. Photogr. EYMA *n.* 1095, March 29, 1939 (Herb. EYMA 4778).

RHIZOPHORACEAE (Ding Hou, Leyden)[1]

Evergreen trees or shrubs, mangrove species with various remarkable root formations. Branching (in the mangrove genera) mostly sympodial; branchlets swollen at the nodes, solid and pithy, hollow in *Crossostylis*, *Gynotroches*, and *Pellacalyx*. Innovation continuous, but flushwise in *Anisophyllea*. *Leaves* decussate and stipulate, rarely alternate and exstipulate (*Anisophyllea* and *Combretocarpus*), usually isomorphic, rarely dimorphic (*Anisophyllea spp.*), gland-like cork warts sometimes occurring as small black spots on the lower surface; young leaves involute or convolute. Nervation generally pinnate, more rarely curvinerved and with 1–2 intramarginal veins (*Anisophyllea*). *Stipules* conspicuous, interpetiolar, caducous, opposite, except in *Pellacalyx* overlapping each with one free margin, in Malaysia with colleters at the base inside, leaving an *annular* scar. *Inflorescences* axillary, simple or branched, usually cymose (lax or condensed and cluster-like), racemose or fascicled, rarely consisting of a solitary flower. *Flowers* usually bisexual, rarely unisexual or polygamous and plants monoecious (*Anisophyllea* and *Gynotroches*), sustained at the base by connate or cupular bracteoles or ebracteolate. *Calyx* 3–16–lobed, lobes valvate, persistent. *Petals* free, equal in number to the calyx lobes and alternating with them, usually fleshy and conduplicate, sometimes embracing 2 (*Bruguiera*) or 1 stamen, entire, 2-fid, lacerate or fringed with appendages at the apex, usually clawed, caducous during or after anthesis, rarely persistent. *Stamens* free or epipetalous ones adnate to the petals in *Anisophyllea sp.* (or adnate to the calyx tube in *Pellacalyx*), in one whorl (except in *P. symphiodiscus*), usually twice the number of the petals and one opposite and one alternating with the petals, in *Bruguiera* in pairs opposite and embraced by the petals, in *Rhizophora apiculata* 3 times and in *Crossostylis spp.* 3–4 times as many stamens as petals, in *Kandelia* indefinite in number, in some species some stamens may be aborted and staminodial, free or connate at the base; anthers typically 4-celled, rarely multi-locellate (*Rhizophora*), dorsifixed, dehiscing longitudinally and introrse, in *Rhizophora* opening with a large ventral valve. Disk fleshy, annular, and crenate or flat, or lobed, rarely absent. *Ovary* inferior, rarely semi-inferior or superior (*Gynotroches*, *Cassipourea*), 2–12-celled, rarely 1-celled by suppression of the septa; style simple with simple or ± lobed stigma, or styles free, persistent. *Ovules* (1–)2–∞ in each cell, pendulous, attached axile or in 1–celled ovaries on the columella-like axis running from base to apex, anatropous with micropyle upward and outward. *Fruit* always bearing the persistent calyx and often other floral remains, a berry or a drupe or dry and rather hard-shelled (*Anisophyllea*), indehiscent, rarely (in extra-Mal. *spp.*) a capsule and dehiscent, winged in *Combretocarpus*. *Seeds* pendulous, 1–∞, sometimes (in extra-Mal. *spp.*) arillate, viviparous in mangroves, germinating in the ordinary way in inland species; albumen fleshy or small and soon obsolete (in *Rhizophoreae*); embryo straight or curved.

Distribution. Mainly in the Old World, 16 genera[2] with an estimated 120 *spp.*

Four mangrove genera are restricted to the littoral zone of the tropics extending slightly into the

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(1) The introductory matter on ecology by C. G. G. J. van Steenis.

(2) Recently Arènes has described two new genera from Madagascar (Not. Syst. 15, 1954, 2–3; Fl. Madag. fam. 150, 1954, 4 & 6, f. I 5–11). *Petalodactylis* differs merely from *Cassipourea s.l.* by 2 short styles and cannot be maintained. *Richeopsis* has been reduced to *Scolopia* (*Flac.*) by Capuron (Ess. Intr. Fl. For. Madag. 1957, p. 123).

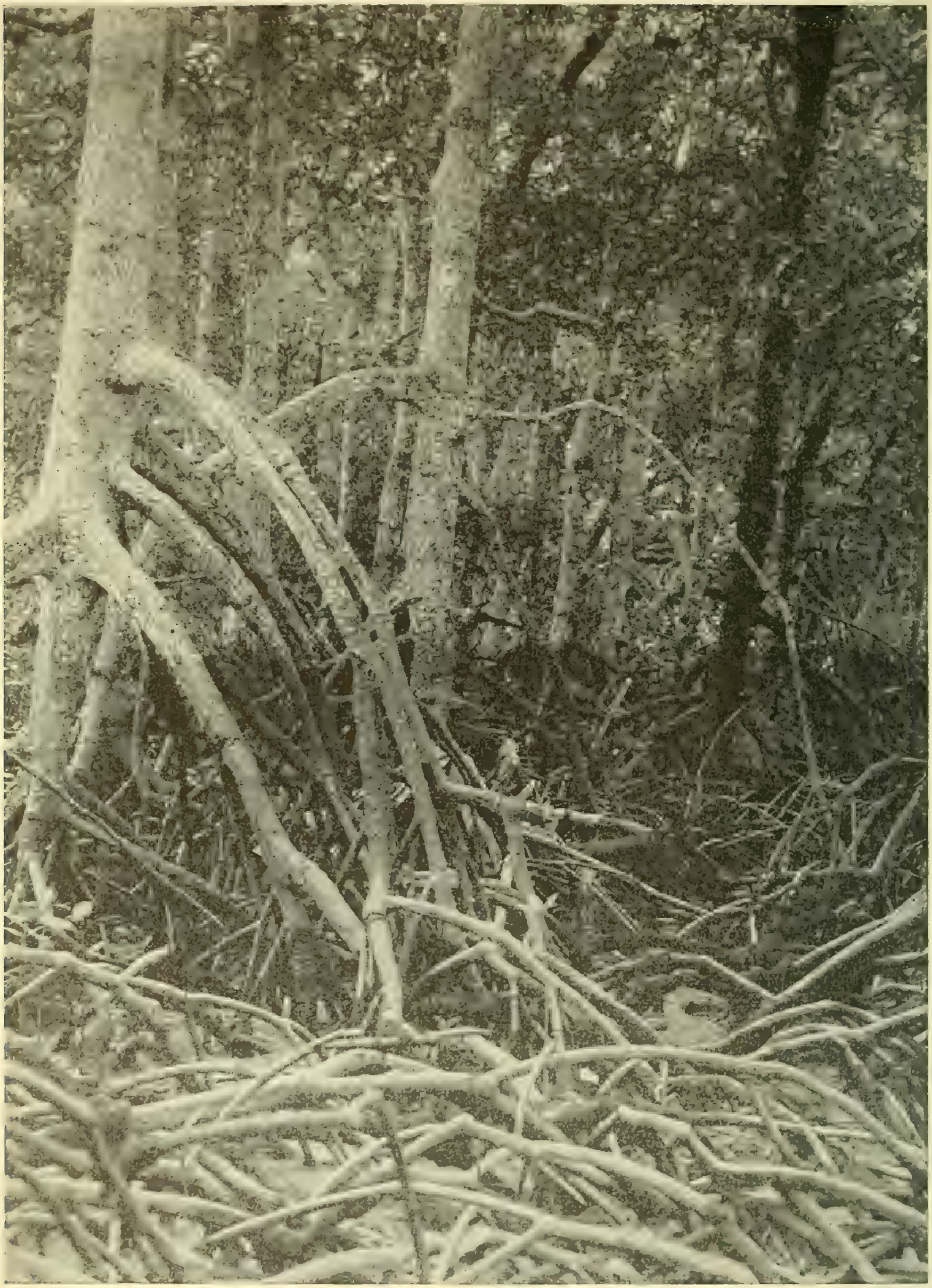

Fig. 1. Inside the *Rhizophora* mangrove forest at low tide at the mouth of the Pahoturi R., Western Division, Papua: *Rh. mucronata* LAMK (dark stems), *Rh. apiculata* BL. (pale stems). The dark horizon on the roots is caused by the mud and marks the high tide level. April 1936 (L. J. BRASS, Archbold Expeditions).

subtropics: *Rhizophora* is pantropical, *Bruguiera* and *Ceriops* occur from tropical Africa through Malaysia to Australia and the Pacific (Micronesia and Samoa), *Kandelia* is restricted to SE. Asia and West Malaysia.

The other genera occur all inland as constituents of the tropical rain-forest, only very occasionally occurring also in the seasonal forest (*Carallia brachiata*). Among them *Anisophyllea* is pantropical (very rare in America and absent from Australia and the Pacific), and *Cassipourea* nearly so (absent E of Ceylon to W. America). *Carallia* occurs from Madagascar to S. China and Australia, *Gynotroches* and *Pellacalyx* are restricted to SE. Asia and Malaysia. The others possess a still more restricted area *viz Macarisia* in Madagascar, *Poga* and *Anopyxis* in tropical W. Africa, *Blepharistemma* in India, *Combretocarpus* in W. Malaysia, *Sterigmapetalum* in tropical S. America, and *Crossostylis* in Melanesia and Polynesia. The latter genus might also occur in E. Malaysia and has, for that reason, been entered in the key without being described further.

Most genera are small and some of them, for instance *Kandelia*, *Combretocarpus*, *Blepharistemma*, *etc.* are even monotypic. The largest genus is *Cassipourea* with about 70 *spp.* (*cf.* ALSTON, Kew Bull. 1925, 241–276). The distribution towards the north and south shows the family to be restricted to the tropical zone and the warm subtropical zone both in the inland genera and the mangroves.

On the northern hemisphere the mangroves extend on *all* coasts north to latitudes varying between 24° and 31° N:

In the Riukius and S. Japan mangrove go north as far as 31° 20′ N, according to ITO (Ann. Bot. 13, 1899, 465) (*Kandelia*, *Bruguiera*, *Rhizophora*).

In Florida and Bermuda they extend to *c.* 28° N, in California to 24° 38′ N.

In the southern hemisphere the situation is very different between the west coasts of the continents and the east coasts.

On the east coast of S. America they go south to about the tropic of Capricorn. On the east coast of Africa[1] *Rh. mucronata* extends to 30° S, *Bruguiera gymnorrhiza* to 30° (or even 32°?) S and *Ceriops tagal* to 26° S. In East Australia mangrove *Rhizophoraceae* go as far south as the far northern corner of New South Wales at 29° S.

On the westcoast of South America *Rhizophora* seems only to extend south as far as 4° S. On the west coast of Africa *Rh. racemosa* G. F. W. MEY. goes to 6° S and *Rh. harrisonii* LEECHM. and *Rh. mangle* L. to 9° S. From West Australia I have no data but I would not be surprised that it will be found there also at small southern latitude. In all these cases the west coasts are very dry or even arid caused by northern directed cold oceanic currents.

Ecology (inland species). They represent constituents of the mixed Malaysian rain-forest, generally avoiding the seasonal areas and rarely found on the mountains above the upper limit of the tropical zone at 1000 m. The (extra-Malaysian) *Pellacalyx parkinsonii* and *P. axillaris* have been found up to 1200 m and 1300 m respectively, *Anisophyllea grandis* up to 1250 m, *A. disticha*, *Carallia brachiata*, and *C. eugenioidea* up to 1800 m, and *Gynotroches axillaris* up to 2250 m.

Though many species are common they are generally of humble size and either shrubs or small or medium-sized trees of the substage. Only a few *spp.* reach the upper canopy and sizes between 40–50 m have been recorded for *Carallia brachiata*, *Gynotroches axillaris*, *Pellacalyx lobbii*, and *Anisophyllea sp.* They may flower and fruit from a very early age onwards and share this tendency with the mangrove genera (see under *Carallia* and *Gynotroches*).

In contrast with the mangrove species none of the inland species occurs gregariously with the exception of *Combretocarpus rotundatus* which is a typical constituent of the lowland swamp- and peat-forests of Sumatra and Borneo.

Germination of representatives of the inland genera has not yet been described. The structure of the seeds in *Anisophyllea* and *Combretocarpus* is even not known with certainty. The seeds in the large-fruited species, for instance *A. grandis* and *A. griffithii*, must be a very curious one, as their enormous seeds are enveloped in exceedingly hard and woody pericarps. The structure of the seeds is in the dry state almost woody, including both embryo and its thick envelop which we assume to represent endosperm and which forms one solid whole with the embryo. In *Gynotroches* and *Carallia* the embryo is almost filiform extending from one end of the seed to the other. Germination experiments are urgently needed for getting a clear picture of both structure and mode of germination.

Ecology (mangrove species). By their wide distribution, their gregarious coastal occurrence and practical application, and their morphological and biological peculiarities, the four littoral genera deserve a more ample treatment in this Flora than is usual in the general paragraphs preceding the taxonomic revision. These four genera, *Rhizophora*, *Bruguiera*, *Ceriops*, and *Kandelia*, form a considerable part of the tropical and semi-tropical forest fringe along the shores called at variance *mangrove*, *bakau* (M) or *tidal forest* (*vloedbos*, N)[2].

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(1) Precise data on African mangroves were kindly supplied by Mr J. R. LAUNDON.

(2) The main works on the Malaysian mangrove are:

BECKING, J. H., L. G. DEN BERGER & H. W. MEINDERSMA: Vloed- of mangrovebosschen in Ned.-Indië (Tectona 15, 1922, 561–611).

(cntd. next page)

Mangroves[1] form a rather uniform, evergreen fringe of forest which is most profusely developed on low muddy shores, in estuaries and lagunes and is less abundant along sandy or rocky beaches and on old coral-reefs covered with a thin sheet of sand or mud. In the latter localities the height of the stands is low, trees are dwarfed and crooked, and the fringe is often narrow and sparse. This is in part due to the poor soil of these habitats and in part to the fact that different species are concerned. Whereas for example *Rh. apiculata* BL. and *Rh. mucronata* LAMK may attain a height of 35–40 m in favourable localities in lagoons and estuaries, with straight stems (fig. 1, 7), *Rh. stylosa* GRIFF., which is bound to the sandy beach, is always a small insignificant tree (fig. 5, 13).

It should be added here at once, in order to avoid confusion with field-workers, that in very many places mangroves are poor at present due to excessive cutting by man (fig. 3). After excessive cutting they may also change their composition and clear fellings of *Rhizophora* are sometimes replaced by regrowth of *Avicennia*, commercially an inferior timber. In many localities, notably near the larger towns, the mangroves have almost disappeared or/and degraded into low, seral thickets of *Acanthus*, *Clerodendron*, and *Acrostichum*. In other cases the destruction has even gone further and mangroves have been replaced by fish-ponds or stands of naturalized exotics, as for example in many places along Manila Bay by *Prosopis*, a spiny leguminous tree doubtless imported from Mexico.

In the field it should therefore always been verified whether a poor mangrove is due to natural factors or in minor or major degree to previous anthropogenous destruction.

The number of trees and shrubs participating in the mangrove forest is a very limited one and reversely the mangrove plants are generally bound to this habitat and are not found inland. BACKER (Krakatao 1929, 174) and I (Tijd. K.N.A.G. 52, 1935, 381) have given a list of the Malaysian mangrove species, the total being approximately 60.

Seen from a distance the mangrove makes the impression of a dark-green more or less monotonous type of forest. On entering it on foot with ebb its eerie aspect appears at once from the oppressing heat, the damp atmosphere, the bare, stinking mud, covered with stilt-rooted trees (fig. 1, 2, 7), and several kinds of other root formations (knee-like roots (fig. 16, 22), knobs, snake-like roots, erect peg- or torpedo-shaped pneumatophores), the mud teeming with crabs, fishes, shells, worms and their holes, mud-heaps and shallow pools, the air with plenty mosquitoes, the silence only interrupted now and then by the sudden rush of monkeys through the gloomy foliage, the thud of a fruit falling in the mud, or the forlorn cry of a passing seabird. For a tourist the place is singularly uninviting, but for the biologist it is a most fascinating biotope and the secrets of its life and life conditions are certainly far from being exhausted. Entering the mangrove on board a small prahu during high tide (fig. 4), gliding through the silent waters of the creeks, bordered now by the flooded forest which is nearly submerged up to the flattish underside of the tree crowns, the aspect is less fascinating and appears more monotonous, as the foliage of the trees is much alike even of representatives of very different families, all of them having dark-green, elliptic to obovate, medium-sized blades of the laurel type but rather coriaceous and slightly fleshy. Flowers are not particularly striking, and those which are, as *e.g.* of *Sonneratia* and *Dolichandrone*, are nocturnal.

On closer observation, however, it appears that each mangrove species has its own niche in accordance with its own claims to habitat and life cycle. Hence, mangroves differ in composition from place to place.

As in these low coastal regions and deltas there is always an intricate mosaic surface relief with deeper and more shallow places, higher grounds are interspersed with creeks, and soil types vary from place to place from more sandy and firm to muddy and less firm or deep soft mud, the particular niches for the species are also available in a mosaic-like pattern. Moreover, rapid changes may occur in these coastal areas where creeks may be silted up, lagoons may be shut off from the open sea by bars, and deposits of silt may be replaced or covered by those of sand.

BROWN, W. H. & A. F. FISCHER: Philippine mangrove swamps (Philip. Bur. For. 17, 1918; 22, 1922); reprinted in Minor Forest Products Philippines vol. 1.

HAAN, J. H. DE: De Tjilatjapsche vloedbosschen (Tectona 24, 1931, 39–76).

KARSTEN, G.: Über die Mangrove Vegetation im malayischen Archipel (Bibl. Bot. Heft 22, 1891).

LUYTJES, A.: De vloedbosschen van Atjeh (Tectona 16, 1923, 575-601).

MEAD, J. P.: The mangrove forests of the Westcoast of the Federated Malay States. 1912.

SCHIMPER, A. F. W.: Die Indo-malayische Strandflora. 1891.

WATSON, J. G.: Mangrove swamps of the Malay Peninsula (Mal. For. Rec. 6, 1928).

(1) In the following publications identification keys are given to the species of the mangrove formation, either based on vegetative or floral characters or on both. Unfortunately none is complete for the whole of Malaysia:

BECKING, J. H., L. G. DEN BERGER & H. W. MEINDERSMA (Tectona 15, 1922, 569-573, trees only).

BROWN, W. H. & A. F. FISCHER: Minor For. Prod. Philippines (For. Bull. 22) 1 (1920) 30–32.

FLOYD, A. G. in WOMERSLEY, J. S. & J. B. MCADAM: For. & For. Conditions in the Territ. of Papua & New Guinea (1957) 56–59.

MEINDERSMA, H. W.: Trop. Natuur 12 (1923) 73–77 (trees only).

WATSON, J. G.: Mal. For. Rec. 6 (1928) 22–23.

The main factors responsible for the ecological preference of the mangrove species are the following three which may occur combined in a limited number of combinations:

(1) *Soil type*, firm or soft, sandy or clayey in various proportions.

(2) *Salinity* and its variation both daily and to yearly average, roughly corresponding to the frequency, depth, and duration of being flooded.

(3) *Resistance to currents and surf of the mangrove species.*

From the side of the species conditions involved are the *conditions of germination and upgrowth of seedlings* and various degree of resistance (ecological amplitude) to these single factors, some being more restricted (stenecous), others allowing for a wider range (euryecous).

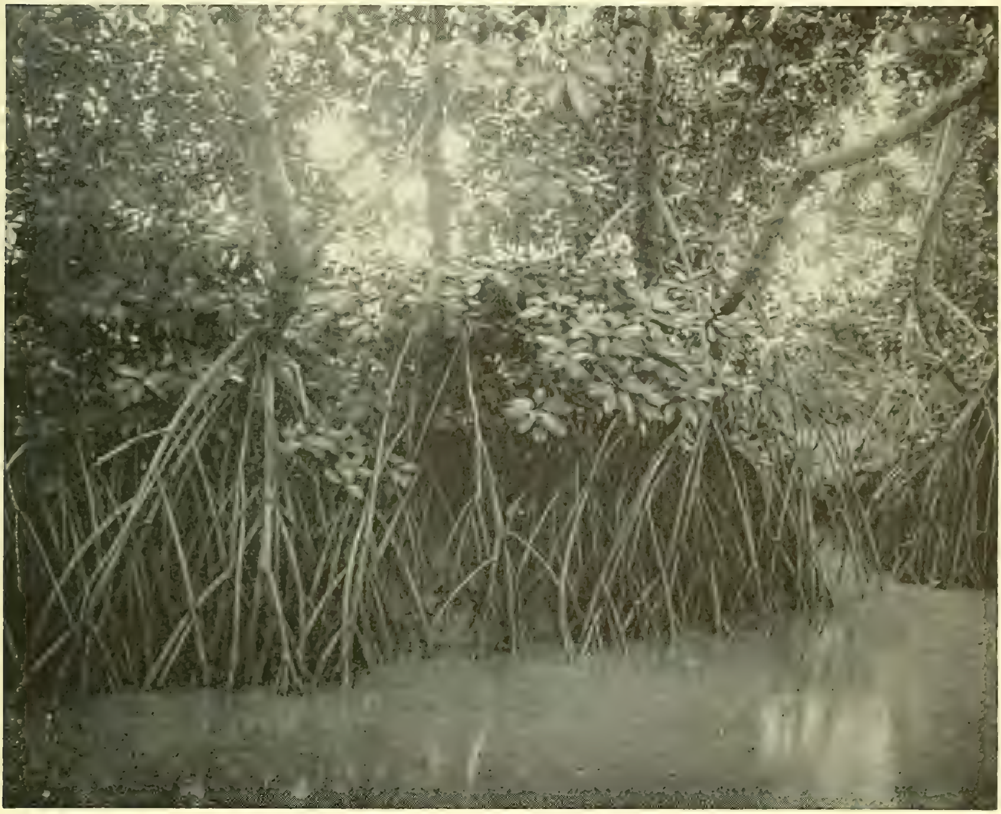

Fig. 2. *Rhizophora* along a creek near Pasuruan (NE. Java), about low tide. Between the root systems abundant regeneration (JESWIET).

Preference for *soil types* is markedly shown in the genus *Rhizophora*, *Rh. mucronata* being typical in general for deep soft mud, *Rh. apiculata* ('*conjugata*') being rather intermediate or indifferent, and *Rh. stylosa* being bound to sandy beaches and coral reefs (eventually covered by a thin sheet of mud or sand). Fig. 5, 13. BÜNNING (Flora 137, 1944, 341–342) rightly concluded that the major factor for the zonation of the mangrove is caused by the soil types (their mineralogical and physical condition), but not primarily by salinity.

Preference to *salinity* or inundation is illustrated by the fact that if the free connection with the sea (hence the tides) of estuaries or lagoons is suddenly shut off by a bar and the salinity decreases through water from the inland, *Rhizophora* forest may suddenly die off and its regeneration prohibited to be replaced by a less saline species typical for the back-mangrove, *e.g.* by *Lumnitzera* (LUYTJES *l.c.*, p. 580). WATSON observed a case of suffocation of *Bruguiera cylindrica* on stiff clays in Malaya and its dying off over a considerable surface, see p. 467.

Along coasts before a hinterland which is subject to a seasonal climate, coastal waters receive during the rainy season a large amount of freshwater diminishing salinity in the littoral zone considerably in the vicinity of the mouths of large rivers.

Possibly the salinity which is naturally closely bound to the rhythm of inundation is not the primary factor as it is interwoven with the amount of oxygen brought in by freshly oxygenated surface water of the tides which, as just shown above, is necessary for the root system prohibiting suffocation.

Preference to *water current velocity* can easily be observed along creeks with the daily recurrence of the rush of the tides. They are often fringed with *Nypa*, the massive and dense root-system of which is better fitted to resist erosive forces of swift running water than that of most other mangroves; from this it derives its advantage in these places, from which it must not be rashly inferred that *Nypa* is bound to such localities, which is by no means the case. The phenomenon may also easily be observed in the bends of the creeks where water velocity is higher in the outward bend than along the inner bend, and where consequently one species may be gregarious along the inner bends and another along the outer bends. Current and soil type go here naturally hand in hand, as silt deposits will be more coarse-grained (sandy) along the outer bend.

Along the tropical shores the three factors mentioned, soil type, salinity & inundation, and resistance against currents are running roughly parallel with the main shore and those of the islands, and are responsible for the ecological preference, manifesting itself in a *girdling* or *zonation* of the mangrove species. WATSON gave an instructive map of how such a zonation may be observed in a tidal estuary (*l.c.* p. 128, map).

The circumstances concerned with tides are naturally different in different localities: maxima and minima of the tides, their average values, turbulence of waters by wind and currents, soils, and other physical fore-shore conditions.

Schemes trying to identify conditions for the species which are responsible for the zonation are therefore apt to be of local value.

In Malaya WATSON (*l.c.* p. 129 *seq.*) attempted to avoid to form inundation classes based on the actual number of times or even days that the ground is flooded in each month, and adopted a classification based rather on the *nature of the tide* that inundates the area. For Port Swettenham he distinguished the following five classes:

Class:	Flooded:	Height above Admiralty Datum	Days flooded p/month
1	All high tides	– 8′	56–62
2	Medium high tides	8–11′	45–59
3	Normal spring tides	11–13′	20–45
4	Spring high tides	13–15′	2–20
5	Abnormal or equinoctial tides	15–	0–2

He correlated the species typical for the different tidal classes with the following (here abbreviated) comment:

Class 1: *Inundated by all high tides.*—It is unlikely that any species can survive complete daily inundation except, perhaps, *Rhizophora mucronata* on the banks of streams, and then only if its head remains above water. On the sea this class is sterile.

Class 2: *Inundated by medium high tides.*—Here belong the *Avicennias* and *Sonneratias*. Bordering the river *Rh. mucronata* predominates.

Class 3: *Inundated by normal high tides.*—Includes the greater part of the mangrove area and the majority of the species will thrive under these conditions, but the *Rhizophoras* predominate, *Rh. mucronata* being found near the streams and, on firm soils, often associated with *Ceriops tagal. Rh. apiculata* reaches its optimum development and forms pure stands. *Bruguiera parviflora* grows well, often in mixture with *Rhizophora*.

Class 4: *Inundated by spring tides.—Rhizophoras* are replaced by *Bruguieras*. On particularly stiff soil *B. cylindrica* forms dense pure stands. On the better drained soils, particularly near the rivers, *B. parviflora* is common, with occasional *B. sexangula*, the latter rarely gregarious. Prawn heaps result in better aeration and the bringing to the surface of shell remains and sand.

Class 5: *Occasionally inundated by exceptional or equinoctial tides.—Bruguiera gymnorrhiza* is definitely established here, often with a dense growth of the mangrove fern. *Rh. apiculata* is sometimes present as an old tree. On the land side bordered by pure growth of *Oncosperma filamentosa*.

The subject has in Java specially been studied by DE HAAN *l.c.* in Segara Anak near Tjilatjap (S. Java). Salinity is naturally varying both daily and with the seasons. In the dry season it is higher than in the wet season; and during the daytime it is highest at ebb when it increases in proportion to evaporation to decrease again with flood. Different species are different in their tolerance against these rather sudden changes in salinity; samples examined in Dec. 1928 (wet season) at high tide gave for *Rh. mucronata*, *Rh. apiculata*, *Bruguiera gymnorrhiza*, and *B. parviflora c.* 10–30⁰/₀₀ NaCl, for *Xylocarpus* and *Nypa* 1–30⁰/₀₀, and for *Bruguiera eriopetala* (= *B. sexangula*) 1–10⁰/₀₀. It appears that *Xylocarpus* and *Nypa* are rather indifferent to salt percentage.

As to inundation frequency DE HAAN *l.c.* distinguished 6 classes, namely: *A*. salinity 10–30⁰/₀₀ (1) Soils flooded 1–2 times per day, at least 20 days per month total, (2) *Ditto*, 10–19 days per month, (3) *Ditto*, 9 days per month or less, (4) Only a few times each year;—*B*. salinity 0—10⁰/₀₀ (5) Soils slightly influenced by the tides, (6) Soils only subject to seasonal water levels in the wet period. Species tolerance to inundation by sea-water decreases hence from class 1 to class 6, that is from the outer mangrove to the inner.

And the species concerned are in this sequence: outer zone: either *Avicennia* or *Sonneratia* on soft-muddy young silts or *Rhizophora* on rather firmer silts, middle zone: *Bruguiera gymnorrhiza*, third zone: *Xylocarpus*, *Heritiera*, inner zone: *Bruguiera caryophylloides* (= *B. cylindrica*), *Scyphiphora*, *Lumnitzera*.

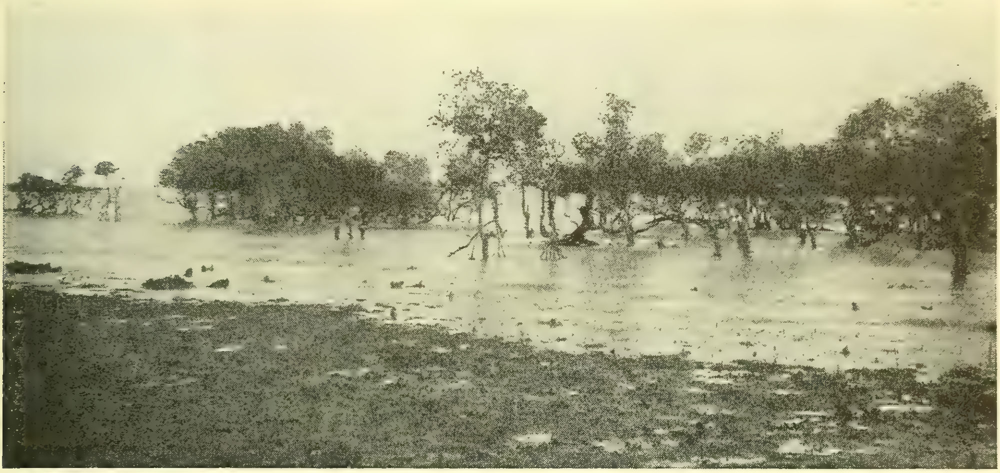

Fig. 3. Degraded type of mangrove through cutting, mostly consisting of *Sonneratia caseolaris* (L.) ENGL. and some *Rhizophora*, at low tide, near the river mouth of K. Pasuruan (NE. Java) (JESWIET).

The 5th and 6th class are rather gradual transitions to the ± freshwater swamp forest at the back of the inner mangrove proper, with *Cerbera* and *Oncosperma*. Of course the soil increases in firmness going inland.

Depending on the physiographical structure of the coast the mangrove will differ from place to place and it will be much broader in one place than in another. Along straight coastlines and absence of streams the mangrove fringe is mostly rather narrow, 25–50 m; where there are streams and deltas bringing abundant clay and sand it may be much wider and in lagoons it may attain many km in depth, depending on the gradient of the sloping land.

The zonation depends on the circumstances: very often either *Sonneratia* or *Avicennia* are the pioneers, but in places as inside estuaries which are protected from turbulent water and surf *Rhizophora* belongs to the first colonists. Fig. 1, 2, and 7.

On reefs and rocky shores seeds and seedlings are deposited in crevices and between boulders and grow where they can attain foothold and are sufficiently sheltered against heavy surf. This biotope is therefore very heterogenous and shows no or less distinct zonation. This is the situation prevailing in many Pacific islands.

With large estuaries and low gradient where rivers are sluggish, the influence of the tides goes far up river and specially the inner mangrove species are able to disperse and grow upstream fringing the banks of the creeks and river itself to considerable distances inland, gradually thinning out in quantity and in number of species, sorted out according to capacity to stand freshwater conditions. In S. Sumatra for example mangroves are found upstream the Musi as far as Palembang. Mr BRASS records to have found mangrove vegetation 85 miles upstream the Kikori River in Papua in a straight line! In the Fly River he found mangrove from the coast as far as Ellengowan Isl. 320 km upstream!, *viz Bruguiera* and *Sonneratia*. The tidal portion of the Hooghly River near Calcutta is also about 300 km long.

It has not been exactly examined whether the roots of these upstream mangrove fringes are growing under pure freshwater conditions all the year round. And this would be interesting since it has been shown by HARDENBERG (Natuurwet. Tijd. Ned. Ind. 104, 1948, 341, fig. 2) that these large, sluggish, tropical rivers contain far upstream a bottom layer of salt or brackish water. This is caused by a natural bar of sand and mud, convex towards the open sea, before the river mouth; this bar is gradually sloping down seaward and steep towards the river mouth. With each high tide sea-water is driven behind it and extends, through its higher gravity, below the upper sheet of seaward bound freshwater. It is most remarkable that these sheets of different salinity do not get mixed immediately but are separated by rather sharp 'spring horizons'. It has been found that in some Bornean rivers the brackish lower sheet may extend upstream over a considerable distance.[1] The brackish sheet will follow the lowest course of the river bottom, *i.e.* that of the main current, coming closest to the river banks along the outer bends. Additional field observations must show whether indeed the upstream mangrove is found specially along these bends and whether their roots are in contact with brackish bottom water.

In passing it may be remarked here that mangrove plants are decidedly not absolutely bound to salt or brackish water; *Acanthus ilicifolius* and *Acrostichum aureum* are occasionally found inland in pure freshwater (analyzed!) (*cf.* VAN STEENIS, Arch. Hydrobiol. Suppl. 11, 1932, 262–263; Trop. Natuur 26, 1937, 206). And it has been reported and is still observable in various temperate greenhouses that mangroves are cultivated under freshwater conditions, as for example shown in the Hamburg Botanic Gardens by HANS WINKLER (Ber. Deut. Bot. Ges. 49, 1931, 87), *n'en déplaise* the negative results with *Rhizophora* obtained by BENECKE and ARNOLD in Münster i/W who maintain that *Rhizophora* is an obligatory halophyte (Planta 14, 1931, 471–481).

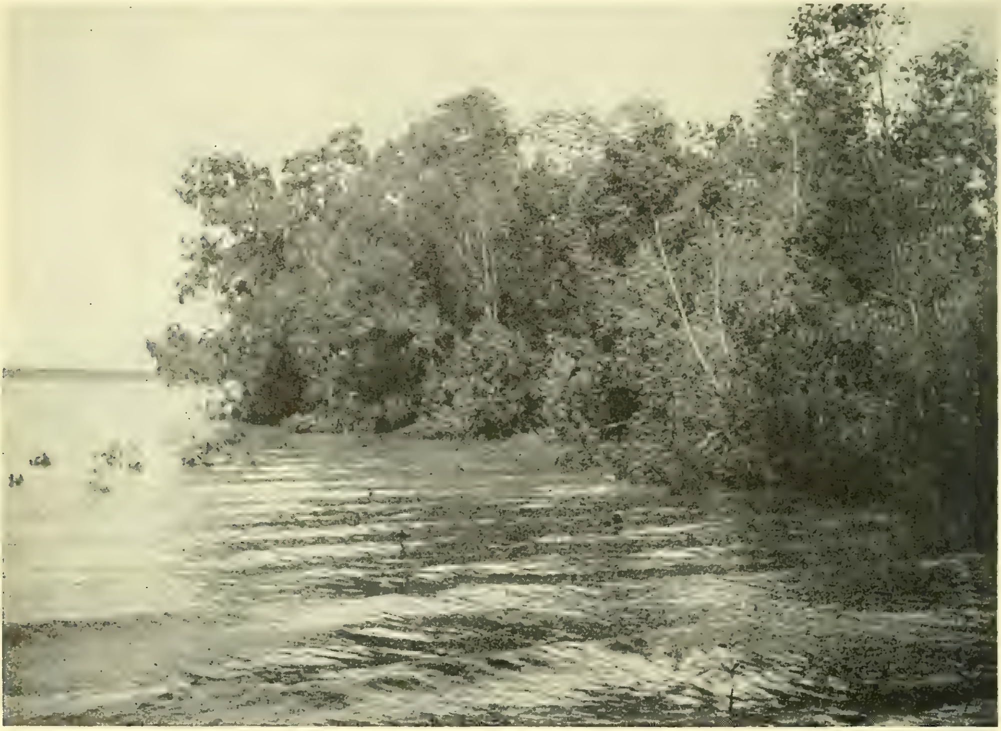

Fig. 4. *Rhizophora* forest from the seaside at high tide, some seedlings in front. Otimmer, Tenimber Isl. (BUWALDA).

Already a century ago TEYSMANN planted and maintained many mangrove species with success in a freshwater swamp and along the ponds in the Bogor Botanic Gardens at 250 m above sea-level and at *c.* 70 km distance from the sea (*cf.* Nat. Tijd. Ned. Ind. 14, 1857, 368), anticipating VON FABER's statement that the mangroves are facultative halophytes. *Sonneratia caseolaris*, *Bruguiera gymnorrhiza*, *B. sexangula*, and others are still cultivated in Kebun Raya Indonesia, Bogor, where they flower and fruit freely and even regenerate. Fig. 23.

In mapping mangroves it appears sufficiently clear that they avoid coastal areas with strong wave action and those which are subject to strong tidal currents. This is natural as frequently agitated waters prohibit generally a stable accumulation of mud or sand, hence a stable soil for the seedlings to grow up and *ditto* for the mature trees to maintain themselves. In other words, mangroves prefer shore conditions

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(1) Accordingly HARDENBERG points to the well-known fact that marine fishes are found in abundance far upstream in these rivers.

which are favourable for accretion (accumulation and extension of soil and land). Their rather superficial root system does not allow otherwise and they follow rather than precede soil accumulation. This can be easily read from the mangrove map of Malaysia drawn by FOXWORTHY (Ann. Bot. Gard. Btzg Suppl. 3 1910, 319–344).

Heavy surf through wave action and wind cause a great difference between the shore vegetation of the ocean-facing S. and SW. sides of Java and Sumatra and the Java–South-China Sea shores on the N. and NE. sides of the same islands. On open ocean-faced sides mangrove is very scarce and found only in closed estuaries or on leeward sides of islands.

Recently HOSOKAWA demonstrated this also with a mapping of mangrove in Micronesia where it is specially developed on the leeward side of the islands (Mem. Fac. Sc. Kyushu Un. E2, 1957, 106, f. 1–2).

WATSON (*l.c.* p. 5) observed the same in Malaya. He says: —"There is a distinct difference between the west and east coasts of Malaya, silting conditions being more favourable along the west coast. On the more exposed east coast wave action is more severe, particularly during the north-east monsoon, so that any fresh water brought down by the rivers is more speedily dispersed. Mangrove forms are, therefore, unable to establish themselves along the beach and are confined to the river mouths, whilst the sandy beaches themselves are flanked by a narrow belt of *Casuarina equisetifolia* which extends practically unbroken from Singapore northwards to far beyond the limits of Malayan territory."

"Where the flow of the river is sluggish the tendency is for banks of sand to be deposited at the mouth through the combined action of the currents and the north-east monsoon, the channel being forced thereby further and further south. The newly formed natural breakwater is speedily covered on its seaward edge with a dense growth of *Casuarina*, and subsequently on its protected side by mangrove forms brought down by the river. The bank continues to advance in a southerly direction, until exceptional circumstances breach it and allow the water to escape by a new mouth. The old channel then rapidly silts up and soon becomes stocked with mangrove species which persist until a new bank is formed and again breached. The new channel is then in its turn converted into a mangrove swamp and the old one is invaded by inland forms."

"Nearly all of the east coast rivers show this tendency. It is most marked at Rumpin, Merchong, and Bebar, where successive folds in the ground running parallel to the coast and bearing a few straggling *Casuarina* on the ridges and decadent mangrove in the hollows, provide unmistakable evidence of former banks and swamps. The last mentioned river demonstrates this process particularly clearly, the abnormal floods at the beginning of 1927 having broken through the *Casuarina* bank about 5 miles above the mouth of the previous channel, which is now beginning to silt up and be invaded by mangrove."

"On the west coast the mangrove is almost continuous from Kedah to Singapore. It varies in width from a few chains to a maximum of *c.* 19 km at the mouth of the Larut River in the Matang District of Perak; but the mangroves follow the rivers much further inland, extending along the banks of the Perak River up to Telok Anson, at *c.* 50 km from the sea."

"Changes of current and unusually heavy seas may sweep away the mud banks before the forest is fully formed, or even the mature forest may be eroded."

WATSON reported (*l.c.* p. 157): —"that disastrous floods on the east coast of the Malay Peninsula in the beginning of 1927 did considerable damage to the mangrove growing in the rivers, much of which was washed away or killed by excessive deposits of sand or silt. Large numbers of trees died as a result of prolonged inundation by practically fresh water, specially of *Bruguiera gymnorrhiza.* It is assumed to be a simple case of drowning; *Nypa* scarcely suffered from either immersion or silt."

FOXWORTHY recorded from Manila Bay also that seedlings of *Rhizophora* are occasionally killed by excess of fresh water.

Land reclamation capacity has been attributed to the stilt-roots and pneumatophores and other root formations projecting above the soil, attributing to them not only the faculty of calming waters and favouring thus precipitation of mud and holding back (accumulating) debris from the retreating flood water, but also attributing to them to act in this manner on *any* coast line.

This idea has been defended by H. H. M. BOWMAN (Proc. Am. Phil. Soc. 66, 1917, 667–670) who claims to have projected dikes, jetties, *etc.* in Florida and Venezuela by planting mangroves on the foreshore as ballast retainers. Recently J. H. DAVIS (Carnegie Inst. Wash. Publ. 517, 1940, 303–412) stated "that it may be possible to use mangrove, by means of plantings, to extend the coast and form islands."

Already a century ago JUNGHUHN (Java 1, 1853, 255) showed that the *mangrove follows the silting up of a coastal area rather than precedes and initiates the accumulation of mud or other soil, and that it establishes itself merely on accrescent coasts.*

BISSCHOP GREVELINK (Pl. Ned.-Ind. 1883, p. 166) pointed out that cause and condition should not be confounded and that mangrove settles only in places outside the heavy surf and current in the quiet bays, estuaries, lagoons; the same opinion is held by BACKER (Schoolfl. 1911, cliv, p. 478), F. C. VAN HEURN (Studiën, 1923, p. 65–71), MEAD (*l.c.* p. 1), WATSON (*l.c.* p. 1, 5), BROWN & FISCHER (*l.c.* p. 17), BECKING *c.s.* (*l.c.*) and has been explained by myself (Natuurwet. Tijd. N.I. 101, 1941, p. 82–85). WATSON observed: —"that as silt deposits remain bare until they have attained a definite condition of elevation and consistency, it is scarcely correct to regard the mangrove as the causative agent in the silting process. The large expanse of unclothed mud of shoals and banks exposed at low water suggests that it is necessary for the banks to remain uncovered for several days together before any form of land vegetation can establish itself. It is considered that the limit of tree growth is to be found round about the neap high-water mark, above which the ground remains unsubmerged for at least two days in every month. In rivers and sheltered situations the *Rhizophoras* may occupy flats that are covered by even the lowest neap tides, but here the superior length of the radicle enables them even the seedlings to keep their heads above water."

This observation fits also with the practical experience of engineers who, in the thirties, tried to prevent the silting up of the Deli River channel in the harbour of Belawan (Deli) by building a dam (dike) from dredged mud. This was regularly damaged and washed away by the heavy surf and current and had to be paved ('metalled'). For further protection the foreshore of the dam was planted on both sides with a fringe of mangrove seedlings but this succeeded only on the side of the silted channel. It appeared impossible to force an accumulation of silt by mere planting of mangrove.

It is of course true that in many places the mangrove has been devastated by man's cutting of firewood and that in those places replanting of mangrove will generally have success.

It is also true that the underwater foreshore conditions may change and may turn a formerly regressing part of the shore into an accrescent one enabling mangrove to settle. The reverse may also happen. In delta areas the underwater surface relief of shoals and gullies may vary and change from place to place on the same coast and may vary in the course of time in one place. It is comparable to the situation on the sand beach where similar conditions, accretion or regression, will be responsible for the origin of dunes: here also the wealth of the pescaprae beach flora is dependent on the supply of sand deposits and not reversely the amount of accumulated sand to the presence of sand-catching beach plants.

It should be admitted that where silt or sand are accumulating by the grace of suitable foreshore conditions plants may accelerate the process by adding mechanically towards a favourable upsilting through quieting waters and acting as a barrier during ebbing time; this is practized in the N. of the Netherlands by building palissades on accrescent muddy coasts. The similar function of the mangrove root formations is, obviously, a secondary one.

Along certain mud shores, notably the west coast of Malaya and the east coast of N. Sumatra there occurs a narrow strip of sand beach on the mud where the surf strikes the coast. This fan of sand is sometimes slowly rolled landwards while the mangrove mud is exposed on the seaward side: in fact here we have simply a narrow belt of sand piled up on top of the mangrove mud, the mud being never more than a few feet below the surface of the sand even at the top of the beach. By this slow retreat of the sand fan mangroves are buried by sand. I found this remarkable situation near Pantatjermin, E of Medan (Deli), and it has also been reported by CHAPMAN (1940, p. 323) from Jamaica. From the air the foreshore of such a coast with a sand beach might be interpreted as sandy, though the sands represent only a very narrow strip of sand veneer. This misinterpretation, I am told by Mr CORNER, has proved to be disastrous in landing attempts of tanks by Allied Forces on the west coast of Malaya at the end of the last world war, the tanks finding a soft mud instead of a firm, sandy bottom.

Mangrove and climate.—It has been considered occasionally (SCHIMPER *l.c.* p. 87–88) that mangrove, being little or not developed in arid or seasonal areas, would require ombrophilous conditions for its full development. The largest development of mangroves is indeed found in the everwet parts of Malaysia.

Besides, as has been mentioned on p. 431 mangrove is absent before the arid *west* coasts of the *S.* hemisphere tropics of America and Africa (and probably Australia).

The correlation between mangrove growth and climate is still often interpreted as a *direct* one, but this rash conclusion is essentially wrong. *The arid climate is not the cause of the absence of mangrove but merely the condition.*

This follows partly from the observation that not in *all* ombrophilous tropics mangroves are found; they are absent from steep shores or those with turbulent coastal waters, *etc.*

For the explanation why they avoid arid shores we have to consider that the occurrence of mangrove is primarily controlled by accretion of silt or sand and this again is controlled by the winds, the tides, the currents before the coast, the foreshore underwater relief and its shoals, and in no mean degree by the amount of silt transported by the rivers to the shore where it is deposited by its gravity and through the coagulating power of the sea-water on soil particles. Inadequacy of any of these factors will prohibit or limit growth of mangrove. Coasts which offer suitable conditions but fall off steeply towards the deep sea can only bear a very narrow fringe. Coasts along shallow seas but without accretion of silt or big rivers bringing silt will possess a poor mangrove development or none.

The situation in the seasonal parts of Malaysia, for instance the Lesser Sunda Islands, is a generally poor development of mangrove but not on account of the dry climate, but on account of the deficiency of the other conditions. In the first place this area is generally provided with steep coasts and a heavy surf. Besides, during the dry monsoon the coasts are subject to strong winds and consequently have agitated coastal water. Finally, in these islands large streams which transport a regular supply of silt to the coast are absent; most rivers are 'flood-rivers' filled only during the rainy season.

If under seasonal conditions there are, however, local sheltered bays and estuaries where silt is deposited in sufficient quantity, the mangrove may appear in luxuriant stands not falling short of those found under ombrogenous conditions, *e.g.* in the south of Central Java (Tjilatjap), the southeast of Java

(Gradjagan & Pampang Bays), SW. Timor (Kupang), and the Fly River delta, E. New Guinea. WATSON rightly remarked (*l.c.* p. 1) that the absence of mangroves along arid shores is due to the absence of rich silt carrying rivers in such places.

The conclusion is that *Rhizophoraceae* and other mangroves follow the coastal silt deposits independent of the dryness of the climate.

Characteristics of mangrove.—As has been alluded to above the characteristic appearance of the mangrove is in part due to the remarkable *root formations* which are obviously tolerant to withstand the peculiar conditions for nutrition, assimilation of water and oxygen in anaerobic mud, besides serving for anchorage on an unstable substratum. *Rhizophora* stems are provided with a cone of branched stilt- or prop-roots (fig. 12), and generally additional similar, also forked aerial roots stick out or hang down to reach eventually the soil (fig. 11); the stembase is obconical and a taproot is absent or feebly developed (fig. 7). *Sonneratia* and *Avicennia* possess a horizontal root system provided with erect, asparagus-, peg-, or torpedo-shaped 'pneumatophores' (fig. 23). *Bruguiera* and *Lumnitzera* show upward knee-like bends in the roots (fig. 16, 22), in *Xylocarpus moluccensis* the horizontal roots possess knobs producing thick-conical 'pneumatophores', in *X. granatum* these roots have an upper thickening which appears as a sharp ridge above the silt. *Ceriops*, however, does not very much show in the way of root formations save for large lenticels in the uncovered parts of the roots and stem base.

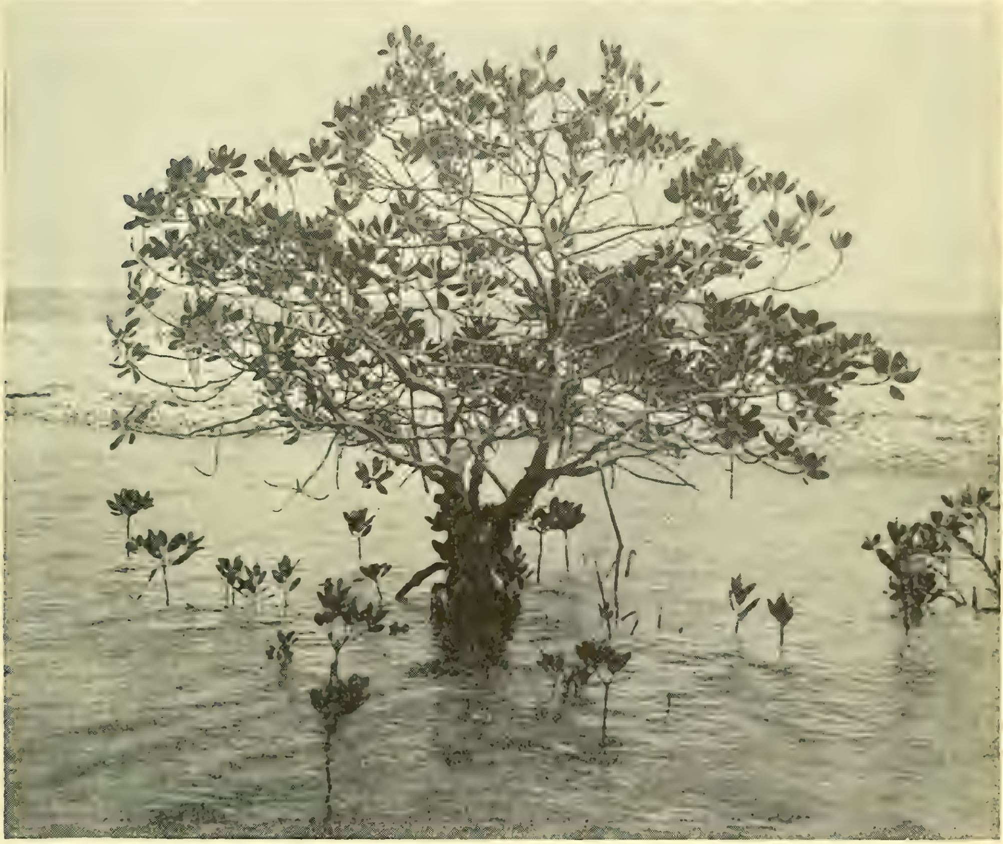

Fig. 5. *Rhizophora stylosa* GRIFF. at high tide in the small lagoon sheltered behind the lee of the shingle-wall on the coralreef island Leyden, Bay of Djakarta, surrounded by seedlings, Nov. 1927 (DOCTERS VAN LEEUWEN).

An other characteristic, unique in the plant world, is the frequent occurrence of *vivipary* in mangrove trees in which either the fruit is enlarged (*Aegiceras*) or the elongating hypocotyl pierces the apex of the fruit in the 4 genera of *Rhizophoraceae:* Fig. 6, 9, 17, 18, 24, and 26.

Further features differentiating the mangrove vegetation from the rain-forest is the *paucity of species* *and their gregarious occurrence* which can easily be observed both in the field and from aerial photographs, the absence of palms (save the stemless *Nypa*), the almost absence of lianas, the general scarcity of epiphytes and parasites, the almost absence of undergrowth, and the absence of storeys with substage layers. These characteristics hold for the proper mangrove and are generally less well pronounced towards the inner transition to the coastal forest behind.

Epiphytes and undergrowth.—Though it should be admitted that mangroves have, in general, less epiphytes if compared with rain-forest, SCHIMPER's assumption that they would be deficient in them is erroneous. BECCARI already mentioned their occurrence in Sarawak (*cf.* Wanderings p. 83, amongst others of *Rhododendron brookeanum* LOW), RUTTEN in E. Borneo (Tijd. K.N.A.G. 28, 1911), and HUB. WINKLER in SE. Borneo (Bot. Jahrb. 50, 1914, Suppl. 190–191). RIDLEY described many epiphytic orchids from the mangrove in Malaya. I found some in the Anambas Isl. mangrove (Bull. Jard. Bot. Btzg III, 12, p. 162) and STEUP mentioned them from the Riouw mangroves (Trop. Nat. 30, 1941, 90). From Java they were mentioned by BEUMÉE (Exc. guides 4th Pac. Sc. Congr. 1928, C 3, p. 11–13) to occur in Segara Anak near Banjumas; BACKER & POSTHUMUS (Varenfl. Java 1939, 325) emphasized that the occurrence of epiphytic ferns in the mangrove is restricted to areas which are not subjected to a rather strong to strong dry annual period and lack, for that reason, near Djakarta, Pasuruan, *etc.* From East New Guinea and Melanesia mangrove epiphytes (mosses, pteridophytes, orchids, *etc.*) were recorded by SCHLECHTER (1914) and from West New Guinea by KOCH. BROWN & FISCHER *l.c.* p. 24 found epiphytes fairly common in Philippine mangroves. HOSOKAWA found a similar condition in Micronesia. I have tried to give a preliminary enumeration (Tijd. K.N.A.G. 52, 1935, 382).

There seems no doubt that the typical mangrove with epiphytes is bound to ombrogenous conditions. Within these the (older) inner mangrove is richer than the (younger) outer one. Epiphytes may grow very close above the waves and subject to salt spray with wind at high tide.

Also ant-inhabited epiphytes occur in the mangrove (*Hydnophytum*, *Myrmecodia*, *Pachycentria*, *Polypodium sinuosum*).

Some epiphytic plants are even restricted to the mangrove, as for example *Humata parvula* (WALL.) METT. on 'old mossy mangrove' in S. Malaya and Borneo, and orchids as *Dendrobium rhizophoreti* J.J.S., *D. prostratum* RIDL., *D. callibotrys* RIDL., and *Bulbophyllum xylocarpi* J.J.S., and a Melastomatacea *Plethiandra sessilifolia* RIDL.

The only parasites I know from the mangrove are *Viscum orientale* and *Amyema gravis*, both *Loranthaceae*. As far as known the latter species is confined to this formation. More loranthaceous representatives will occur in the mangrove, as they also freely occur on trees of the *Barringtonia* formation; their exact number is difficult to ascertain from DANSER's works on that family as he omitted to mention the host plants save in certain exceptional cases.

Among the lianas the only true ones of the outer mangrove are *Derris heptaphylla* and *D. heterophylla*; in the inner mangrove several representatives are found of the *Asclepiadaceae* (*Cynanchum carnosum*, *Finlaysonia maritima*, *Gymnanthera paludosa*, and *Sarcolobus banksii*).

Undergrowth may consist in local, open places of few grasses (*Xerochloa imberbis*, *Diplachne polystachya*) or sedges (*Fimbristylis ferruginea*, *Cyperus malaccensis*). A submerged water-plant of the pools and creeks is *Cryptocoryne ciliata*.

Low shrubs or tall herbs appearing in open places are *Acanthus spp.*, *Acrostichum aureum*, and *Clerodendron inerme*. These may gain ground in clearings and cuttings, specially invading the colossal mud heaps accumulated by mangrove crabfish and finally form dense thickets in which regeneration of the mangrove proves difficult.

According to measurements by BÜNNING (Flora 137, 1944, 342) inside well-developed mangrove the light intensity at the bottom is about 1–5% of the open.

The mangrove as a primary vegetation type.—The thesis is defended here that the mangrove cannot merely be subordinated as an edaphic (seral) subtype of the tropical rain-forest on the argument that the back-mangrove may sometimes contain an increasing number of coastal trees if one proceeds inland. There is only a narrow transition zone, in Sumatra characterized by a strip of a tall, spiny palm: *Oncosperma horrida*.

It is certainly interesting that several mangroves (with the exception of *Rhizophora*?) can successfully be planted and grown in freshwater mud in greenhouses. In Kebun Raya Indonesia at 250 m there is an artificial freshwater swamp where *Bruguiera gymnorrhiza*, *Sonneratia caseolaris*, *&c.* flower and fruit freely and produce natural regeneration (fig. 23). This might induce the viewpoint that their restricted occurrence in the littoral zone is merely a question of resistance against the extreme littoral environment combined with low competitive power as compared with the freshwater swamp forest trees immediately behind the coast. But this argument derived from cultivated plants holds for representatives of nearly all vegetation types for which the range of edaphic tolerance is always much wider than that exhibited under natural conditions.

Mangroves are certainly bound to specific edaphic conditions, but as I have tried to demonstrate (Proc. Int. Bot. Congr. Stockholm 1950, p. 638, 1954) all vegetation types are, in last instance, edaphic.

Structurally the mangrove forest differs markedly from both the dryland rain-forest and from the freshwater swamp- and peat-forest in that *it lacks substage strata* and in that its subtypes, when fully developed mostly consist of *one or a few dominant species.* In this the mangrove forest structure approaches that of some forest types of the temperate and cold zones.

The second important reason why the mangrove cannot be considered to represent an edaphic subtype of the rain-forest is because *it is independent of the climate* and is found under both everwet and seasonal conditions, though it should be admitted that under the latter the mangrove is generally poorer and more stunted, but as has been shown above for other than climatical reasons.

An additional argument, significant but not conclusive for assigning primary rank to the mangrove, is the high percentage of genera and species confined to it and provided with a unique set of structures, morphological and physiological, fitting to the environment.

By some authors it has been held that the mangrove is a pioneer forest only, preceding the stable rain-forest. This is inferred from the fact that certain coasts show a very rapid land increase (for human concepts of time) in which the mangrove fringe is continuously pushed seaward, sending out its pioneer specimens forward while the back-mangrove is simultaneously gradually replaced by the mixed coastal rain- or swamp-forest. This land increase may average a dozen or several dozen metres per year (E. Sumatra, N. Java, S. New Guinea), leaving the hinterland interspersed with old, ± parallel strand dikes.

Elsewhere land is secularly sinking and the rain-forests are drowned and replaced by a landwards retreating mangrove; this process goes sometimes at such a rate that even the peat-forest, which bordered the mangrove on the land side, is gradually washed away by the sea.

Many are the vicissitudes of this shore vegetation and in Malaya it has been found that freshwater swamp forest has (probably often) replaced mangrove, as shown by subfossil mangrove timber and by marine diatoms in Telok Forest Reserve (WYATT-SMITH, Mal. For. 17, 1954, 25–26).

But there are also coasts which are, at present, stable and neither regressive nor accrescent, and there the mangrove behaves not different from other climax types and comes up fully to the age class criterion which is the test for a climax: in the full grown stand all year classes of all species are present, with no further potential participiants (LUYTJES *l.c.* p. 580; WATSON *l.c.*; NOAKES, Mal. For. 18, 1955, 26).

It is true that many (specially outer) stands of mangroves are about even-aged and represent a pioneer stage of the mangrove itself, but that is no proof for accepting the mature mangrove forest as consisting of nomad species. These pioneer stands mostly consist of one species in an immature environment: there will always be an immature environment fringing the seaside with a border of pioneer stands.

It is due to the bare-soil habitat, the very restricted number of species, and their rapid growth, that the stabilization of a mature mangrove forest on a stable soil type is performed in a very much shorter period than for example a climax of the very much mixed rain-forest.

The mangrove forest formation is a type *sui generis* with its own stable type of regeneration.

Morphology. (1) *Root system.* As alluded to above the mangroves present a number of remarkable root structures worthy of special mention. A taproot is generally insignificant or absent. In *Rhizophora* the root system is mainly consisting of lateral adventitious prop-roots; they originate from the hypocotyl and later the stem in an upward sequence (fig. 9, 10, 11 and 12), sticking obliquely down or hanging down as rather thick, repeatedly di- or trichotomously branched aerial roots finally striking ground and rooting. The highest of these branched adventitious roots may originate on the lower branches of the crown and may attain more than 10 m in length! According to GOEBEL and WARMING extreme heat and drought would be responsible for the dying of the tips of the stilt-roots. These would then in a subsequent growth period be replaced by secondary adventitious roots originating somewhat above the dead root tip. And this process would be repeated, resulting in the sympodially branched stilt-roots. DOCTERS VAN LEEUWEN (Ber. Deut. Bot. Ges. 29, 1911, 476–478) has offered a much more reasonable, though very curious explanation of the dying of the root tips which he observed to be damaged by a boring beetle of the *Scolytidae*! Normal stilt-roots should remain unbranched. Fig. 11.

In *Bruguiera* the horizontal cable roots produce knee- or elbow-shaped, negative-geotropical, supraterranean bends acting as 'pneumatophores'. *Ceriops* does not have much in the way of special root structures, but may occasionally have stilt-roots at the stem base. *Kandelia* has merely a thickened stem base, but with pneumatophores and true buttresses. It is worthy of note that the inland *Carallia brachiata* sometimes produces stilt-roots (fig. 32) at the stem base under marshy conditions!

Seedlings and very young trees of *Rhizophora* have some coppicing power, but contrary to what some believe the aerial roots from the branches play no part in reproduction. *Bruguiera spp.* do not coppice. This capacity is, however, strongly developed in *Combretocarpus* (*cf.* p. 481).

The underground root system of all mangroves is flat, densely branched, and superficial, the horizontal main roots (cable roots) are anchored by vertically descending small lateral roots (anchor roots); besides they (or the pneumatophores respectively) produce an extensive net of very fine nutrition ('absorption') roots in the uppermost mud stratum. The structure differs from species to species in detail, but the scheme is apparently not essentially different from that worked out by TROLL for *Sonneratia* (*cf.* vol. 4, p. 281, fig. 1). The cable and anchor roots give the tree mechanical fastening in the substratum, the fine nutritional roots serve for nutrition and assimilation of oxygen from the uppermost silt layer which is distinctly better aerated than the silt lower down. If the substratum is silted up, new nutritional roots are produced above the old ones, thus keeping pace with the accumulation of silt. The results obtained by TROLL with *Sonneratia* in Malaysia (*cf.* vol. 4, p. 281–282, fig. 2) are in general corroborated by CHAPMAN for *Avi-*

cennia in Jamaica (J. Linn. Soc. Lond. Bot. 52, 1944, p. 407–533) and there seems good reason to assume the general validity for various root formations of other mangroves.

(2) *Foliage and stipules.* The foliage of the mangroves is generally dark green and glossy, more or less coriaceous to fleshy, elliptic to obovate as common to the laurel type of rain-forest. They are said to have frequently a downward hanging position, specially in the daytime, which is assumed to be an ecological adjustment to avoid overheating. No critical experiments or observations are known to me to sustain this idea.

The leaves of *both* the mangrove and inland *Rhizophoraceae* show the occurrence of characteristic dark glandlike dots which appear to be corked epithem cells. The vernation of the leaves in the Malaysian *Rhizophoraceae* is either convolute (fig. 6j) in the genera *Bruguiera* and *Rhizophora* or involute (fig. 6i) in the genera *Ceriops*, *Carallia*, *Gynotroches*, and *Pellacalyx*. In *Kandelia* it could not be examined due to lack of adequate material.

The interpetiolar stipules of the mangrove *Rhizophoraceae* are large and caducous and are cigar-like clasping one another, each having one free margin (fig. 6k). It has sometimes been assumed that they serve for bud protection but this again has, as far as I know, not been verified by some simple experiments: it would be easy for people on the spot to cut away stipules in various stages of development to see whether the terminal bud will succeed without them.

A peculiar phenomenon is the occurrence of glandular emergences (*colleters*) in the axil of the stipules; they were first described by ALSTON in African *Cassipourea*, later by METCALFE & CHALK in *Carallia*, but appear to occur in all Malaysian genera, both of the mangrove and inland. The resin exuded by them during the time the flush expands lends a certain varnish to the innovations which is specially conspicuous in *Carallia brachiata*.

(3) *Branching.* The mode of branching is often sympodial which adds to a flat undersurface of the crown; with low tide this flattened appearance is very distinct.

(4) *Flowering* of mangrove trees takes often place at an early stage (3–4 years) if sufficient light is available in seedling trees of all genera. This capacity is shared by the inland genera.

(5) *Vivipary* and *embryology.* Among mangrove plants, both of the *Rhizophoraceae* and belonging to taxonomically quite different families, there is a distinct tendency towards a viviparous development of the seed, which finds its extreme in the *Rhizophoras.* The endosperm plays only a short role and is soon obsolete. In the myrsinaceous *Aegiceras corniculatum* the embryo ruptures the testa and fills the pericarp which then starts to enlarge in proportion to the growth of the embryo; after the enlarged fruit is fallen the embryo pierces the pericarp. In the verbenaceous *Avicennia* there is a similar development, but the embryo may or may not pierce the pericarp while the fruit is still on the tree. In *Bruguiera* the apex of the

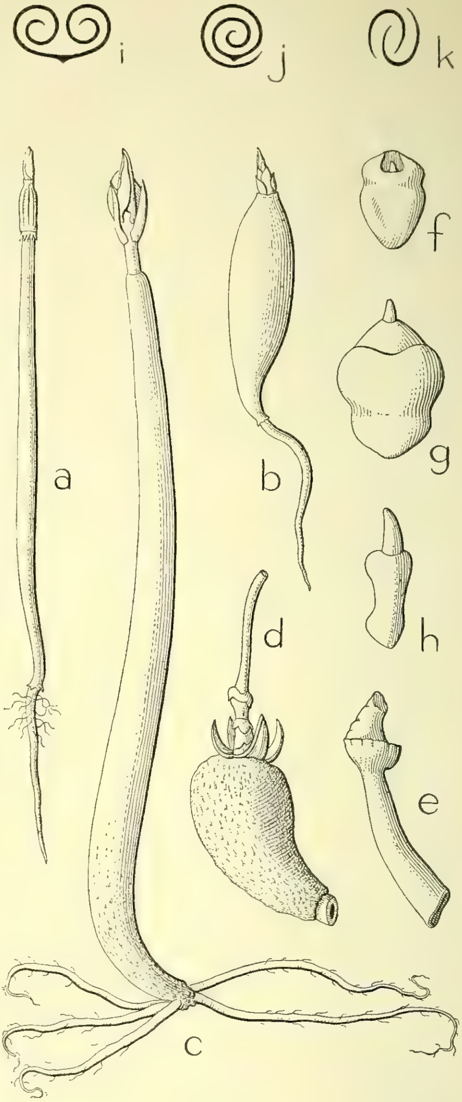

Fig. 6. *a. Bruguiera parviflora* (ROXB.) W. & A. seedling, the pericarp + calyx are pierced at both sides, × $^1/_2$, *b. Br. sexangula* (LOUR.) POIR., young seedling, × $^1/_2$, *c. Rhizophora mangle* L., *ditto*, × $^1/_2$, *d. Rh. mucronata* LAMK, fruit from which the seedling has fallen out, the basis of the cotyledonar body just protruding from the fruit calyx, × $^1/_2$, *e. ditto*, cotyledonar body removed, in the same position, × $^1/_2$, *f. ditto*, developing seed with widely opened micropyle, × 2, *g. ditto*, older stage, × 2, *h.* young germlet with the dumb-bell shaped cotyledonar body, × 2.—Vernation of *i.* involute leaves, *j.* convolute leaves, *k.* clasping stipules (all in schematic cross section) (*a–h* after SCHIMPER).

hypocotyl pierces the fruit apex and the hypocotyl grows cigar-like out of it, to fall together while still attached. In *B. parviflora* the fruit base is frequently pierced by the growing plumule, the pericarp persisting as a cuff round the seedling (fig. 6a). In *Bruguiera* the cotyledons are only connate at the base but they serve by their glandular epidermal tissue for assimilating nutrients from the pericarp and feeding the hypocotyl. In *Rhizophora* vivipary has advanced so far that the hypocotyl may attain a considerable length and when ripe fall out of the fruit; its plumule is entrenched in a single, club-shaped cotyledonar body (fig. 6d–e), formed by the fleshy connate cotyledons. This serves for sucking nutrients from the pericarp for the growth of the hypocotyl; it often protrudes from the fruit and is demarcated against the hypocotyl by an articulation. When mature this articulation is ruptured and the hypocotyl crowned by the plumule (fig. 6c) falls out of the fruit (*Rhizophora*, *Ceriops*) or the hypocotyl falls together with the fruit (*Bruguiera*, *Kandelia*). Fig. 6a, 17l, 26e.

In *Avicennia* TREUB (Ann. Jard. Bot. Btzg 3, 1883, 79–85, t. 14–15) observed one enormous, branched cell performing this assimilatory function retained in the embryo which for the greater part escapes very early from the integuments.

It is current usage to accept, teleologically, the striking vivipary of the mangroves as a 'special adaptation' to the environment, though what 'profit' is exactly meant by this trend of thought is not disclosed. It is termed 'adaptation' as it is exhibited in one environment by various not related plants. As a matter of fact vivipary with such intricate designs is not found in any other vegetation type. But on the other hand it appears that certainly not all mangroves possess it; none of these remarkable features occurs for example in *Sonneratia* which is, among the mangroves, taxonomically the closest ally of the *Rhizophoraceae* and ecologically a pioneer! Also none of these characters is found among the representatives of the *Barringtonia* formation which grows under rather similar conditions of the shore, though not under permanent inundation, and none is found among the trees of the swamp- and peat-forests which are often found immediately behind the mangrove. Consequently a generalization seems out of question and the term 'adaptation' seems rather an excuse for ignorance than explanatory.

Seedling stage and dispersal. As is usual among shore plants dispersal is mainly waterborne. Drift capacity over relative short distances is undeniable. The idea that the hypocotyls would fall from the seed tree (at ebb tide) torpedo-like penetrating into the mud and grow into seedlings in that same place is a popular opinion, but seems to be wrong and to happen only in exceptional cases. To my knowledge there have been made no pertinent observations in nature to the effect that one has actually seen fruits falling, sticking in the mud, remaining in a vertical position, and growing up. The 'torpedo-act' would only be possible in very soft exposed mud and then the chance that they will soon sag sideways is likely. On stiff clays and on sand (*Rhizophora stylosa*) it seems out of question that it may happen even occasionally. Furthermore all fruits falling when the mud is covered with a good sheet of water will not have the force to penetrate into the mud as the water will act as a distinct brake on their falling speed. C. D. DE LA RUE & T. J. MUZIK have made a plea to the contrary (Science 114, 1951, 169) and assume *Rhizophoras* mainly 'plant themselves' but they counted the erect seedlings as being borne from 'self-planting' and those which are curved they assumed derived from fruits which took root while lying flat. It is quite possible, however, that the latter may get an erect position and remain straight by the uplifting power of the water in conjunction with their own drifting capacity. I agree entirely with the excellent observations and considerations by EGLER (Carib. For. 9, 1948, *no* 4) and by B. D. LAWRENCE (Am. J. Bot. 36, 1949, 426–427) on the self-erecting habit of *Rh. mangle* which seems the usual way of seedling growing up. As a matter of fact hypocotyls are dispersed by floating horizontally in the water (though some have been observed floating in a vertical position). It is true that sometimes a seed tree is surrounded by seedlings as children under a mother (fig. 5), but we should not jump to the conclusion that they are *per se* its own children. The observation is that the hypocotyls drift freely in the water; the hypocotyl produces small roots near its tip and they get attached to the mud during ebb tide in a horizontal position. When the anchorage is obviously firm enough, the hypocotyl bends itself upwards and soon gains the erect position (fig. 6c). That this happens often nearly an already existing tree is due to the fact that this offers obviously a suitable ecology for growth of mangrove, and secondly in that mature hypocotyls are easily caught between the projecting root structures of existing trees with other drifting debris. Spring ebb is possibly the most suitable time for the hypocotyls to fasten their rootlets for anchorage. For no obvious reason the main root of the seedling in *Rhizophora* and *Ceriops* is abortive and lateral roots take its function (fig. 9–10).

According to GUPPY fruits or seedlings may drift for several months and retain their vitality. In Malaya, however, it is maintained (Res. Pamphl. For. Res. Inst. Mal. 15c, 1957, 7) that observations on natural regeneration in the mangrove indicate that recruitment of seedlings of *Rhizophora*, *Bruguiera*, and *Ceriops* species, in deep flooding blanks of the Perak mangrove, proceeds slowly with seed from nearby trees and not from seed which has been waterborne for any distance. Recruitment of *Sonneratia* and *Avicennia* species may occur with seed which has been waterborne for a considerable distance.

CHAPMAN *c.s.* have pointed out (Geogr. J. 76, 1940, 320) that a successful colonization of seedlings depends either upon a very shallow sea in those cases where there is only a small tidal rise, otherwise there must be a considerable tidal rise and fall so that they are exposed for some hours during the day, as unless the small shoot portion is out of the water the seedling soon dies.

Accordingly the *length of the hypocotyl* must play a considerable role in the colonization and is obviously responsible for the fact that *Rhizophora mucronata*, the hypocotyls of which may attain 60 cm in length (according to CORNER even 3 feet!), are able to grow in the deepest water (or places subject to deepest fall and rise of the water level with the tides), and is henceforth the principal seaward pioneer.

The waterborne dispersal is certainly one of the factors responsible for the generally wide distribution of mangroves. Obviously the megatherm character of the *Rhizophoraceae* has prohibited species to migrate freely between oceans which are separated by N–S directed continents, as Indo-Pacific species do not occur in the Atlantic, *vice versa*, but those of the Caribbean occur also in West Africa. SCHIMPER (*l.c.* p. 193) has already pointed to the agreement between the littoral flora of the Caribbean and West Africa and the marked difference between the West African and East African coastal floras, the latter being a depauperated Indo-Malaysian one. The situation is obviously radically different from that found in the distribution of the seagrasses (see p. 382).

The relation between the mangroves of the Caribbean and those of the Pacific coast of North America are less clear and can not be explained before a critical detail identification of Pacific *Rhizophoras* has been undertaken. If the tentative assumptions made under the genus *Rhizophora* (see p. 450) are right it would seem that at least two Caribbean *Rhizophoras* occur on the Pacific American coast and their distribution must have been effected before the closing of the isthmus of Panama.

From the rather restricted area of a few rhizophoraceous mangrove species we also may infer that there are limitations to either the long-distance dispersal capacity or the ecology. It is for example difficult to explain why *Kandelia candel* is so extremely rare in Malaysia, as the number of ecological niches offered by Malaysian coastal areas certainly includes the one suitable for *Kandelia*. *Bruguiera exaristata* and *B. hainesii* are other examples of geographically relatively restricted species.

Another argument for the relative difficulty in dispersal for the seaborne mangroves is the remarkable fact that *no* mangroves are known to occur native in the Hawaiian islands, although they can grow there in certain localities, as has been shown by extensive planting experiments initiated by the Hawaiian Sugar Planters' Association in 1922. This peculiarity is even more remarkable if it is remembered that of the *inland* genus *Crossostylis* representatives have been found eastwards in the Pacific in truly oceanic islands as far as southeast Polynesia, although their means of dispersal would appear far inferior to those of the mangroves!

Physiology. The extreme habitat of the mangrove vegetation has led to several assumptions, some of which have been mentioned in passing in the foregoing paragraphs. SCHIMPER (Pfl. Geogr. 1898) classified the mangroves among the 'xerophytes', accepting a low rate of transpiration and growth. His (± teleological) argument was that this must be so in order to avoid too high salt concentration in the tissues. He believed to have circumstantial evidence for this viewpoint in morphological 'adaptations' to xerophily, *viz* fleshy or lepidote leaves, hairy leaves, isolateral leaves, thickened epidermis and cuticle, slime cells and thin-walled water tissue, sunken stomata, *etc.*. HOLTERMANN (Einfl. Klimas, &c. 1907), and specially VON FABER (Proc. 4th Pac. Sc. Congr. 1929, 3, 1930, 113–120) have shown, however, that mangroves are strong transpirators and besides show abundant guttation. Concentration of salt is avoided by exuding it and the water supply and water stream through the plant consists of salt water.

As has been shown by Mrs REINDERS-GOUWENTAK in an excellent digest of later literature in this Flora (vol. 4, p. 513–515) on the relation between wood anatomy and water relations later authors are not in full agreement with VON FABER's results and are of opinion that his evaporation figures are overestimated. But growth measurements by silviculturists have shown mangroves to be not particularly slow growers. And it can be maintained that their classification with xerophytes is definitely erroneous.

It would be most interesting to make a comparative study of the physiology of the mangrove *in situ* and that in the Botanic Gardens, Bogor, where the same species have grown up in fresh-water.

It seemed an attractive idea of SCHIMPER to base a wholesale ecological classification of the plant kingdom on correlating the water supply of substratum and climate with the morphology of plants, but it appears more and more that this simple device has to be abandoned, both for the halophytes, mangroves, and desert plants themselves, some of which show a high rate of transpiration.

In the foregoing paragraphs the other major physiological problem of the *Rhizophoraceae*, *viz* their respiration under anaerobic soil conditions has already been touched upon and reference has been made to the work of TROLL and CHAPHAM who I believe have found a reasonable explanation for the way how the root systems of *Sonneratia* and *Avicennia* are provided with sufficient oxygen, from which it follows that the respiratory function of the supraterranean 'breathing roots' has formerly been exaggerated. This pattern will, *mutatis mutandis*, probably hold in its basic design for other mangroves; there is here a need for further investigation.

Galls. DOCTERS VAN LEEUWEN (Zoocecidia Neth. Ind. 1926, 402, fig. 746–747) reported a leaf-gall caused by a gall-midge in *Anisophyllea disticha* and a flower-gall caused by a gall-midge in *Carallia lucida* (= *C. brachiata*). I have also seen those two kinds of galls in the above-mentioned species. Besides, I have found a fruit-gall in *Anisophyllea beccariana* where the ovary is swollen into a fruit-like body.

Flower biology. Though the flowers are, for example in *Bruguiera*, *Kandelia*, and *Rhizophora*, not small, very little actual observation has been recorded and this remains an urgent desideratum.

Many representatives possess a distinct disk and their flowers will contain honey. Further there are in certain genera unisexual or polygamous flowers which might require insect pollination.

GEHRMANN (Ber. Deut. Bot. Ges. 29, 1911, 308–318) and PORSCH (Jahrb. Wiss. Bot. 63, 1924, 611) assume occasional visits by birds in addition to anemophily in *Bruguiera*. The first author studied in the Botanic Gardens, Bogor, March 1911, the structure of the flowers of *B. gymnorrhiza*. He found the anthers pressed between the petal lobes with a tension in the snakelike curved filaments. This tension can be released by touching with a needle or hair the sensitive inner basis of the petal after which the anther comes forward and explodes into a cloud of powdery pollen. This can also be attained by shock. The cupular calyx basis is filled with honey. No flower visitors were observed.

DOCTERS VAN LEEUWEN (Ann. Jard. Bot. Btzg 37, 1927, 11) did not observe bird's visits, though the red calyx and abundance of honey would suit them. But visits by *Xylocopa* (wood bees) and wind might also be capable of setting free the pollen. In the flowers of *Rhizophora stylosa* he observed once a small bee (*l.c.* p. 24).

Wood anatomy. DEN BERGER, Med. Proefstat. Boschw. 13 (1926) 138, Determinatietabel Malesië, Veenman, Wageningen (1949) pp. several & 71; DESCH, Mal. For. Rec. 15^{II} (1954) 447; REYES, Dep. Agr. & Comm. Manila, Techn. Bull. 7 (1938) 354 (hand lens). JANSSONIUS, Key to Jav. woods, Brill, Leiden (1952) 16, 22; MARCO, Trop. Woods 44 (1935) 1; METCALFE & CHALK, 1 (1950) 605; MOLL & JANSSONIUS, Mikr. 3 (1918) 323; PANSHIN, Philip. J. Sc. 48 (1932) 143; PEARSON & BROWN, 1 (1932) 486. For review of anatomical structure and water relations: REINDERS-GOUWENTAK, Fl. Mal. I, 4 (1953) 513.

The group of the tidal genera is readily separated from the 3 groups (see MARCO, METCALFE & CHALK) of inland genera by the heavy-barred scalariform perforations of the vessels, the scalariform intervascular pitting, the libriform fibers, the scanty (except in *Kandelia*) vasicentric parenchyma, and the structure of the fine-celled rays (JANSSONIUS, MARCO, METCALFE & CHALK). Four of the 5 inland genera are rather readily separated from the *Macarisieae* (MARCO) but METCALFE & CHALK do not quite agree. *Pellacalyx* cannot be placed satisfactorily into any group of the family (MARCO, METCALFE & CHALK).—C.A.R.-G.

Taxonomy. The family was established by R. BROWN as order *Rhizophoreae* including *Rhizophora* L., *Bruguiera* LAMK, and *Carallia* ROXB. (in Flinders' Voy. II, 1814, App. iii, p. 549).

ENDLICHER separated two inland genera *Cassipourea* and *Dryptopetalum* (= *Gynotroches*) from the mangrove genera and accommodated them in a subdivision *Legnotideae* (Gen. Pl. 1840, p. 1184), but he left *Carallia* in the *Rhizophoreae sens. strict.* He maintained this division in his Enchir. Bot. (1840) 634–635, where he added that the *Legnotideae* differed from the *Rhizophoreae* by albuminous seeds and superior ovary.

These two subdivisions were raised to family rank by BLUME (Mus. Bot. 1, 1849, 126, 131), followed by MIQUEL (Fl. Ind. Bat. 1, 1, 1855, 581, 591), but *Carallia* was (rightly) transferred to the *Legnotideae* which then consisted merely of inland genera.

BENTHAM & HOOKER *f.* maintained the two groups *Rhizophoreae* and *Legnotideae* as tribes of one family but added a third tribe, *Anisophylleae*, including two inland genera *Anisophyllea* and *Combretocarpus* (Gen. Pl. 1, 1865, 687).

This system was recently still followed by RIDLEY, who raised these three tribes each to family rank (Fl. Mal. Pen. 1, 1922, 692, 696, 700).

It was also followed by BAILLON who, however, split the *Legnotideae* into two separate tribes ('series') (Hist. Pl. 6, 1876, 284–304).

CORNER distinguished the same three groups as BENTHAM & HOOKER *f.* but was of opinion that the *Anisophylleae* deserved family rank against the *Rhizophoraceae* proper, subdividing the latter into two subfamilies *Rhizophoreae* and *Legnotideae* (Ways. Trees 1940, 122, 520).

SCHIMPER had a quite different opinion as compared with preceding authors, in assuming that the remarkable structure of the fruit and mode of germination of the mangrove genera were mere adaptations to the tidal habitat, which would represent therefore artificial characters. He suggested a different system and rearranged the genera according to what he assumed to represent 'natural relationships'; he kept the subfam. *Anisophylloideae* in the circumscription of BENTHAM & HOOKER *f.* and kept also one inland tribe *Macarisieae* in about the circumscription of BAILLON, but he assembled *Carallia* and *Pellacalyx* with *Bruguiera* in a subtribe and added *Gynotroches* and *Crossostylis* to the *Rhizophora-Ceriops-Kandelia* affinity (in Engl. & Pr. Nat. Pfl. Fam. 3, 7, 1898, 49–50).

This mixing of inland and mangrove genera in both tribes and subtribes as advocated by SCHIMPER is not sustained by the wood anatomy and other anatomical characters, as pointed out by SOLEREDER (Syst. Anat. Dicot. 1908, 384, Ergänz. Bd 1908, 137), MOLL & JANSSONIUS (Mikr. Holz. Jav. 3, 1918, 323), and DEN BERGER (Hand. 4e N.I. Nat. Congr. 1926, 403–404, 1927). SCHIMPER's clearly wrong classification provides again a good example of what danger is involved if a taxonomist introduces preoccupied theoretical ideas in a classification.

MARCO (Trop. Woods 44, 1935, 1–21) in a comprehensive study of the wood anatomy classified the family into 3 divisions, leaving *Pellacalyx* and *Poga* unclassified, as he could not refer them to any of these divisions. He considered the mangrove division, *Rhizophoreae*, to form wood-anatomically, a well-defined, homogeneous, natural division readily separable from other groups of this or any other family;

it might even deserve family rank. In his opinion BENTHAM & HOOKER's *Legnotideae* are, wood-anatomically, heterogeneous and unnatural. Therefore he split it into two divisions, *Gynotrocheae* and *Macarisieae*, adding the *Anisophylleae* (*Anisophyllea & Combretocarpus*) to the *Gynotrocheae*, as a separate section.

METCALFE & CHALK (Anat. Dic. 1, 1950, 610) confirmed in general MARCO's scheme, but remarked that the material they examined provided less convincing evidence of the clear distinction between *Gynotrocheae* and *Macarisieae*. They confirmed also that MARCO's unclassified genera *Poga* and *Pellacalyx* do not fit very well into any of their proposed groups though these genera have many characteristics in common, even in detail, with other members of the *Rhizophoraceae*.

DESCH had a similar opinion (Mal. For. Rec. 15^2, 1954, 447–454) and assumed that *Pellacalyx* shows wood-anatomically a distinct alliance with both *Carallia* and *Gynotroches*, all belonging together to the *Legnotideae sens. lat.*

Affinities with other families. R. BROWN, *l.c.*, BENTHAM (J. Proc. Linn. Soc. Bot. 3, 1859, 65), LINDLEY (Veg. Kingd. 1846, 726), BAILLON, *l.c.*, and HUTCHINSON (Fam. Fl. Pl. 1, 1926, 185) have discussed the multiple affinity of this family. It shows relationships with *Myrtaceae*, *Lythraceae*, *Cunoniaceae*, *Combretaceae*, and *Melastomataceae* in one way or another.

ERDTMAN (Pollen Morph. & Pl. Tax. 1952, 379) has examined pollen grains of 12 species from 10 genera of *Rhizophoraceae*. He stated that "grains ± similar to those in *Rhizophoraceae* occur for instance in certain *lythraceous* genera (*cf.* also *Dialypetalanthaceae* and *Santalaceae*). The grains in *Combretaceae*, *Cunoniaceae*, *Lecythidaceae*, *Melastomataceae*, *Sonneratiaceae*, *etc.* are ± different." The pollen structure gives obviously no clear conclusion either for the subdivision of the family or for its affinity. *Anisophyllea* has no aberrant pollen type justifying a separate rank.

Resemblance with Rubiaceae. There is an astonishing outward, vegetative morphological resemblance between *Rhizophoraceae* and *Rubiaceae*, both families sharing in the majority of genera, decussate leaves, interpetiolar stipules provided with colleters, and an inferior ovary.

In *Rhizophoraceae* the caducous stipules have overlapping margins (except in *Pellacalyx* where they are flat), each stipule having one free margin (fig. 6k). In *Rubiaceae* they are generally flat, often persistent, and not overlapping, though in *Mastixiodendron* the situation is exactly the same as in *Rhizophoraceae* (except that each stipule is inserted between the leaves and besides intra-axillary in one axil!); in *Timonius spp.* the situation varies with the *spp.* and may be overlapping as in the *Rhizophoraceae*, or one stipule may embrace entirely the other, or the stipules may be connate and are cucullately caducous, or they may be valvate.

The families can of course easily be distinguished by the structure of the corolla (sympetalous in *Rubiaceae* and choripetalous in *Rhizophoraceae*) and the androecium (isomerous in *Rubiaceae* and twice or more the number of flower parts in *Rhizophoraceae*). Besides the petals of *Rhizophoraceae* have a distinct tendency to produce fringes or appendages and are generally erose, emarginate, or 2-lobed.

Uses. Nearly all *Rhizophoraceae* have a heavy, dense, and hard, often red timber, but none of them seems to be capable to withstand use in the open, except for the proper heart-wood of some mangroves which is said to be durable in the soil below the water level.

The timber of some inland genera seems to be of better quality for building purposes and cabinet work.

Mangrove timber is frequently used for short time purposes, poles in fisheries, piles for mining, for tobacco drying sheds, *etc.*

Its main use is for fire-wood, fuel in locomotives, *etc.* and for making charcoal. Chinese coastal people in Malaya and Sumatra (*e.g.* on Rupat Isl. near Bengkalis and in Aru Bay) are using large, stone-built permanent kilns of which the filling and burning takes one month, one filling delivering nearly 8000 piculs charcoal. NOAKES described the charcoal industry in the Matang mangrove and recorded that the art of building good brick kilns was introduced by the Siamese (Mal. For. 13, 1950, 80–83).

The bark of nearly all species of mangrove species is used for tanning purpose (bakau: *Rhizophora*, *Bruguiera;* tĕngar: *Ceriops*) and may contain up to more than 40% tanning substance in air-dry bark. The tannin is sometimes extracted and concentrated into cutch. In general the impression of HEYNE is (Nutt. Pl. 1927, 1162 *seq.*) that the quality of the tan is less good than that derived from *Acacia* bark, partly caused by the red colour of leather tanned with bakau bark. The bark is also used for tanning nets and fishing lines but is not judged of excellent quality. Large studies on the use of mangrove have been published by R. WIND (Med. Proefst. Boschwezen Ned. Ind. *no* 9, 1924) and T. A. BUCKLEY (Publ. Dep. For. Malaya *no* 7, 1929).

Tĕngar bark is also used for the purpose of dyeing, phlobaphene colouring-matter being associated with the tan, and has been used in the batik industry; it is preferred for black colours to *Melastoma*.

For more details and for minor uses (as food or medicinal purposes) see under the species.

The mangrove forests are of distinct value for the timber industry in the widest sense for various reasons: species are few and gregarious, the terrain is not fit for many other purposes (save in some cases for fish-ponds[1], the coastal situation near large towns and harbours needing timber and fuel is favourable, and extraction and transport is relatively easy.

The total surfaces covered by mangrove are rather considerable; in Malaya (West Coast) estimated at

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(1) In North Java these fish-ponds ('tambaks') cover *c.* 75.000 ha.

about 1400 sq. km, in Riouw-Indragiri at 1750 sq. km, in Papua the area from the Purari mouth to the Turama River is estimated to contain 800–1200 sq. km mangrove forest.

The stands are often heavy: a good mangrove forest may contain in certain cases, according to MERRITT (in Mindoro) 500–1000 trees per ha 10–30 cm thick and 6–14 m high. In Subuguey Bay (Mindanao) FOXWORTHY found in 1912 old stands to contain the enormous amount of 300–650 m³/ha (stacks), and also in Mindanao he found virgin mangrove forest to contain 149 trees per ha over 25 cm diam. with a cubic content of 130 m³/ha. According to WATSON (*l.c.* p. 167) the average yield of 250 m³/ha (stacks) is optimistic for future yield of productive areas; in Riouw it is according to JONKER (Tect. 26, 1933, 730) 100–200 m³; planted forest 40 years old would yield 400 m³.

The rotation period in Malaya was originally estimated at 20 years, later 40 years, but the latest and obviously final working plan by NOAKES is set at 30 years.

Cutting and management of mangrove must be planned from place to place in accordance with available rejuvenation, the course of the creeks, occurrence of *Acrostichum* and *Acanthus* which may hamper upgrowth of seedlings or sometimes be favourable for nursing them. Care should be taken that a felling is not followed by a succession of the inferior *Avicennia* or *Bruguiera parviflora*. Sometimes it is advisable to leave seed trees ('standards'). The planting of mangroves can be performed both by using young seedlings or fruits (DE JONG, Tect. 27, 1934, 290). Extraction of timber is sometimes done by rail but mostly by water transport. Drainage ditches or canals are sometimes necessary for improving stands or specific composition.

KEY TO THE GENERA

Based on fertile material

1. Plants of mangrove forests. Seeds germinating in the fruit while the latter is still attached to the tree; hypocotyl protruding from the fruit.
 2. Calyx always 4–lobed. Petals entire, without appendages. Anthers multi-locellate, finally dehiscing with a large ventral valve . . . . **1. Rhizophora**
 2. Calyx 5–16-lobed. Petals 2-lobed, multifid, or with apical appendages. Anthers 4-locular, dehiscing with lengthwise slits.
  3. Calyx 8–16-lobed, lobes subulate-lanceolate, pointed. Petals bilobed or emarginate **2. Bruguiera**
  3. Calyx 5- or 6-lobed, lobes ovate or linear-oblong, acuminate or obtuse. Petals fringed with apical appendages or multifid.
   4. Calyx lobes ovate, 2½–3½ mm long. Petals less than ½ cm long. Stamens 10–12. Hypocotyl ridged . . . . **3. Ceriops**
   4. Calyx lobes linear-oblong, *c.* 15 mm long. Petals *c.* 1½ cm long. Stamens indefinite. Hypocotyl smooth . . . . **4. Kandelia**
1. Plants of inland habit. Seeds not germinating in the fruit when the latter is still attached to the tree.
 5. Leaves alternate, exstipulate. Styles free.
  6. Flowers usually polygamous, 4-merous. Fruits not winged. Leaves usually 3–5-plinerved. . **5. Anisophyllea**
  6. Flowers bisexual, 3-merous. Fruit 3-winged. Leaves pinnate-nerved . . . **6. Combretocarpus**
 5. Leaves decussate, stipulate. Styles simple.
  7. Free part of the calyx divided to the base, inside glabrous in the lower part. Disk annular or cup-shaped surrounding the base of the style. Stamens attached to the disk. Stipules imbricate and overlapping.
   8. Fruits globose to ellipsoid, indehiscent. Seeds not embedded in a thin pulp. Petals erose, fimbriate, or fringed with filamentous appendages in the upper part. Stamens always twice the number of petals.
    9. Branchlets solid. Flowers usually in peduncled rarely in sessile cymes, pedicelled or not, not articulate. Petals erose or fimbriate. Persistent calyx lobes terminating the fruit . **7. Carallia**
    9. Branchlets hollow. Flowers in fascicles; pedicels with distinct articulation. Petals fringed with filamentous appendages. Persistent calyx lobes at the base of the fruit . . **8. Gynotroches**
   8. Fruits ovoid, dehiscent. Seeds embedded in a thin pulp (aril?). Petals entire. Stamens usually three or more times the number of petals . . . . **Crossostylis**[1]
  7. Free part of the calyx forming a distinct tube and divided only at the upper part; lower part of the tube hairy inside. Disk none. Stamens attached to the mouth of the calyx tube. Stipules flat, not imbricate . . . . **9. Pellacalyx**

KEY TO THE GENERA

Mainly based on vegetative characters

1. Leaves decussate. Stipules interpetiolar.
 2. Stipules imbricate, one margin of each free. Free part of the calyx not forming a tube or forming an obscure one much shorter than the lobes.
  3. Branchlets solid. Pedicel without articulation.

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(1) See footnote on p. 448.

4. Leaves acute or pointed at the apex, lower surface usually with scattered black dots.
 5. Leaf tip mucronate by the extending midrib. Trees supported by conspicuous stilt roots. Calyx lobes always 4. Anthers multilocellate . . . . **1. Rhizophora**
 5. Midrib not mucronate. Stilt roots absent or occasional and small. Calyx lobes 5–16. Anthers 4-locular.
  6. Flowers ebracteolate. Calyx lobes 8–16, lobes subulate-lanceolate, pointed. Petals fringed with white hairs on the margins sometimes also on the dorsal surface, each embracing 2 stamens. Mangrove trees . . . . **2. Bruguiera**
  6. Flowers bracteolate. Calyx lobes 5 or 6(–7), lobes deltoid, acute to acuminate. Petals glabrous, each embracing 1 stamen. Inland trees . . . . **7. Carallia**
4. Leaves obtuse or slightly notched at the apex, lower surface without black dots.
 7. Calyx lobes ovate, $2\frac{1}{2}$–$3\frac{1}{2}$ mm long. Petals entire, with 3 or many appendages at the apex. Stamens 10–12. Hypocotyl ridged. Stem-base flanged . . . . **3. Ceriops**
 7. Calyx lobes linear-oblong, *c.* 15 mm long. Petals multifid without appendages. Stamens ∞. Hypocotyl smooth. Stem-base conical, not flanged . . . . **4. Kandelia**
3. Branchlets hollow. Pedicel with distinct articulation.
 8. Fruits globose or subglobose, indehiscent. Seeds not embedded in a thin pulp. Upper part of the petals split into filamentous appendages. Stamens always twice the number of petals **8. Gynotroches**
 8. Fruits ovoid, dehiscent. Seeds embedded in a thin pulp (aril?). Petals entire. Stamens usually three or more times the number of petals . . . . **Crossostylis**[1]
2. Stipules flat, not imbricate. Free part of the calyx forming a distinct tube much longer than the lobes . . . . **9. Pellacalyx**
1. Leaves alternate. Stipules none.
9. Leaves 3–5-plinerved, or at least (in *A. griffithii*) with a distinct regular intramarginal vein. Leaves without scale-like dots underneath. Flowers usually polygamous, 4-merous. Fruits not winged. . . . . **5. Anisophyllea**
9. Leaves pinnate-nerved, intramarginal vein indistinct and irregular. Leaf surface underneath with very minute scale-like dots. Flowers bisexual, 3-merous. Fruit 3-winged . . **6. Combretocarpus**

1. RHIZOPHORA

LINNÉ, Gen. Pl. ed. 5 (1754) 202; Sp. Pl. (1753) 443; LAMK, Encycl. Méth. Bot. 6 (1804) 187; SALVOZA, Nat. Appl. Sc. Bull. Un. Philip. 5 (1936) 207; KEAY, Kew Bull. (1953) 121–127.—*Mangle* PLUKENET *ex* ADANS. Fam. 2 (1763) 445, *nom. illeg.*—*Mangium* RUMPH. *ex* SCOP. Introd. Hist. Nat. (1777) 218.—**Fig. 1–13.**

Trees. Stems supported by numerous, branched stilt-roots provided with a root cap; tap-root abortive. *Leaves* decussate, entire, coriaceous, petioled, usually black-dotted below, glabrous; midrib protruding at the tip into a (caducous) mucro; nerves and veinlets obscure beneath, visible or distinct above. Stipules lanceolate, more or less red when fresh. *Inflorescences* peduncled, simple or di- to trichotomously branched cymes. *Flowers* bisexual, bracteolate. *Calyx* deeply 4-lobed, coriaceous, accrescent and reflexed in fruit, surrounded at the base by cup-shaped bracteoles. *Petals* 4, lanceolate, caducous, inserted at the base of the disk. *Stamens* 8–12, sessile or with very short filaments, inserted on the margin of the crenulate disk; anthers areolate, elongated, pointed, triangular in cross section, multilocellate, opening with a large ventral valve. *Ovary* semi-inferior, 2-celled; each cell with 2 ovules; style obscure to 6 mm long, stigma simple or obscurely 2-lobed. *Fruits* ovoid with a granular or roughened surface. *Seeds* 1, very rarely 2–3. Cotyledons connate into a fleshy body continuous with but set off from the hypocotyl, in old fruits protruding from the fruit; *hypocotyl* clavate, elongate, perforating the apex of the fruit and falling out of it.

Distr. About 6(–?9) *spp.*, widely distributed along tropical coasts, throughout *Malaysia*.

Ecol. In coastal swamps and along tidal streams; the most important and widest spread of the man-

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(1) The genus *Crossostylis* FORST. (*Haplopetalum* A. GRAY) has also been entered in the key though it is hitherto only recorded from Melanesia (Solomons, New Hebrides, New Caledonia, Fiji, and Samoa) as far east as the Marquesas in Polynesia. It might occur in East Malaysia.

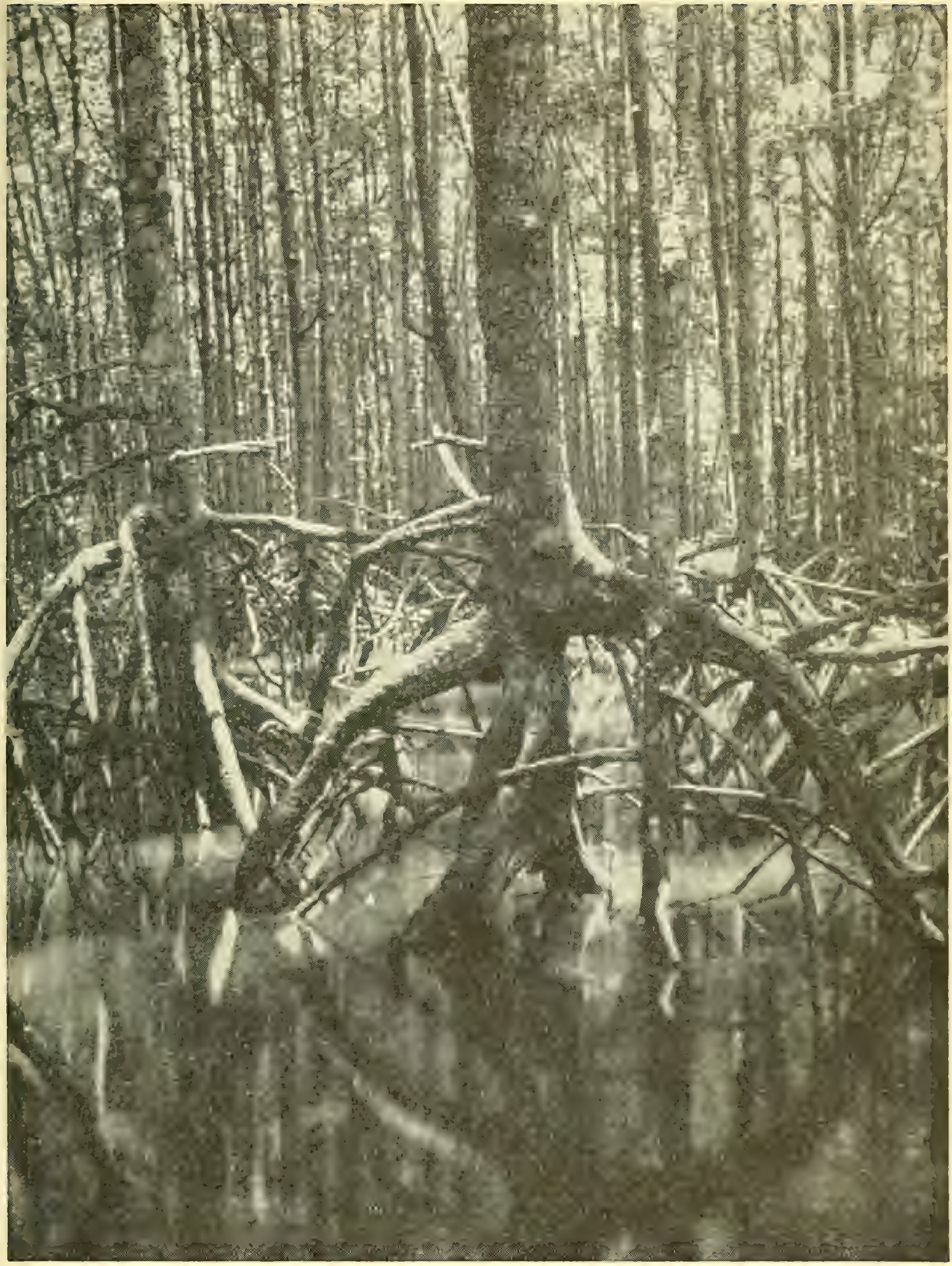


Fig. 7. Forest of *Rhizophora apiculata* Bl., with falling tide, at Pangkalan Susu, Aru Bay, in the estuary of the Besitang River, NE. Sumatra, April 1937.

grove genera. Several botanists have said that the *Rhizophoras* occur to the exposed sea-face; this is not so, and they are generally found well behind the *Avicennias*, which are the pioneers extending into the sea. Only *R. stylosa*, occurring on sandy reefs and sandy beaches, faces the open sea. The *Rhizophoras* make in Malaya about 70–90% of the stock of the mangrove belt, filling the estuaries with a closed forest of straight cylindric boles and compact ellipsoid crowns, raised commonly about 20 m from the ground; exceptional trees are sometimes over 30 m tall, with a clear bole of 25 m and a maximum diameter of 60 cm.

NOAKES (Work. Plan Matang 1952, 59) recorded that "regeneration is always present beneath mature bakau, whether or not there has been a regeneration felling, but little of it survives the final felling."

Morph. According to DOCTERS VAN LEEUWEN (Ber. Deut. Bot. Ges. 29, 1911, 476–478) the branching of the stilt-roots seems to be abnormal and caused by a Scolytid beetle damaging the root tips; above the hole one or more adventitious roots develop, the tips of which may be attacked in turn, and so forth, giving a sympodial branching.

Uses. The wood is used for timber, fire-wood, and the making of charcoal. The bark contains up to 30% tannin of its dry weight. BROWNE (1955, p. 297) cited some chemical analysis from bark which appears to contain high percentages of pentosans and furfurol, the ash consisting mostly of lime and $CaCO_3$.

In Java *Rhizophora* is sometimes planted along littoral fishponds for protecting the dykes and banks by the extensive root system.

Taxon. *Rhizophora* is subdivided into two sections:

1. *sect.* **Rhizophora.**—*sect. Mangle* BL. Bot. Mus. 1 (1849) 132.—Peduncles longer than the petiole, bi-trifid or dichotomously branched. Flowers pedicelled. Petals with involute and villous margins. Stamens 8, 4 epipetalous, 4 episepalous (in Malaysia *R. mucronata* and *R. stylosa;* type species: *R. mangle* L.).

2. *sect.* **Aërope** BL. Bot. Mus. 1 (1849) 134.—*Aerope* ENDL. *ex* RCHB. Nomencl. (1841) 171, *n.* 6618. —Peduncles shorter than the petiole, undivided. Flowers sessile. Petals flat, glabrous. Stamens normally 12, 4 epipetalous, 8 episepalous, in some flowers 1–2 of the latter absent by abortion (in Malaysia *R. apiculata;* type species: *ditto*).

Specific distinction.—As to the species of *Rhizophora* it is very clear that in the E. African–Indo-Australian area there are three well distinguished species. In the Atlantic Ocean tropics there are also three (other) good species (KEAY *l.c.*) which all occur also in the Caribbean as recently found by Dr JONKER.

Specific identification of the *Rhizophoras* of the Pacific Ocean as far West as Fiji is still unsatisfactory. Formerly it was held that there would be only *R. mangle* the area of which would then touch the areas of *R. mucronata* and *R. stylosa* in Fiji.

SALVOZA (*l.c.* 225) recorded in the Pacific *R. mangle* only from Hawaii as introduced!

In the Pacific Ocean he distinguished *R. brevistyla* SALV. (obviously closely allied to the Caribbean *R. harrisonii* (*cf.* KEAY; *non sens.* SALVOZA) from the Pacific coast of America.

The second species he distinguished in the Pacific basin, ranging from the Pacific coast of America westwards to Polynesia and Melanesia is *R. samoensis* SALV. put in the key close to *R. mangle.*

Finally he distinguished a third Pacific species *R. lamarckii* MONTR. from New Caledonia which he puts very close to *R. apiculata;* this is known only from very few specimens.

I have some doubt about these distinctions; it may well appear that two of the Caribbean species (*R. mangle* and *R. harrisonii*) occur also on the Pacific coasts of America (in slightly different forms).

It falls beyond the scope of this revision to make a closer study of the situation in the Pacific which should preferably be performed in a combined study of living plants and adequate herbarium material.

Nomencl. In the Species Plantarum LINNAEUS inserted 5 species among *Rhizophora*, 4 of which have later been transferred to *Bruguiera* and *Kandelia*, the only one remaining in *Rhizophora* being *R. mangle.* This is, consequently, the type species.

Under *R. mangle* there are several references, partly relating to Caribbean plants, partly to those from Malabar (*Pee-Kandel* RHEEDE). This mixture led also to the definition of *Rhizophora* as having 12 stamens (in *R. mangle* there are 8) obviously derived from the characters of *R. apiculata* (RHEEDE's plate).

KEAY in his careful study of the W. African species (Kew Bull. 1953, 124) records 2 specimens from the Linnean Herbarium, probably entered posterior to 1755: one is possibly *R. mangle*, the other *R. mucronata.* KEAY found good reason to typify *R. mangle* with the specimen in the SLOANE herbarium (BM) which is the basis of a reference mentioned by LINNAEUS.

KEY TO THE SPECIES

1. Inflorescences 2–flowered, shorter than the petiole, in the axils of leaf scars of last year's or season's growth. Bracteoles at the base of the flower completely connate, cup-shaped. Petals glabrous . . . . **1. R. apiculata**
1. Inflorescences 2–16-flowered, longer than the petiole, in the axils of the leaves on the twigs of current year's or season's growth. Bracteoles only connate at their base. Petals hairy.
   2. Style obscure or very short up to 1½ mm . . . . **2. R. mucronata**
   2. Style filiform 4–6 mm . . . . **3. R. stylosa**

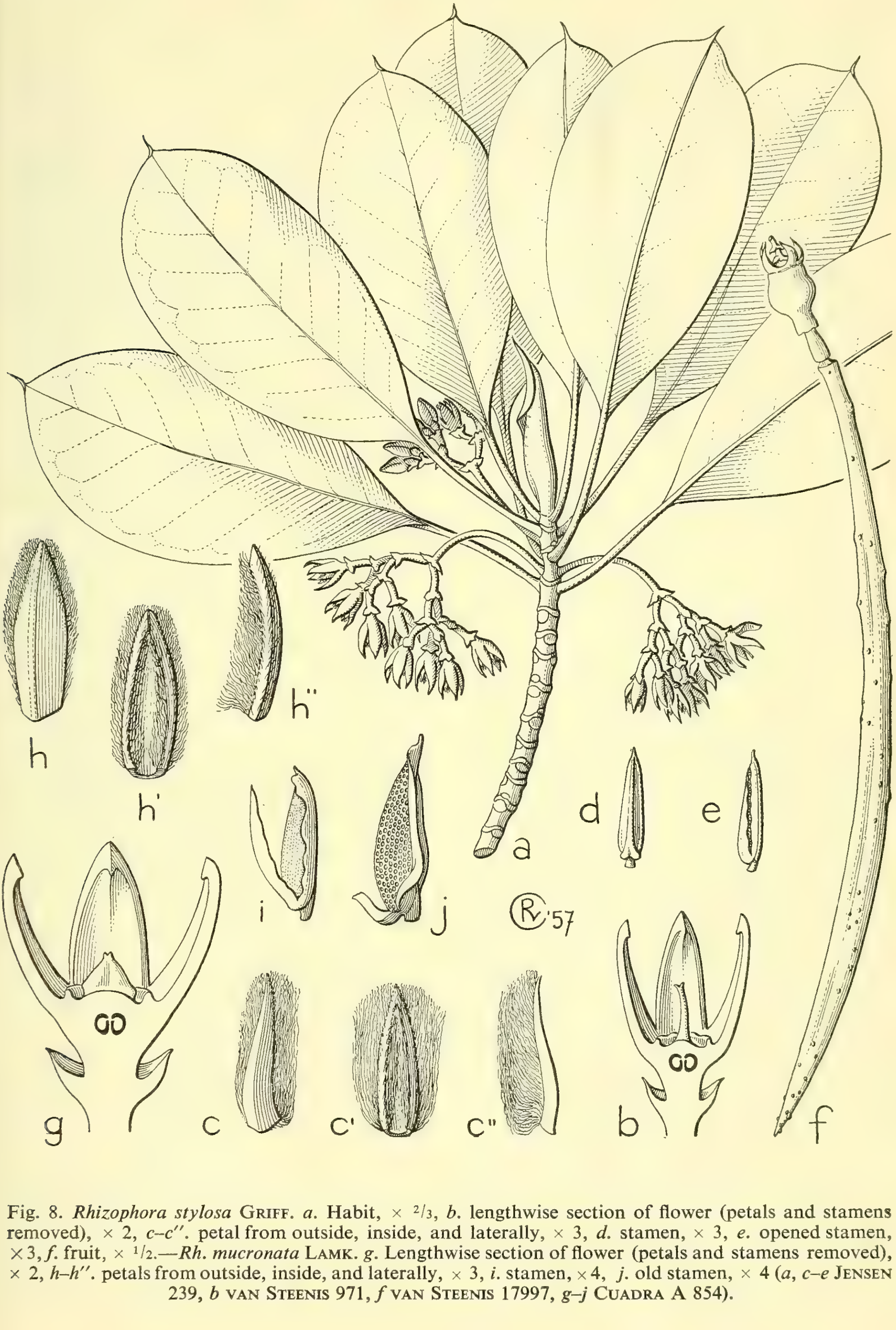


Fig. 8. *Rhizophora stylosa* Griff. *a.* Habit, × 2/3, *b.* lengthwise section of flower (petals and stamens removed), × 2, *c–c''.* petal from outside, inside, and laterally, × 3, *d.* stamen, × 3, *e.* opened stamen, × 3, *f.* fruit, × 1/2.—*Rh. mucronata* Lamk. *g.* Lengthwise section of flower (petals and stamens removed), × 2, *h–h''.* petals from outside, inside, and laterally, × 3, *i.* stamen, × 4, *j.* old stamen, × 4 (*a, c–e* Jensen 239, *b* van Steenis 971, *f* van Steenis 17997, *g–j* Cuadra A 854).

1. Rhizophora apiculata BLUME, En. Pl. Jav. 1 (1827) 91; HOCHREUTINER, Candollea 2 (1925) 446; KANEHIRA, En. Micr. (1935) 377; SALVOZA, Nat. Appl. Sc. Bull. Un. Philip. 5 (1936) 229, t. 9; BACKER, Bekn. Fl. Jav. (em. ed.) 4b (1944) fam. 102, p. 5.—*Pee-Kandel* RHEEDE, Hort. Mal. 6 (1686) 61, t. 34.—*Mangium candelarium* RUMPH. Herb. Amb. 3 (1743) 108, t. 71 & 72.—*R. mangle* (*non* LINNÉ) [LINNÉ, Sp. Pl. (1753) 443, *pro syn.* RHEEDE] BLANCO, Fl. Filip. (1837) 397, ed. 2 (1845) 278, ed. 3, 2 (1878) 151, t. 135.—*R. candelaria* DC. Prod. 3 (1828) 32; W. & A. Prod. (1834) 310; DECAISNE, Herb. Timor. (1835) 124; GRIFF. Trans. Med. Phys. Soc. Calc. 8 (1836) 7, f. 1 & 3; Ann. Sc. Nat. Bot. 10 (1838) 121; TRIM. Fl. Ceyl. 2 (1894) 151; MERR. Philip. J. Sc. 9 (1914) Bot. 118; Int. Rumph. (1917) 387; BROWN & FISCHER, Bull. Bur. For. Philip. 17 (1918) 56, f. 27, reimpr. in BROWN, Min. Prod. Philip. For. 1 (1920) 68, t. 1 & 27; MERR. Sp. Blanc. (1918) 283; En. Philip. 3 (1923) 145; CRAIB, En. Siam. 1 (1931) 592.—*R. conjugata* (*non* LINNÉ) ARN. Ann. Mag. Nat. Hist. 1. (1838) 363; WIGHT, Ill. Ind. Bot. 1 (1840) 209; BL. Mus. Bot. 1 (1849) 134; MIQ. Fl. Ind. Bat. 1, 1 (1855) 584; Sum. (1861) 324; THWAITES, En. Pl. Zeyl. (1859) 120; KURZ, For. Fl. Burma 1 (1877) 447; HENSLOW in Hook. *f.* Fl. Br. Ind. 2 (1878) 436; F.-VILL. Nov. App. (1880) 79; HEMSL. Bot. Chall. 1, 3 (1884) 237; SCHIMP. Bot. Mitt. Trop. 3 (1891) 92, t. 5, f. 3; K. & V. Bijdr. 4 (1896) 282; KING, J. As. Soc. Beng. 66, ii (1897) 213; SCHIMPER in E. & P. Pfl. Fam. 3, 7 (1898) 52, t. 24A; MERR. Philip. J. Sc. 1 (1906) Suppl. 102; Fl. Manila (1912) 347; BACK. Schoolfl. (1911) 480; KOORD. Exk. Fl. Jav. 2 (1912) 668; Atlas 1 (1913) t. 101; GUILL. Fl. Gén. I.-C. 2 (1920) 724; RIDL. Fl. Mal. Pen. 1 (1922) 693; HEYNE, Nutt. Pl. (1927) 1168; WATSON, Mal. For. Rec. (1928) 27, 107, 185, t. 10, 11, 51; VAN DER MEER MOHR, Rec. Trav. Bot. Néerl. 26 (1929) 15–18, f. 1–2; GUILL. J. Arn. Arb. 12 (1931) 252; COSTERUS & SMITH, Bull. Jard. Bot. Btzg 42 (1932) 10; BROWNE, For. Trees Sar. Brun. (1955) 298.—**Fig. 1, 7, 11, 12.**

Tree up to over 30 m tall and 50 cm diam.; bole 10–12 m. Branching primarily sympodial. *Leaves* elliptic-oblong to sublanceolate, 7–18 by 3–8 cm, acute to apiculate, base cuneate; midrib ± tinged reddish beneath; petiole 1½–3 cm, tinged reddish. Stipules 4–8 cm long. *Inflorescences* 2-flowered, peduncle thick, ½–1½ cm. *Flowers* sessile, developing from the cupular involucre after the falling of the sustaining leaf, yellow; mature buds elliptic; 14 mm long; bracteoles at the base of the flower cup-shaped, fleshy, crenulate. *Calyx* lobes brown-yellow to reddish, ovate, concave, acute, 10–14 by 6–8 mm. *Petals* 8–11 by 1½–2 mm, lanceolate, glabrous, membranous, covering the epipetalous stamen only on the back. *Stamens* mostly 12, 4 epipetalous, and 4 pairs episepalous (sometimes 1 or 2 pairs with only 1 stamen), 6–7½ mm long, sessile, acute. Superior part of the ovary 1½–2½ mm high, enclosed by the disk, bluntly conical; style ½–1 mm, 2-lobed. *Fruit* obpyriform, rather rough, 2–2½ cm long, brown, the protruding part of the cotyledons red, 12–20 mm long. *Hypocotyl* cylindric-club-shaped, ± blunt, green with purple, up to 38 cm by 12 mm before falling.

Distr. Tropical SE. Asia (also Ceylon) throughout *Malaysia* to Micronesia (Marianes, Ponape, Guam, Yap) and New Britain.

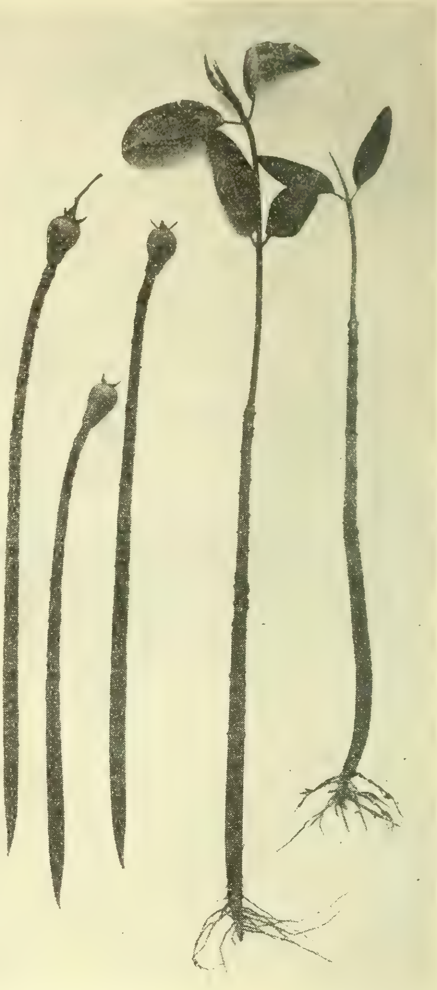


Fig. 9. Detached fruits with hypocotyls and seedlings of *Rhizophora mucronata* LAMK, E. Java, March 1914 (P. ARENS).

Ecol. Gregarious on deep soft mud of estuaries flooded by normal high tides and forming often 90% of the crop, avoiding bottoms which are harder and mixed with sand. Bark grey, with vertical fissures rather than horizontal, sometimes producing aerial roots from the branches. Crabs are sometimes, according to WATSON, a menace to the upgrowth of the seedlings by devouring or removing the bark of the seedlings until they are completely girdled or even bitten right through. In the Malay Peninsula judged to be a slow grower attaining 30 cm diam. in 35 years.

Uses. This most important species has red-brown, heavy, and hard heart-wood. The trees are standing in places very densely and make a pure forest up creeks and in estuaries behind the protecting belt of *Avicennia*. The timber of both *R. apiculata* and *R. mucronata* is used indiscriminately. A great advantage of *Rhizophora* in the eyes of fire-wood dealers is that it can easily be split. Besides it has a high caloric value.

Branched stilt-roots are used for anchors weightened by a stone.

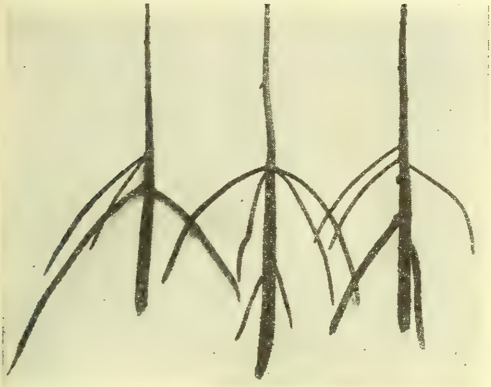


Fig. 10. Root system of young saplings of *Rhizophora mucronata* LAMK, E. Java, March 1917 (P. ARENS).

Vern. *Bakau minjak, b. tandok, b. akik, b. puteh, akik, akit*, Mal. Pen. & Sumatra, *bangka minjak*, Atjeh, *donggo akit*, N. Simalur, *bako, djankar*, J, *bakau minyak*, Born., *bangkita*, Sandakan, *kantar, hamu, lolaro*, Minah. (Alf.); Philippines: *bakáuan, bakáu*, Tag. & other lang., *bakáuan-babáe, b. lalaki, uakatan*, Tag., *bakád*, Sbl., *bakháu*, S. L. Bis., P. Bis., *bakkáuan*, Bik., *balbaro*, Pamp., *bangkau, lupá pulá*, Sulu, *kalamagus*, Bag.; *abat*, Ceram, *ailave, kailau*, Aru, *kaihu, parai*, Babo, *tonggong*, Blanche Bay, *kora*, Buin, *itasasa*, Fly R., *koriki*, Kiwai, *aua, akaka*, Akuna.

Notes. Many authors have for this species adopted the specific name *R. conjugata* L. (Sp. Pl. 1, 443) which was based on *Rhizophora, etc.* LINNÉ, Fl. Zeyl. (1748) 81, *no* 181. The type of the latter is an unpublished plate by HERMANN (t. 279) which is preserved in the Br. Mus.

Part of the plate is a flowering branch with two opposite flowers; each of them is in the leaf axil of the terminal node, which had led LINNAEUS to describe them as 'flowers in twins' (*calyces gemini*). It is unmistakably a *Bruguiera*, but it can hardly be identified with certainty whether it is *B. gymnorrhiza* or *B. sexangula*. TRIMEN (J. Linn. Soc. Bot. 29, 1888, 142) had identified the plate as *B. gymnorrhiza*. However, the tips of petals are obtuse and glabrous and quite similar to those of *B. sexangula*.

At the lower part of the flowering branch, an infructescence is drawn consisting of two 'cylindric, subulate, very long and nodding fruits' (*fructus cylindrici, subulati, longissimi, nutantes*). These two 'fruits' as described by LINNAEUS are actually hypocotyls of *Rhizophora*. One of the 'fruits' is detached from the pedicel and had been placed upside down. To which species they belong is uncertain.

In the Linnean Herbarium there is further a specimen which according to SAVAGE (Cat. 1945, 84) bears LINNAEUS's handwriting. It is sterile and provided with the doubtful locality 'Chin'; it has not yet been identified. It is neither a *Rhizophora* nor a *Bruguiera*. It does not agree with LINNAEUS's description of *R. conjugata* and it may have been added to his Herbarium after 1753. It can not serve for more precise typification.

Merely on the basis of literature and without having studied the drawing and specimen at London MERRILL has proposed to use *R. conjugata* L. as the basionym for what is called here *B. gymnorrhiza* (L.) LAMK (*cf.* Philip. J. Sc. 9, 1914, Bot. 118), with which BACKER (*l.c.* 7) and I disagree.

As *R. conjugata* L. is based on a drawing composed of flowers and fruits of two species of entirely different genera, the specific interpretation of which must remain distinctly uncertain by the inadequacy of the drawing, which has led in the past already to confusion and error, I reject it in agreement with Art. 65 and 66 of the 1956 Code.

VAN DER MEER MOHR (1929, *l.c.*) found near Medan three fruits each with two hypocotyls.

2. Rhizophora mucronata LAMK, Encycl. 6 (1804) 189; Tab. Encycl. Méth. Bot. 2 (1819) 517, t. 396, f. 2; DC. Prod. 3 (1828) 32; DECAISNE, Ann. Sc. Nat. n.s. 4 (1835) 75; ARN. Ann. Mag. Nat. Hist. 1 (1838) 362; WIGHT, Ic. 1 (1840) t. 238; BL. Mus. Bot. 1 (1849) 132; MIQ. Fl. Ind. Bat. 1, 1 (1855) 583; THWAITES, En. Pl. Zeyl. (1859) 120; BENTH. Fl. Austr. 2 (1864) 493; KURZ, For. Fl. Burma 1 (1877) 447; HENSLOW in Hook. *f.* Fl. Br. Ind. 2 (1878) 435; F.-VILL. Nov. App. (1880) 79; HEMSL. Bot. Chall. 1, 3 (1884) 149, 291; SEEM. Fl. Vit. (1890) 19; SCHIMP. Bot. Mitt. Trop. Jena 3 (1891) 92, t. 5, f. 7–8; TRIM. Fl. Ceyl. 2 (1894) 151; K. & V. Bijdr. 4 (1896) 278; KING, J. As. Soc. Beng. 66, ii (1897) 312; SCHIMP. in E. & P. Pfl. Fam. 3, 7 (1898) 52, f. 26, N–Q; BACK. Schoolfl. (1911) 481; MERR. Fl. Man. (1912) 347; KOORD. Exk. Fl. Jav. 2 (1912) 668; Atlas 1 (1913) t. 102; EWART & DAVIES, Fl. North. Terr. (1917) 199; MERR. Sp. Blanc. (1918) 283; BROWN & FISCHER, Bull. Bur. For. Philip. 17 (1918) 56, f. 28 & 29, reimpr. in BROWN, Min. Prod. Philip. For. 1 (1920) 68, t. 28 & 29; GUILL. Fl. Gén. I.-C. 2 (1920) 723, f. 75, 1–4; MERR. En. Born. (1921) 421; En. Philip. 3 (1923) 145; HEYNE, Nutt. Pl. (1927) 1169; WATSON, Mal. For. Rec. 6 (1928) 27, 106, 185, t. 8, 9 & 51; CRAIB, En. Siam. 1 (1931) 592; KANEHIRA, En. Micr. (1935) 377; Formos. Trees

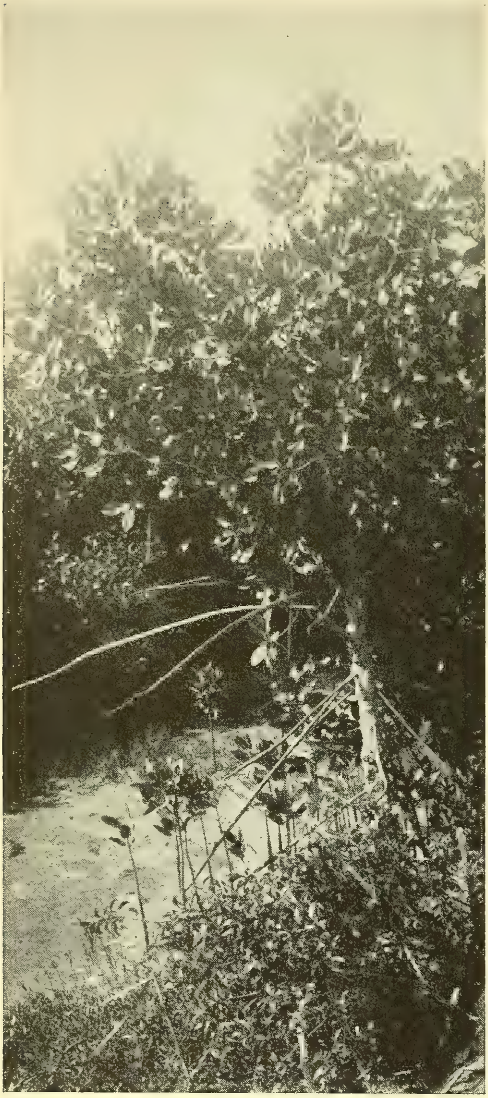


Fig. 11. Young but already fruiting tree of *Rhizophora apiculata* BL., showing the young, unbranched, straight aerial roots sticking out in the air, one of them already attacked by the beetle. Good regeneration by seedlings. E. Java, 1916 (JESWIET).

rev. ed. (1936) 496, f. 456; SALVOZA, Nat. Appl. Sc. Bull. Un. Philip. 5 (1936) 213, t. 4; HOLTHUIS & LAM, Blumea 5 (1942) 217; BACK. Bekn. Fl. Jav. (em. ed.) 4b (1944) fam. 102, p. 6; QUIS. Med. Pl. Philip. (1951) 653; WALKER, Import. Trees Ryukyu (1952) 235, f. 146; BLAKE, Austr. J. Bot. 2 (1954) 133; BROWNE, Forest Trees Sar. Brun. (1955) 298; LEWIS, Fl. Trop. E. Africa, Rhiz. (1956) 2, f. 1. — *R. mangle* (*non* LINNÉ) ROXB. Hort. Beng. (1814) 36; Fl. Ind. 2 (1832) 459; BL. En. Pl. Java 1 (1827) 91.—*R. macrorrhiza* GRIFF. Trans. Med. Phys. Soc. Calc. 8 (1836) 8, f. 2 & 4–7; Ann. Sc. Nat. Bot. II, 10 (1838) 122; Not. Pl. As. 4 (1854) 664.—*R. longissima* BLANCO, Fl. Filip. (1837) 398; ed. 2 (1845) 278; ed. 3, 2 (1878) 151.—*R. latifolia* MIQ. Sum. (1861) 324.—*R. mucronata var. typica* SCHIMP. Bot. Mitt. Trop. 3 (1891) 92; K. & V. Bijdr. 4 (1896) 279, 282; HOCHREUTINER, Candollea 2 (1925) 446.—**Fig. 1, 6d–h, 8g–j, 9–10.**

Tree up to 27 m tall, rarely over 30 m by 70 cm diam. Branching not distinctly sympodial. *Leaves* broad-elliptic to oblong, ($8^{1}/_{2}$–)11–18(–23) cm by 5–$10^{1}/_{2}$(–13) cm, apex ± blunt to ± acute, base cuneate; midrib green beneath; petiole $2^{1}/_{2}$–$5^{1}/_{2}$ cm, green. Stipules $5^{1}/_{2}$–$8^{1}/_{2}$ cm long. *Inflorescences* 2–3 times forked, each arm with an apical involucre, 2–5(–12)-flowered; peduncles $2^{1}/_{2}$–5 cm; pedicels 4–8 mm. Free parts of the bracteoles at the base of the flower distinctly 2-lobed, lobes deltoid, acute or obtuse. Buds emerging from the bracteolar involucre long before the falling of the sustaining leaf. Mature buds widest near the base. *Calyx* 13–19 mm long, deeply lobed, lobes ovate, in anthesis pale yellow, *c.* 13–15 by 5–7 mm. *Petals* 9 mm long, densely hairy along the margins, partly clasping the epipetalous stamen with these margins, sparsely hairy on the back, hairs up to 3 mm. *Stamens* 8, sessile, 4 epipetalous, 4 episepalous, anthers 6–8 mm long. Free part of the ovary high-conical, in anthesis already emerging far beyond the disk, $2^{1}/_{2}$–3 mm high; style $^{1}/_{2}$–$1^{1}/_{2}$ mm, 2-lobed. Mature *fruit* elongate ovoid, with hardly contracted apex and often rugose base, dull brown-green, 5–7 by $2^{1}/_{2}$–$3^{1}/_{2}$ cm; cotyledons 2–4 cm protruding; mature cotyledons green; *hypocotyl* cylindric, strongly rugose, 36–64 by $1^{3}/_{4}$ cm.

Distr. On the coasts of Old World tropics: East Africa, Madagascar, Seychelles, Mauritius, SE. Asia, Riukiu, throughout *Malaysia* to N. Australia, Melanesia (Fiji, New Caledonia, New Hebrides), and *Micronesia* (Guam, Palau, Ponape, Ogiwal), introduced in Hawaii (SALVOZA, *l.c.*).

Ecol. In similar localities as *R. apiculata* but more tolerant for sandy and firmer bottoms. Generally gregarious near and on the banks of tidal creeks and in estuaries, seldom more than a few chains from tidal water; optimal development with rather deep inundation classes and soils rich in humus and somewhat firmer than those of *R. apiculata*. Bark dark, almost black, with horizontal fissures (WATSON). Occasionally planted along coastal fish-ponds for protecting the banks.

Crabs are great enemies to seedlings and damage plantations when they are made. It has been found in the Philippine Islands that seedlings dried for several days in the shade, before planting are more or less spared by them; BURKILL queries whether the arrest of growth due to this unnatural drying can have led to an accumulation of protecting tannin in the tissues.

Uses. The timber is used for fuel and charcoal. The heart-wood is dark orange-red. The bark is rich in tannin, used for tanning and dyeing, and occasionally medicinally in cases of haematuria. In Malaya the poles are in considerable demand

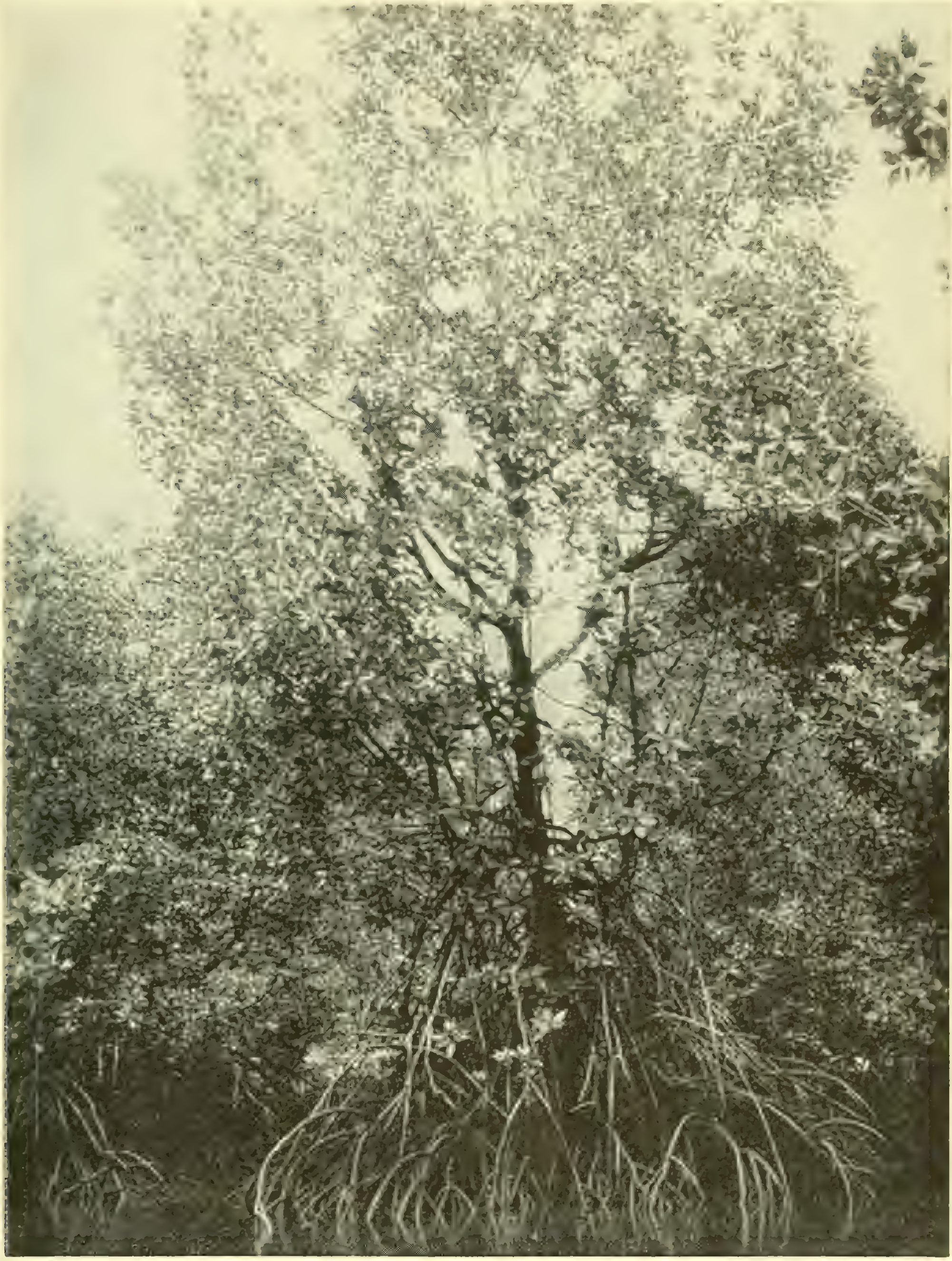


Fig. 12. Well developed *Rhizophora apiculata* Bl., with its cone of branched stilt-roots. Rantau Pandjang, E. Sumatra (H. H. Th. Schreuder).

for piling and for frames of houses in and about the swamps; for fish-traps, being preferred over other available trees in certain localities; and particularly for firewood. The bark is rich in tannin, associated with which is a substance darkening gradually. It served as a deep brown or black dye (samak bakau) and its chief function was to toughen fishing-lines and ropes, for which *Ceriops* bark is preferable. See for the cutch industry BURKILL, p. 1898–1902.

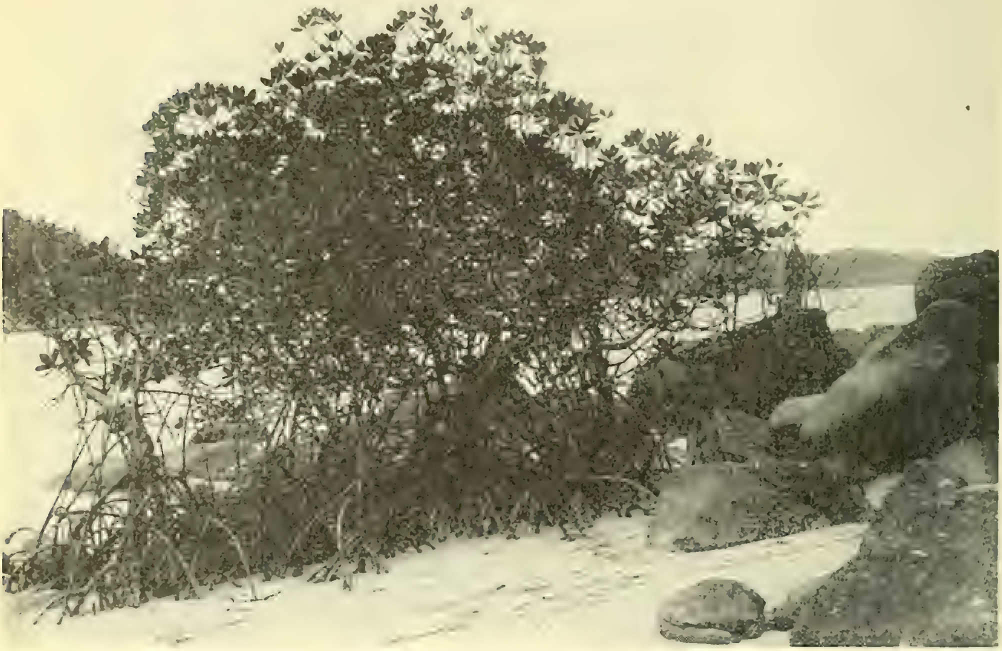


Fig. 13. *Rhizophora stylosa* GRIFF. at low tide between granite boulders on the quartz sand beach of the islet P. Tandjung Suka, Anambas Isl., April 1928.

Vern. *Bakau bĕlukap*, *b. gĕlukap*, *b. jangkar*, *b. hitam*, *b. kurap*, *b. mèrah*, *bĕlukap*, Mal. Pen., *bangka itam*, *b. u*, Atjeh, *dongoh korap*, N. Simalur, *bakau itam*, *b. korap*, *b. mèrah*, M, *bako*, *djankar*, J, *lĕnggayong*, S.; Celebes: *bĕlukap*, Bugin., *lolaro*, Manado; Philippines: *bakáuan-babáe*, Tag. (common name), *bakáu* (many lang.), *bakháu*, C. Bis., *bangkáu*, Tag.; *nanàsi ésatá*, Karakelong; New Guinea: *koriki*, Daru, *pabo*, Babo, *togo* (for fruit), *tortor*, Kanosia, *totoa*, Motu, *kamo*, Binandele, *kui*, Hagen.

Note. RAJAGOPALAN & NATARAJAN found (J. Bomb. Nat. Hist. Soc. 50, 1952, 684–685) ten fruits with 2 and one with 3 hypocotyls.

3. Rhizophora stylosa GRIFF. Not. Pl. As. 4 (1854) 665; Ic. 4 (1854) t. 640; BACK. Schoolfl. (1911) 482; RIDL. Fl. Mal. Pen. 1 (1922) 693; BACK. Bekn. Fl. Jav. (em. ed.) 4b (1944) fam. 102, p. 6. —*R. mucronata var. stylosa* SCHIMP. Bot. Mitt. Trop. 3 (1891) 92; K. & V. Bijdr. 4 (1896) 279, 282; GUILL. J. Arn. Arb. 12 (1931) 252; SALVOZA, Nat. Appl. Sc. Bull. Un. Philip. 5 (1936) 218, t. 5.—**Fig. 5, 8a–f, 13.**

Small tree up to 10 m tall; branching not primarily sympodial. *Leaves* broadly elliptic, 6½–12½ by 3½–6½ cm, apex blunt, base cuneate, midrib green; petiole 2½–3½ cm, green. Stipules 4–6 cm long. *Inflorescences* 3–4 times forked, each arm with an apical bracteolar involucre, (4–)5–8(–16)-flowered; peduncle 2½–5 cm; pedicels ½–1 cm. Buds emerging from the involucre long before the falling of the sustaining leaf. Mature buds widest near the base. *Calyx* in anthesis pale yellow, lobes 9–12 by 3–5 mm. *Petals c.* 8 mm long, densely villose along the margins rarely also on the back, partly enclosing the epipetalous stamen with these margins, hairs 3–6 mm. *Stamens* 8, 4 epipetalous, 4 episepalous, anthers 5–6 mm long, apiculate, filament distinct, short. Superior part of the ovary *depressed-conical, in anthesis enclosed by the disk, hardly 1½ mm high; style* filiform *4–6 mm*, shortly and obscurely 2-toothed. Mature *fruit* obpyriform, with *strongly contracted* apex, *not rugose*, brown, 2½–4 by 1¾–2½ cm; cotyledons emerging for 1½–2½ cm from the calyx,

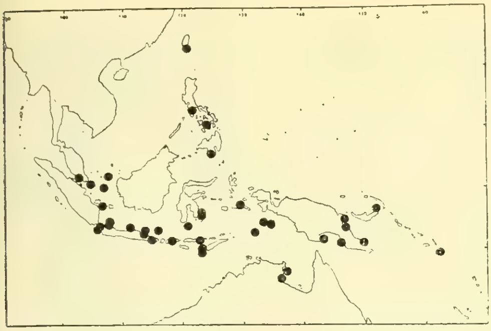


Fig. 14. Localities of *Rhizophora stylosa* GRIFF.

green; *hypocotyl* cylindric, up to 54 cm by 12–16 mm before falling.

Distr. Formosa, throughout *Malaysia:* Philippines, Java, Malay Peninsula, Celebes, Moluccas, New Guinea, to Melanesia (Solomon Isl., Fiji), New Britain, and N. Australia. Fig. 14.

Ecol. Exclusively along sandy shores and coral terraces, facing the open sea, obviously better resisting the surf than the other species.

Excluded

Rhizophora aegiceras GMELIN, Syst. 1 (1791) 747, based on RUMPH. Herb. Amb. 3, t. 82 = *Aegiceras corniculatum* (L.) BLANCO, *cf.* MERR. Int. Rumph. (1917) 413 (*Myrsinac.*).

Rhizophora caseolaris LINNÉ in Stickman, Herb. Amb. (1754) 13, based on RUMPH. Herb. Amb. 3, t. 74 and 73 = *Sonneratia caseolaris* (L.) ENGL. and *S. alba* J. SM., *cf.* BACK. & STEEN. Fl. Mal. I, 4 (1951) 283, 285 (*Sonneratiac.*).

Rhizophora conjugata L. Sp. Pl. 1 (1753) 443 = mixture of different plants and is here rejected, *cf.* p. 453.

Rhizophora corniculata LINNÉ in Stickman, Herb. Amb. (1754) 13; Amoen. Acad. 4 (1759) 123, based on RUMPH. Herb. Amb. 3, t. 77 = *Aegiceras corniculatum* (L.) BLANCO, *cf.* MERR. Sp. Blanc. (1918) 299 (*Myrsinac.*).

Rhizophora obtusa DENNST. Schlüss. Hort. Mal. (1818) 15, 24, 32, based on RHEEDE, Hort. Mal. 6, t. 36 = *Aegiceras* (*Myrsinac.*).

2. BRUGUIERA

LAMARCK, Tabl. Enc. Méth. (1793 ? or 1797) t. 397; Encycl. Méth. Bot. 4 (1797 or 1798 ?) 696; ARN. Ann. Mag. Nat. Hist. 1 (1838) 365; BLUME, Mus. Bot. 1 (1849) 135; MIQ. Fl. Ned. Ind. 1, 1 (1855) 585–590, *incl. sect. Mangium et Kanilia*; WYATT-SMITH, Mal. For. 16 (1953) 156–181; DING HOU, Nova Guinea n.s. 8 (1957) 164; *non* THOUARS, Gen. Nov. Madag. (1806), *quae est Lumnitzera* (*Combret.*).—*Paletuviera* THOUARS *ex* DC. Prod. 3 (1828) 32.— *Kanilia* BL. Mus. Bot. 1 (1849) 140.—**Fig. 6a-b, 15-23**.

Buttressed trees up to 40 m, with kneed pneumatophores, sometimes with aerial roots when young. *Leaves* decussate, entire, usually coriaceous, glabrous, black-dotted beneath, petioled. Stipules lanceolate, 2–4 cm long, glabrous. *Flowers* bisexual, ebracteolate, articulated at the base with the pedicel, solitary or in 2–5-flowered, peduncled cymes. *Calyx* coriaceous, accrescent, 8–14(–15)-lobed, lobes subulate-lanceolate, acute. *Petals* each embracing a pair of stamens, 2-lobed rarely emarginate, caducous. Disk distinctly cup-shaped and adnate to the calyx tube. *Stamens* twice the number of petals, paired, epipetalous, filaments filiform, unequal in length; anthers linear. *Ovary* inferior, adnate to the lower part of the calyx tube, 2–4-celled, each cell with 2 ovules; style filiform, stigma obscurely 2–4-lobed. *Fruit* included in or adnate to the calyx tube, usually 1-celled, 1(–2)-seeded; cotyledons connate at the base; hypocotyl terete or obscurely ribbed, blunt, perforating the apex of the fruit and falling with it.

Distr. Species 6, widely distributed from tropical East Africa (*B. gymnorrhiza*) to Asia, throughout *Malaysia* to Australia, and Polynesia (*B. gymnorrhiza* to Samoa, and the Marshall Isl.).

Ecol. In tropical mangrove forests, ascending tidal parts of rivers. *Bruguieras* grow in less frequently inundated situations than the *Rhizophoras*, and rely to a greater extent (*B. cylindrica* probably almost entirely) on distribution by surface water following heavy rains. *B. parviflora* is less discriminating than any other mangrove species and forms pure crops under a great variety of conditions.

The calyx falls with the fruit but becomes soon detached, except in *B. parviflora*.

Uses. The wood is seldom used for timber, but is profusely used for fuel and charcoal; the bark is less suitable for tanning than that of *Rhizophora*.

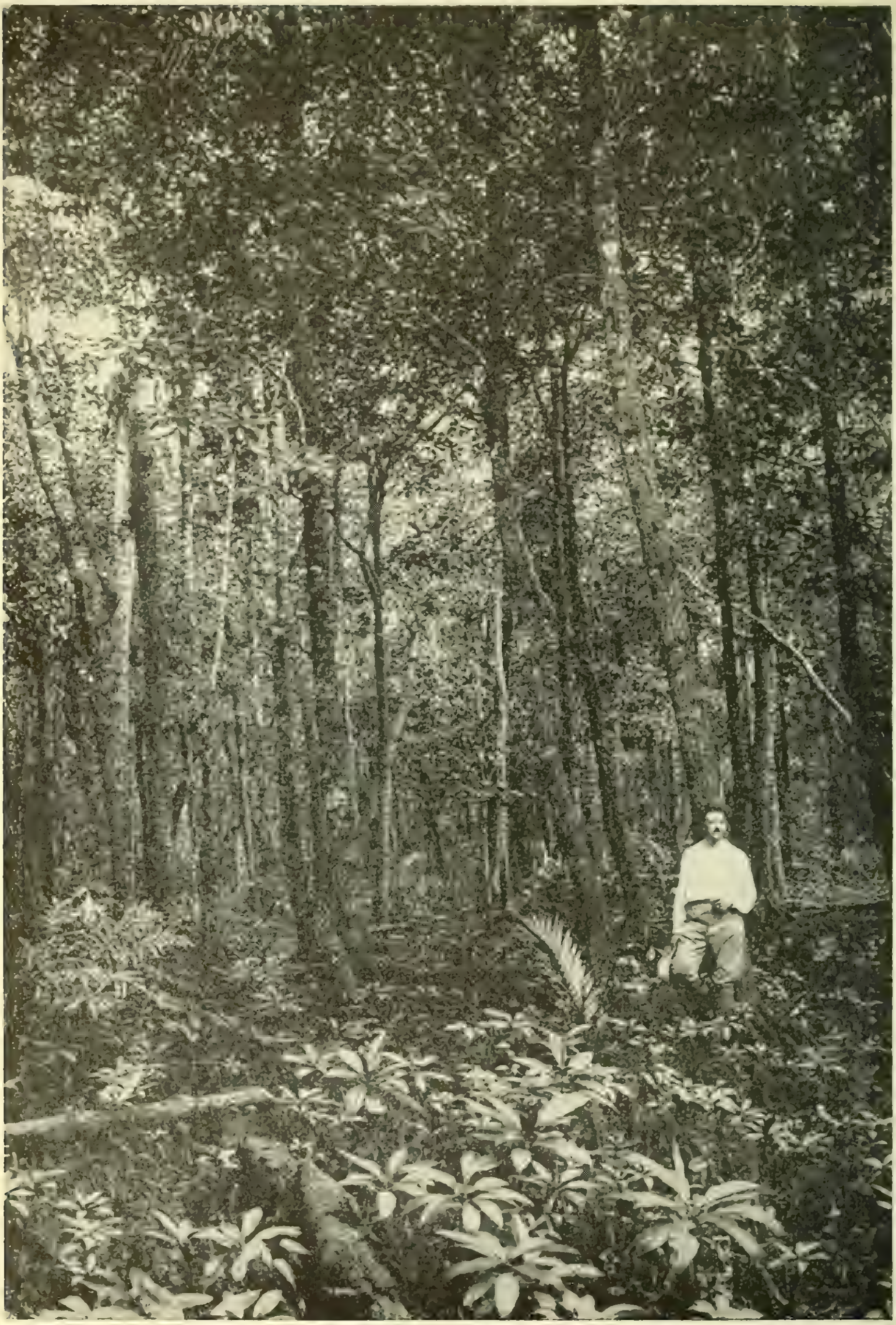


Fig. 15. Fully developed *Bruguiera* forest at Nusa Kambangan, S. Central Java, with Prof. SKOTTSBERG standing amidst the luxuriant regeneration, 1929 (JESWIET).

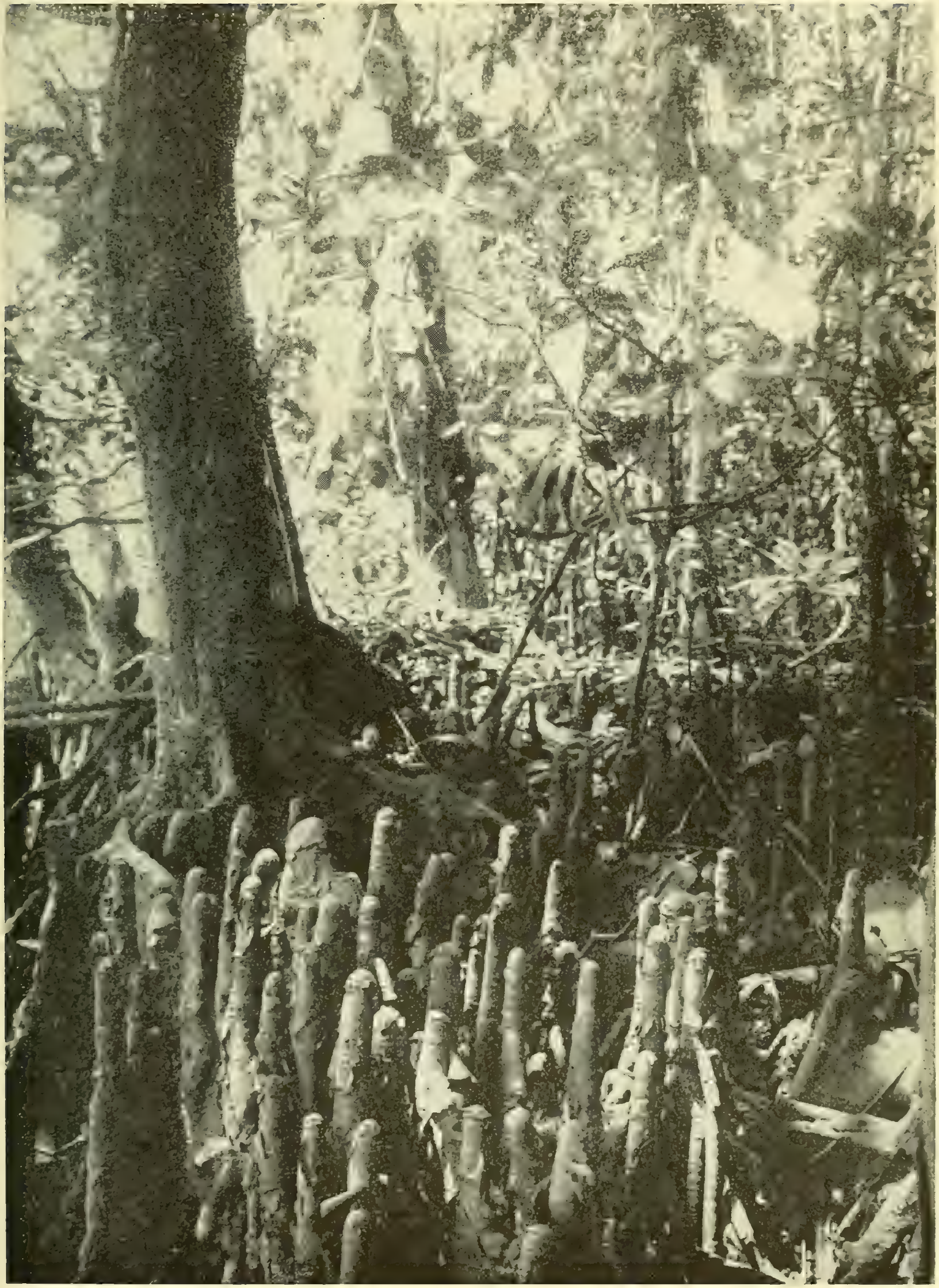


Fig. 16. Stem-base with knee-roots of *Bruguiera cf. gymnorrhiza* (L.) LAMK. Nusa Kambangan (JESWIET).

Taxon. BLUME, *l.c.* 140, segregated the many-flowered species from those with solitary flowers and established the former group as a new genus *Kanilia*. MIQUEL, *l.c.* 588, reduced *Kanilia* to a section of *Bruguiera*, dividing the genus into two sections *Mangium.* MIQ. and *Kanilia* (BL.) MIQ. which he distinguished chiefly by the shape of the calyx tube, the anthers, and number of floral parts. Through the recently described *B. hainesii* and *B. exaristata* the distinction between these sections is obscured and they should in my opinion be omitted.

Note. In his Schlüss. Hort. Mal. (1818) DENNSTEDT gave three indexes, the first containing RHEEDE's vernacular names with their Latin equivalents, the second giving the Latin plant names with references to RHEEDE's work, the third tabulating RHEEDE's plates, volume by volume and plate by plate, with their Latin equivalents. In the third index a genus name has not been repeated for successive species and has from the second species onwards been indicated by a dash indicating the repetition. This has led to an error under *Bruguiera* on p. 32 of the 'Schlüssel' where tab. 31–32 = *Bruguiera gymnorrhiza* is followed by tab. 33–36 with four *Rhizophoras* but where the generic name *Rhizophora* has been omitted and erroneously been replaced by a dash, which formally consequently refers to *Bruguiera.* From this omission it can not be concluded that DENNSTEDT's intention was to reduce the genus *Rhizophora* to *Bruguiera* as the lists further agree *inter se*. In case DENNSTEDT made a new combination in his 'Schlüssel' he added consistently '*mihi*'; this was not done here except for his new species *Rhizophora obtusa*. Therefore, it cannot be inferred that he actually made four new combinations under *Bruguiera*.

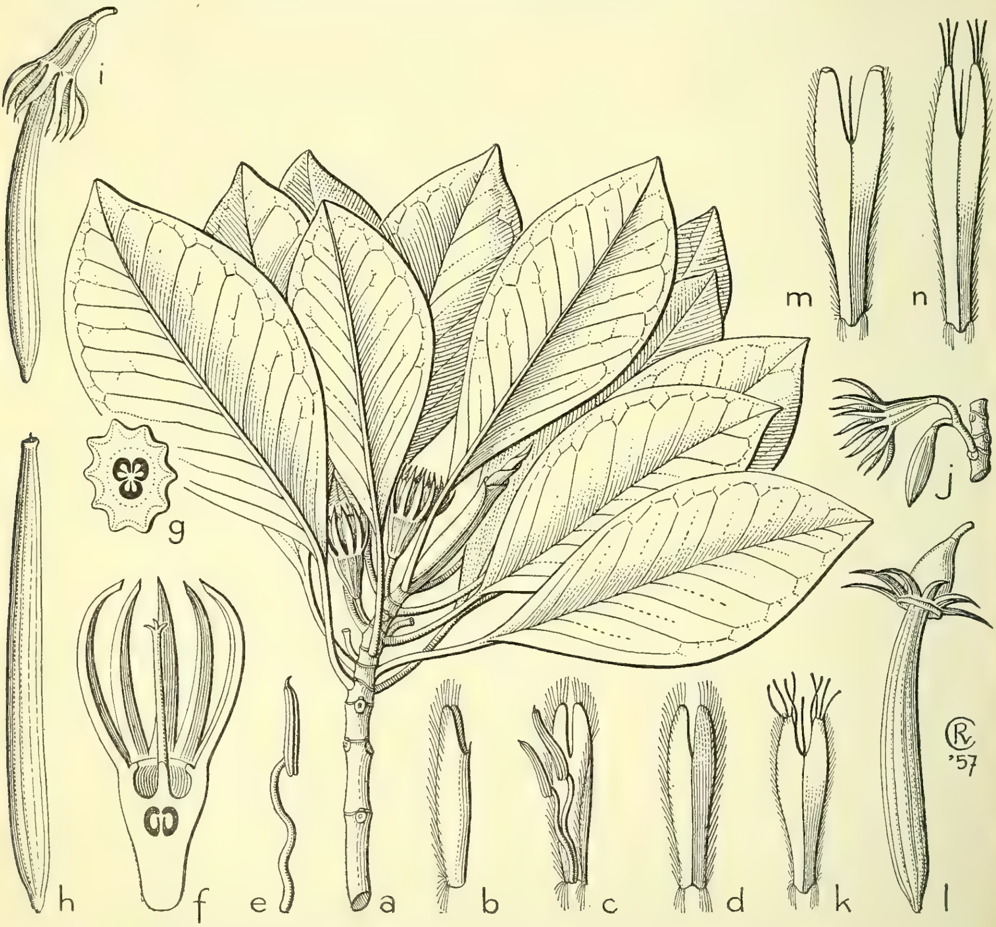


Fig. 17. *Bruguiera exaristata* DING HOU. *a.* Habit, × 2/3, *b–d.* petals, lateral, ventral (with 2 stamens), and dorsal, × 3, *e.* stamen, × 3, *f.* lengthwise section of flower (petals and stamens removed), × 2, *g.* cross-section of ovary, × 2, *h–i.* hypocotyls, × 2/3.—*Br. hainesii* ROGERS. *j.* Flower beyond anthesis, × 3, *k.* petals from outside, × 3, *l.* hypocotyl with calyx, × 2/3.—*Br. sexangula* (Lour.) POIR. *m.* Petal, from outside, × 3.—*Br. gymnorrhiza* (L.) LAMK. *n.* Petal, from outside, × 3 (*a, e–i* BRASS 808, *b–d* VAN ROYEN 4826, *j, l* SYMINGTON CF 51661, *k* F.M.S. 3, *m* KOORDERS 6293, *n* HOOGLAND 4182).

KEY TO THE SPECIES

1. Flowers solitary. Bristle in the sinus between the petal lobes not exceeding the lobe tips or minute to absent.
  2. Tips of the petal lobes acute, each with 3 or 4 bristles 2–3 mm long, distinctly exceeding the lobe tips . . . . **1. B. gymnorrhiza**
  2. Tips of the petal lobes obtuse, without or each with 1 or 2, rarely 3 short bristles usually less than 1¼ mm, not or hardly exceeding the apex.
    3. Leaves usually elliptic-oblong, flat, 8–13 by 3–6 cm, base acute to obtuse. Petals 13–15 mm long, the lobe tips with 1–3 bristles usually less than 1¼ mm; a distinct bristle in the sinus between the lobes. . . . . **2. B. sexangula**
    3. Leaves usually obovate (rarely elliptic), with revolute margins, 5–9½ by 3–4½ cm, base acuminate. Petals 9–11 mm long, exaristate, without (or very rarely with an obscure) bristle in the sinus of the lobes . . . . **3. B. exaristata**
1. Peduncles 2–5-flowered (in some specimens of *B. hainesii* a few solitary flowers have been observed along with 2–3-flowered peduncles). Bristle in the sinus of the petal lobes far exceeding the lobe tips.
    4. Calyx lobes ¼–⅕ the length of the calyx, erect or slightly spreading in fruit. Petals 1½–2 mm long . . . . **4. B. parviflora**
    4. Calyx lobes half length of the calyx, reflexed in fruit. Petals 4–9 mm long.
      5. Mature flowers 10–12 mm long. Petals 3–4 mm long. Calyx tube 2 mm diam., lobes 8, completely reflexed in fruit . . . . **5. B. cylindrica**
      5. Mature flowers 18–22 mm long. Petals 7–9 mm long. Calyx tube 5 mm diam., lobes 10, patent at right angles in fruit . . . . **6. B. hainesii**

1. Bruguiera gymnorrhiza (L.) Lamk, Encycl. Méth. Bot. 4 (1797 or 1798?) 696; Tabl. Encycl. Méth. 2 (1819) 517, t. 397 (as *gymnorhiza*); Bl. En. Pl. Jav. 1 (1827) 92; Mus. Bot. 1 (1849) 136, *incl. var. palun;* Miq. Fl. Ind. Bat. 1, 1 (1856) 586; Thwaites, En. Pl. Zeyl. (1859) 120; Kurz, For. Fl. Burma 1 (1877) 450; Henslow in Hook. *f.* Fl. Br. Ind. 2 (1878) 437; Schimp. Bot. Mitt. Trop. 3 (1891) 95, t. 5, f. 1; Trim. Fl. Ceyl. 2 (1894) 153; K. & V. Bijdr. 4 (1896) 292; King, J. As. Soc. Beng. 66, ii (1898) 314; Back. Schoolfl. (1911) 484; Koord. Exk. Fl. Java 2 (1912) 668; Atlas 1 (1913) t. 103; Guill. in Fl. Gén. I.-C. 2 (1920) 728, f. 75, 16–17; Ewart & Davies, Fl. North. Terr. Austr. (1917) 200; Costerus & Smith, Ann. Jard. Bot. Btzg 33 (1923) 81; Hochreutiner, Candollea 2 (1925) 448; Watson, Mal. For. Rec. (1928) 42, 108, t. 12; Back. Bekn. Fl. Jav. (em. ed.) 4b (1944) fam. 102, p. 7; Wyatt-Smith, Mal. For. 16 (1953) 157, f. 1; Browne, For. Trees Sar. & Brun. (1955) 301; Ding Hou, Nova Guinea, n.s. 8 (1957) 164.—*Kandel* Rheede, Hort. Mal. 6 (1686) 57, t. 31, not t. 32.—*Mangium celsum* Rumph. Herb. Amb. 3 (1743) 120, t. 68. —*Mangium minus* Rumph. Herb. Amb. 3 (1743) 106, t. 69, *excl. fl. et fig.* A–B.—*Rhizophora gymnorhiza* Linné, Sp. Pl. (1753) 443; Willd. Sp. Pl. 2, 2 (1800) 843.—*Rhizophora palun* DC. Prod. 3 (1828) 33.—*B. rheedii* Bl. En. Pl. Jav. 1 (1827) 92; Arn. Ann. Mag. Nat. Hist. 1 (1838) 367; Bl. Mus. Bot. 1 (1849) 138; Wight, Ill. Ind. Bot. (1860) 210; Ic. 1 (1839) t. 239^{A}, 1–8.—*Rhizophora tinctoria* Blanco, Fl. Filip. (1837) 394. —*Rhizophora rheedii* Steud. Nomencl. 2 (1841) 449.—*B. capensis* Bl. Mus. Bot. 1 (1849) 137.—*B. wightii* Bl. *op. cit.* 138.—*B. rumphii* Bl. *op.cit.* 138.—*B. zippelii* Bl. *op. cit.* 139, *incl. var. oblongifolia* Bl.—*B. cylindrica* (*non* Bl.) Hance, J. Bot. 18 (1879) 10; Engler, Bot. Jahrb. 6 (1885) 63; Forbes & Hemsl. J. Linn. Soc. Bot. 23 (1887) 293.—*B. conjugata* (*non Rhizophora conjugata* L.) Merr. Philip. J. Sc. 9 (1914) Bot. 118; Int. Rumph. (1917) 388; Sp. Blanc. (1918) 284; Gamble, Fl. Madras pt 3 (1919) 458; Brown, Min. Prod. Philip. For. 1 (1920) 52, t. 18; Merr. En. Born. (1921) 421; En. Philip. 3 (1923) 146; Costerus & Smith, Ann. Jard. Bot. Btzg 42 (1932) 10; Christoph. Bull. Bish. Mus. 128 (1933) 155; Craib, Fl. Siam. En. 1 (1931) 595; Kanehira, En. Micr. (1935) 376; Merr. Comm. Lour. (1935) 282; Burk. Dict. 1 (1935) 373; Kanehira, Form. Trees, rev. ed. (1936) 491, f. 453; Holthuis & Lam, Blumea 5 (1942) 217; Walker, Import. Trees Ryukyu Isl. (1952) 232, f. 144.—**Fig. 16, 17n**.

Buttressed tree up to 36 m by 40–65 cm. Branching mostly sympodial. Bark grey to almost black, roughly fissured, usually with large corky lenticels on buttresses and base of stems. *Leaves* elliptic-oblong, coriaceous, 8½–22 by (4½–)5–7(–9) cm, acute, base cuneate, rarely obtuse; nerves 9–10 pairs, visible beneath, obscure above; petiole 2–4½ cm, pruinose, often reddish. Stipules *c.* 4 cm long, often reddish. *Flowers* in anthesis 3–3½ cm long, generally nodding; pedicel 1–2½ cm, pruinose, bright red on the outside curve. *Calyx* red to pink-red, lobes (10–)12–14(–16), usually ⅔ the length of the calyx, obliquely ascending in fruit, tube usually ribbed at the upper part. *Petals* 13–15 mm long, lobe ⅓–½ the length of the petal, acute, each with 3 or 4 bristles 2–3 mm exceeding the tip, outer margins fringed with white silky hairs especially at the base, rarely the upper part glabrous. *Stamens* 8–11 mm long, anthers linear, 4–5 mm. Style *c.* 15 mm, angular towards the base; stigmatic arms 3–4, filiform, ½–1¼ mm. *Fruit* not ribbed, 2–2½ cm long. Seeds 1(–2). *Hypocotyl* cigar-shaped, slightly angular, with a blunt narrowed apex, 15–25 by 1½–2 cm.

Distr. Tropical South and East Africa, Madagascar, Seychelles, Ceylon, SE. Asia, Riukiu; throughout *Malaysia*, to Australia, Micronesia (Palau, Yap, Marshall Isl., &c.), and Polynesia (Samoa, Fiji).

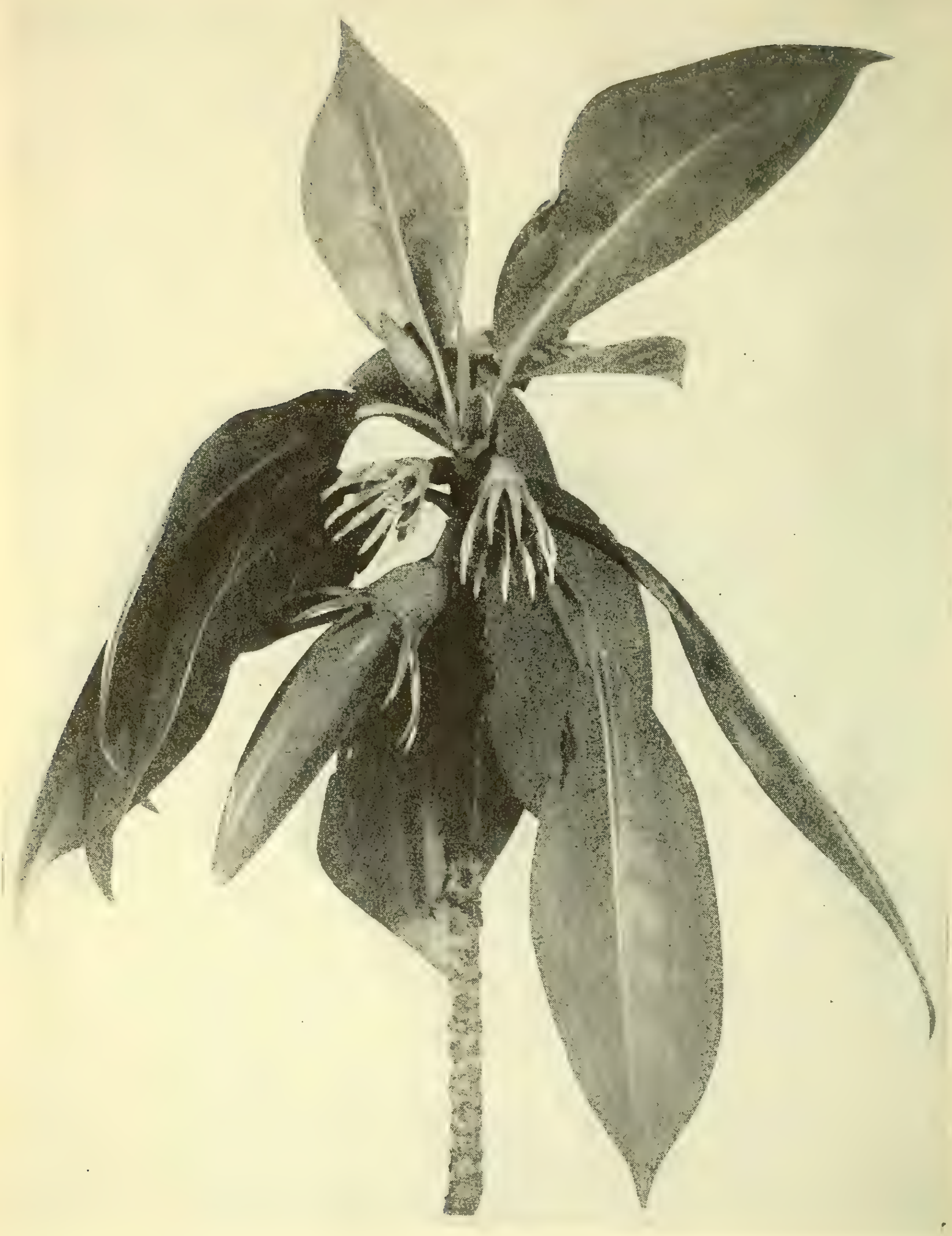


Fig. 18. *Bruguiera sexangula* (LOUR.) POIR. (KEBUN RAJA INDONESIA).

Ecol. One of the largest trees of the mangrove, as a rule on somewhat dry, well aerated soil towards the landward side, often dominating as a tall forest with occasional stems up to 36 m by 65 cm. In the interior of islands it is sometimes pure but more often associated with *R. apiculata*. On the seaface it is only found following erosion.

B. gymnorrhiza marks the final stage in the development of the littoral forests and the beginning of the transition to ordinary inland types. It is the largest and probably the longest lived of the mangroves. It can stand any amount of shade and is frequently able to establish itself in pure bakau stands when the shade is too dense for *Rhizophora* seedlings to develop. Watson considers it a 'cuckoo species', leaving the nursing of its progeny to be carried out by others. After felling its regeneration is often very scant or absent and there is danger of overgrowth by *Acrostichum*; but once seedlings have established themselves the fern acts rather as a nurse, forcing the seedlings up.

Uses. The red, hard timber is used for fire-wood and for charcoal, less so for piles, house-posts and rafters. Rumphius says that the leaves and peeled hypocotyls are eaten in the Moluccas after having been soaked in water and boiled, which he deems a poor food.

In Djakarta the starchy central part of the hypocotyls is treated with sugar and the sweet-meat sold as 'manisan kandéka'. The fruits are sometimes used as an adstringent in the betel-quid, when not anything better is available.

Vern. *Bakau bĕsar*, *bĕtut*, *tumbus*, *tumu*, *t. mèrah*, *tumus*, Mal. Pen., *pĕrtut*, Atjeh, *taheup*, N. Simalur, *tĕnggĕl*, Simalur (Tapah), *putut*, *tumu*, Sum. E. C., *tomo*, Palemb., *kutit*, *putut*, Sarawak, *kandéka*, M (Djak.), *tandjang*, J, *lindur*, Md, *sala-sala*, Bugin.; Philippines: *potótan*, Tag. & various lang., *bakáuan*, *busíing*, *petútan*, Tag., *busain*, Tag., Bik., *potútan*, Tag., S. L. Bis., *putútan*, Tag., Ibn., C. Bis., *bakáu*, Bis., *patótan*, *pulútan*, Ibn., *siap*, *uñgon*, Ilk.; *dau*, M (Molucc.), *tongké*, M (Ambon); Papua: *arara*, Motu, *bagoia*, Binandele, *mapeke*, Kiwai.

Note. For a discussion of the rejection of the combination '*B. conjugata* (L.) Merr.' see under *Rhizophora apiculata* Bl.

Docters van Leeuwen found in specimens cultivated in Kebun Raya Indonesia a fruit with 2 hypocotyls (Costerus & Smith, *l.c.* 1923).

2. **Bruguiera sexangula** (Lour.) Poir. in Lamk, Encycl. Suppl. 4 (1816) 262; Arn. Ann. Mag. Nat. Hist. 1 (1838) 369; Merr. Int. Rumph. (1917) 389; Sp. Blanc. (1918) 284; Brown, Min. Prod. Philip. For. 1 (1920) 52, 54, t. 19–20; Merr. En. Born. (1921) 422; En. Philip. 3 (1923) 147; Pl. Elm. Born. (1929) 214; Craib, Fl. Siam. En. 1 (1931) 597; Degener, Fl. Haw. book 2 (1934) fam. 269, tab.; Merr. Comm. Lour. (1935) 282; Burk. Dict. 1 (1935) 375; Back. Bekn. Fl. Jav. (em. ed.) 4b (1944) fam. 102, p. 7; Ding Hou, Nova Guinea, n.s. 8 (1957) 168.—*Mangium digitatum* Rumph. Herb. Amb. 3 (1741) 107, t. 70.—*Rhizophora sexangula* Lour. Fl. Coch. (1790) 297.—*B. sexangularis* Spreng. Syst. Veg. 2 (1825) 602.—*B. cylindrica* (*non Rhizophora cylindrica* L.) Bl. En. Pl. Jav. (1827) 93, *quoad specim.*; Arn. Ann. Mag. Nat. Hist. 1 (1838) 366; Bl. Mus. Bot. 1 (1849) 137; Miq. Fl. Ind. Bat. 1, 1 (1856) 586.—*Rhizophora polyandra* Blanco, Fl. Filip. (1837) 396, ed. 2 (1845) 277, ed. 3, 2 (1878) 150, t. 415*bis*.—*Rhizophora plicata* Blanco, *op. cit.* 398, 279, 152.—*B. eriopetala* W. & A. *ex* Arn. Ann. Mag. Nat. Hist. 1 (1838) 368; Wight, Ic. 1 (1839) t. 239B, 1–3; Ill. Ind. Bot. 1 (1840) 210; Schimp. Bot. Mitt. Trop. 3 (1891) 95, t. 5, f. 2; K. & V. Bijdr. 4 (1896) 295; King, J. As. Soc. Beng. 66, ii (1898) 316; Back. Schoolfl. (1911) 485; Merr. Fl. Man. (1912) 347; Koord. Exk. Fl. Jav. 2 (1912) 669; Atlas 1 (1913) t. 104; Guill. in Fl. Gén. I.—C. 2 (1920) 729, f. 75, 23; Hochreutiner, Candollea 2 (1925) 449; Watson, Mal. For. Rec. (1928) 109, t. 11a, 14; Wyatt-Smith, Mal. For. 16 (1953) 157, f. 2. —*B. australis* A. Cunn. *ex* Arn. Ann. Mag. Nat. Hist. 1 (1838) 368.—*Rhizophora australis* Steud. Nomencl. ed. 2, 2 (1841) 449.—*Rhizophora eriopetala* Steud. *l.c.*—*B. parietosa* Griff. Notul. 4 (1854) 670; Ic. Pl. As. (1854) t. 641.—*B. 10-angulata* Griff. Notul. 4 (1854) 669.—*B. oxyphylla* Miq. Sum. (1861) 324.—*B. malabarica* (*non* Arn.) F.—Vill. Nov. App. (1880) 79.—**Fig. 6b, 17m, 18, 23.**

Tree up to 33 m by 65(–80) cm, buttresses up to 1 m high; kneed roots 45 cm. Bark smooth, grey to pale-brown, with a few large corky lenticels especially on the buttresses, sometimes with stilt-roots. Branching mostly sympodial. *Leaves* elliptic to elliptic-oblong, rarely oblanceolate, 8–13(–16) by 3–6 cm, acute at both ends, flat; nerves 7–11 pairs visible to obscure on both surfaces; petiole $1\frac{1}{2}$–5 cm, not pruinose. Stipules green or yellowish, $3\frac{1}{2}$–4 cm long. *Flowers* generally nodding, at anthesis $2\frac{3}{4}$–4 cm long. Pedicels 6–12 mm, green, yellow, or brownish, not pruinose. *Calyx* 10–12-lobed, yellow, yellow-brown or reddish, never bright red, tube 1–$1\frac{1}{2}$ cm long, outside distinctly ridged to the base. *Petals* $1\frac{1}{2}$ cm long, densely fringed with hairs along the outer margins from the base to the apex; lobes half the length of the petal, apex reflexed and obtuse, each near the top with a few (1–3) bristles up to $1\frac{1}{4}$ mm long and not or hardly exceeding the apex; a distinct bristle in the sinus between the lobes. *Stamens* 7–14 mm, anthers linear, 3–5 mm. Style filiform, $1\frac{1}{2}$–$2\frac{1}{4}$ cm long, arms 3–4, at most $\frac{1}{2}$ mm. *Hypocotyl* thick, rather angular, with narrowed blunt ends, 6–8 by $1\frac{1}{2}$ cm, straight.

Distr. Ceylon, SE. Asia, throughout *Malaysia*, to New Britain and E. New Guinea, introduced in Hawaii.

Ecol. As of *B. gymnorrhiza*, mainly in the back mangrove in places which are infrequently submerged, but generally preferring wetter soils in association with *B. cylindrica* and *B. parviflora*. According to Burkill it has been suggested that it is a hybrid between *B. cylindrica* and *B. gymnorrhiza;* there is nothing to sustain this idea and its large area of distribution and fertility indicate its good specific status. According to Watson the rarest *Bruguiera* in Malaya; it is the only one which occasionally stands on stilt-roots.

Uses. As *B. gymnorrhiza.* The tree yields firewood and poles and is suitable for making charcoal. Fruit is said to be used in an application for shingles, and root or leaves are used for burns. In Celebes the fruits are eaten after having been soaked and boiled.

Vern. *Tumu barau,* (*tumu*) *mata buaya,* Mal. Pen., *busing, busung, mata buwaja, tumu,* Sum. E. C., *kurung, tumu, utut,* Sarawak, *bakau tampusing,* Bandjerm., *tandjang,* J, *lindur,* Md, *ting,* Manado (Mol.), *makurung,* Minah. (Alf.), *tongké pĕrampuan,* Ambon, *guwoi,* Weda; Philippines: *potótan,* Tag. & various lang., *bakáuan- babáe, b. laláki, balinsasayan, balinsarayan, busáin, kalabayuan, potótan-babáe, potútan, putútan, tagasa,* Tag., *busáing,* Sulu, *gutulan, lagasa*(*k*), *sagasa*(*k*), Ibn.; *ai bon,* Nuf, *wapa,* Marind.

Note. For a discussion of the evaluation of *Rhizophora conjugata* L. I refer to *Rhizophora apiculata* BL.

In Hawaii introduced Aug. 1922 by the Hawaiian Sugar Planters' Association and ten years later growing naturalized in the salt marshes near Heeia, Oahu (DEGENER, *l.c.*).

3. Bruguiera exaristata DING HOU, Nova Guinea, n.s. 8 (1957) 166, f. 1–2.—**Fig. 17a–i.**

Small tree up to 10 m by 25 cm. Bark dark-grey and cracked. *Leaves* obovate, rarely elliptic, 5–$9^1/_2$ by 3–$4^1/_2$ cm, acute, base acuminate, margin sometimes revolute; nerves 7 pairs, distinct; petiole $1^1/_2$–$2^1/_2$ cm. Stipules *c.* 2 cm long. Peduncle 7–12 mm. *Flowers* at anthesis 2–$2^1/_2$ cm long. *Calyx* 8(–10)-lobed, 10–15 mm long, tube distinctly ridged externally down to the base. *Petals* 9–11 mm long, densely fringed with white appressed hairs at the base and along the outer margins, lobes $^1/_3$ the length of the petal, obtuse, without bristles at the apex and in the sinus, very rarely with a minute, obscure one in the sinus. *Filaments* 10 mm, anthers 5 mm long, apiculate. Style *c.* 14 mm long, stigmas obscurely 3-lobed. *Hypocotyl* cylindric, obtuse at both ends, obscurely ridged, $4^1/_2$–6 cm by 6–8 mm.

Distr. Northern Australia (Northern Territory, Queensland) and *Malaysia:* South New Guinea (Kapa Kapa, Merauke) and Lesser Sunda Islands (Timor). Fig. 19.

Ecol. In mangroves or growing at the rear of other mangroves and along creeks (Mossman River, Queensland).

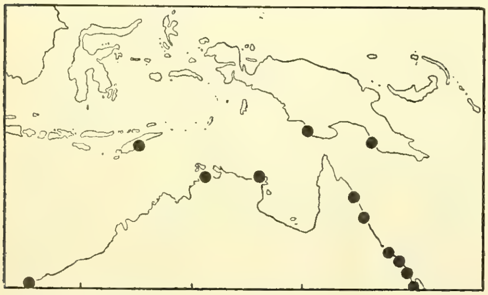


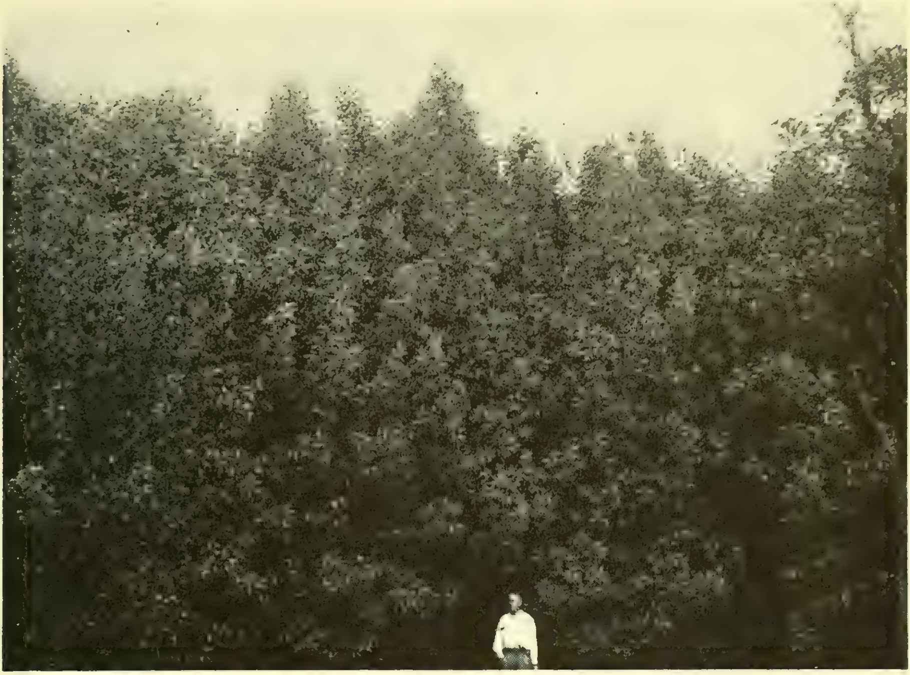
Fig. 19. Localities of *Bruguiera exaristata* DING HOU.

4. Bruguiera parviflora (ROXB.) W. & A. *ex* GRIFF. Trans. Med. Phys. Soc. Calc. 8 (1836) 10; Ann. Sc. Nat. Bot. Paris II, 10 (1838) 123; ARN. Ann. Mag. Nat. Hist. 1 (1838) 369; MIQ. Fl. Ind. Bat. 1, 1 (1855) 588; KURZ, For. Fl. Burma 1 (1877) 449; HENSLOW in Hook. Fl. Br. Ind. 2 (1878) 438; F.—VILL. Nov. App. (1880) 79; VIDAL, Rev. Pl. Vasc. Filip. (1886) 126; SCHIMP. Bot. Mitt. Trop. 3 (1891) 96, t. 5, f. 4; K. & V. Bijdr. 4 (1896) 297; KING, J. As. Soc. Beng. 66, ii (1898) 315; BACK. Schoolfl. (1911) 485; KOORD. Exk. Fl. Jav. 2 (1912) 668; Atlas 1 (1913) t. 105, F–G; MERR. En. Born. (1921) 421; En. Philip. 3 (1923) 147; Pl. Elm. Born. (1929) 214; HOCHREUTINER, Candollea 2 (1925) 450; WATSON, Mal. For. Rec. (1928) 111, t. 17, 18; CRAIB, Fl. Siam. En. 1 (1931) 596; DEGENER, Fl. Haw. book 2 (1934) fam. 269; BROWN, Min. Prod. Philip. For. 1 (1935) 58, t. 23–24; BURK. Dict. 1 (1935) 374; BACK. Bekn. Fl. Jav. (em. ed.) 4b (1944) fam. 102, p. 8; WYATT-SMITH, Mal. For. 16 (1953) 157, f. 5; BLAKE, Austr. J. Bot. 2 (1954) 134; BROWNE, For. Trees Sar. & Brun. (1955) 301; DING HOU, Nova Guinea, n.s. 8 (1957) 168.—*Rhizophora parviflora* ROXB. Fl. Ind. ed. Carey 2 (1832) 461.—*? Rhizophora cylindrica* (*non* L.) ROXB. Hort. Beng. (1814) 36, *nomen.*—*Kanilia parviflora* BL. Mus. Bot. 1 (1849) 140, f. 30.—*B. ritchiei* MERR. Publ. Govt. Lab. Philip. 6 (1904) 11.—**Fig. 6a, 20–21.**

Tree up to 24 m by 15–30(–55) cm. Bark smooth, grey, with a few small, obscure lenticels. *Leaves* elliptic, $7^1/_2$–13 by $2^1/_2$–4 cm, apex acute, base cuneate; nerves about 10 pairs, faintly visible on both surfaces; petiole $1^1/_2$–2 cm. Stipules *c.* $4^1/_2$ cm long. Cymes 3–7-flowered. Peduncle *c.* 2 cm, 2–5-flowered. *Flowers* yellowish green. Pedicels 6–13 mm. *Calyx* tube ridged, 7–9 mm long, lobes 8, about $^1/_4$–$^1/_5$ as long as the tube. *Petals* $1^1/_2$–2 mm long, the lobes $^1/_3$ the length of the petal, each with 3 bristles *c.* $^1/_2$ mm, white hairy at the lower margin. *Stamens* $1^1/_2$ mm, anthers slightly oblong, $^1/_3$ mm long. Style *c.* $1^1/_4$–$1^1/_2$ mm long, obscurely lobed, stigmas 2–3. Fruit-calyx-tube $1^3/_4$–$2^1/_4$ cm long, lobes erect, not accrescent. *Hypocotyl* cylindric, smooth, $7^1/_2$–13 by $^1/_2$ cm; plumule piercing the base of the fruit which remains on the seedling as a cuff.

Distr. SE. Asia, throughout *Malaysia* to Melanesia (New Hebrides, Solomon Isl.) and Australia (N. Queensland and Northern Territory), introduced in Hawaii (DEGENER, *l.c.*).

Ecol. Mostly on the inner side of the mangrove, not infrequently found associated with *B. cylindrica,* but more often with *Rhizophoras* where it is at its best. Occasionally it forms pure, solid stands. It distinctly increases as a result of exploitation of immature areas. It often establishes itself on soils formerly occupied by *Rhizophora* and is frequently common on river-banks where excessive pole



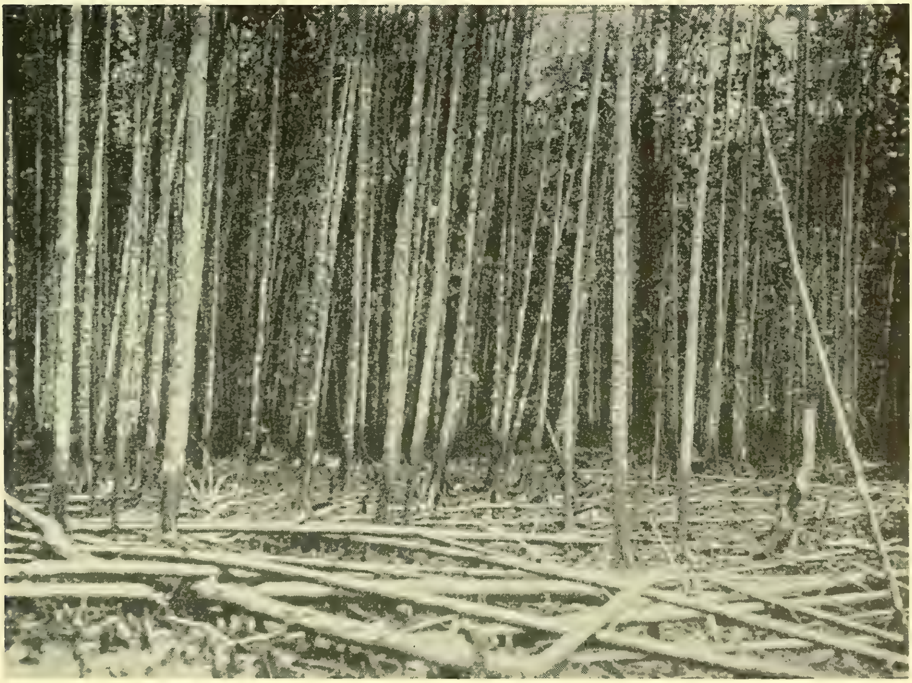


Fig. 20–21. Pure forest of *Bruguiera parviflora* W. & A. as seen from the outside near Palu Piai (E. Sumatra), *c.* 10 years old (H. H. TH. SCHREUDER) and inside, with mud mark of high tide in Malaya (J. WYATT-SMITH).

cutting has been indulged in by fishermen. And then it may become a nurse for the *Rhizophoras*. If it grows mixed with *B. gymnorrhiza* it is evidently under conditions which suit it as then it attains its largest size. It is much more tolerant of submergence than *B. cylindrica*. Though quick to establish itself, WATSON finds it a slow grower and among the *Bruguieras* it has the shortest life, particularly when it grows in pure stands as it frequently does in the wetter parts. WATSON calls it an 'opportunist species' occurring under a variety of conditions. For that reason the forester encourages it if he cuts as frequently as every twenty years.

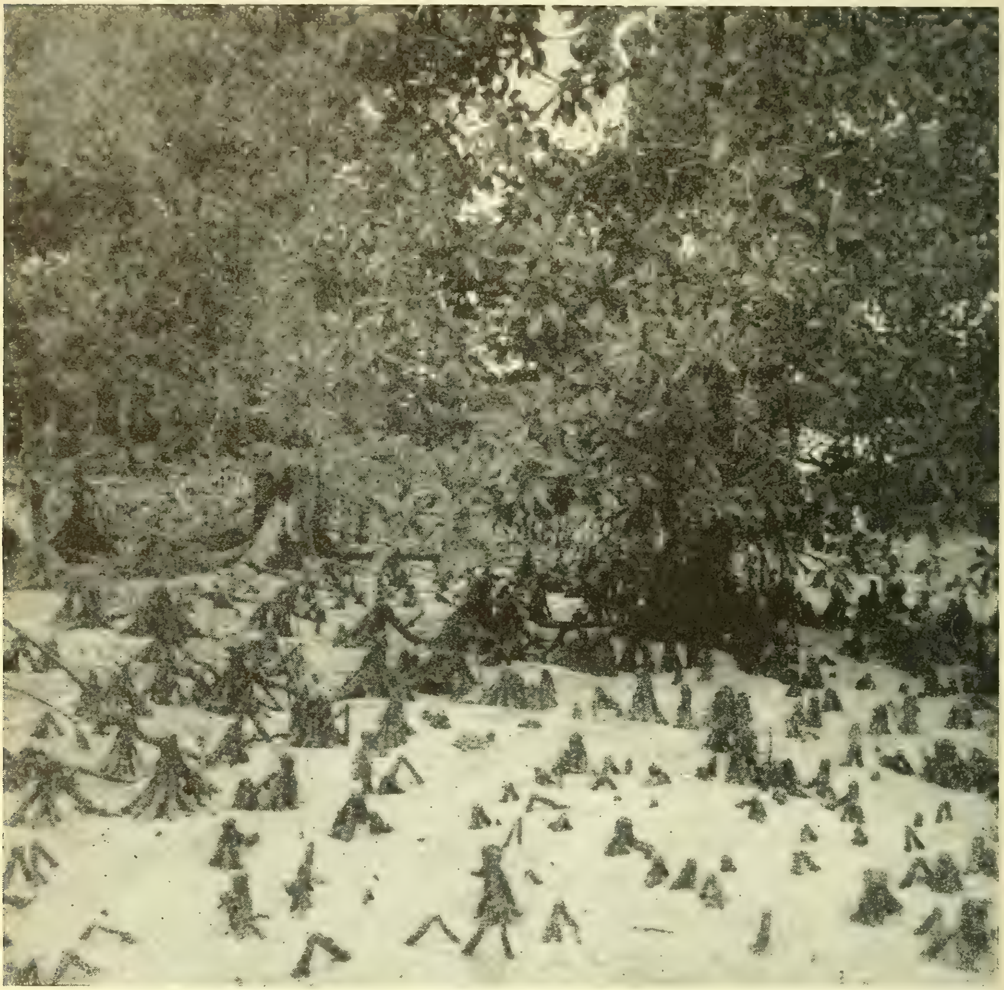


Fig. 22. *Bruguiera* forest with knee-roots in sandy mangrove at low tide, near Kiojoh, south coast of Enggano Isl. (LÜTJEHARMS).

Uses. By its small dimensions not of much use, but employed for (inferior) fire-wood and for mining and on the Selangor coast for fishing-stakes and traps, but in Perak fishermen say that, like *B. cylindrica*, it has a peculiar odour which frightens fish away. Sometimes poles are used for rafters. Bark is deficient in tannin. Malays sometimes use the germinating embryo as a vegetable.

Vern. *Lĕnggadai*, *lĕnggadis*, *mĕngkadai*, Mal. Pen., *langgadé*, Atjeh, *lĕnggadai*, Banka, Borneo, *mĕngĕlangan*, Palemb., *tandjang*, J, *tĕngit*, M (Palo); Philippines: *hañgarai*, *lañgarai*, Tag. & other lang., *bakáuan-laláki*, *mañgalai*, *potótan*, Tag., *hañgalai*, Tag., Mbo., *hiñgalai*, *hiñgarai*, Tag., P. Bis., *arum*, Bag., *biosan*, *bubutigan*, S. L. Bis., *hanagaiai*, *hañgai*, C. Bis.

5. Bruguiera cylindrica (L.) BL. En. Pl. Jav. 1 (1827) 93, *quoad basionym;* W. & A. Prod. (1834) 311; MIQ. Fl. Ind. Bat. 1, 1 (1855) 586; NAVES in Blanco, Fl. Filip. ed. 3 (1877–83) t. 136; MERR. Fl. Man. (1912) 348; Int. Rumph. (1917) 388; En. Philip. 3 (1923) 147; BROWN, Min. Prod. Philip. For. 1 (1920) 54, t. 21–22; CRAIB, Fl. Siam. En. 1 (1931) 595; BURK. Dict. 1 (1935) 374; HOLTHUIS & LAM, Blumea 5 (1942) 217; DING HOU, Nova Guinea, n.s. 8 (1957) 168.—*Karil-Candel* RHEEDE, Hort. Mal. 6 (1686) 59, t. 33.—*Mangium minus* RUMPH. Herb. Amb. 3 (1743) 106, t. 69, *quoad fl. et fig.* A–B.—*Mangium caryophylloides* RUMPH. *ibid.* 119, t. 78.—*Rhizophora cylindrica* LINNÉ, Sp. Pl. (1753) 443.—*Rhizophora caryophylloides* BURM. *f.* Fl. Ind. (1768) 109, *excl. var.* β*;* JACK, Mal. Misc. 1 (1820) 34; reimpr. Calc. J. Nat. Hist. 4 (1843) 334.—*Rhizophora ceratophylloides* GMEL. Syst. Veg. (1796) 749; RAEUSCH. Nom. ed. 3 (1797) 136 (*sphalm. caryophylloides*).—*B. caryophylloides* BL. En. Pl. Jav. 1 (1827) 93; ARN. Ann. Mag. Nat. Hist. 1 (1838) 368; MIQ. Fl. Ind. Bat. 1, 1 (1855) 589; KURZ, For. Fl. Burma 1 (1877) 450; TRIM. Fl. Ceyl. 2 (1894) 154; SCHIMP. Bot. Mitt. Trop. 3 (1891) 96, t. 5, f. 5; K. & V. Bijdr. 4 (1896) 299; KING, J. As. Soc. Beng. 66, ii (1898) 315; BACK. Schoolfl. (1911) 485; GUILL. in Fl. Gén. I.-C. 2 (1920) 730; WATSON, Mal. For. Rec. (1928) 110, t. 15, 16; BACK. Bekn. Fl. Jav. (em. ed.) 4b (1944) fam. 102, p. 7; WYATT-SMITH, Mal. For. 16 (1953) 157, f. 4.—*B. malabarica* ARN. Ann. Mag. Nat. Hist. 1 (1838) 369.—*Kanilia caryophylloides* BL. Mus. Bot. 1 (1849) 141.

Tree up to 23 m by 20–30 cm, buttresses small, up to 1 m. Bark grey, with a few small, corky lenticels. *Leaves* thin, elliptic, 7–17 by 2–8 cm, acute, base cuneate; nerves *c.* 7 pairs, distinct, rarely obscure on both surfaces; petiole 1–4$^1/_2$ cm. Stipules 2$^1/_2$–3$^1/_2$ cm long. Cymes 3-flowered. Peduncle 6–8 mm. *Flowers* greenish, at anthesis 10–12 mm long. Pedicels 1–4 mm. *Calyx* tube smooth, 4–6 by 2 mm, lobes 8, about as long as the tube. *Petals* 3–4 mm long, the lobes *c.* $^1/_6$ as long as the petal, with 2 or 3 bristles at the apex, outer margins usually fringed with white hairs in the lower part. *Stamens* 1$^1/_2$–2$^1/_2$ mm long, anthers oblong, $^1/_2$ mm long, slightly apiculate. Calyx tube in fruit 10–12 mm long, the lobes reflexed, not accrescent. *Hypocotyl* cylindric, often curved, 8–15 cm by 5 mm.

Distr. SE. Asia, throughout *Malaysia* to N. Queensland.

Ecol. Generally not higher than 20 m, essentially gregarious on stiff clay behind *Avicennia* on the seaface; it gives way to other species on better drained soils, existing gregariously by virtue of its ability to grow in newly formed soils unsuitable to other mangroves.

The almost entire absence of aeration in the dense clay habitually occupied by *B. cylindrica* makes the tree more than usually dependent on its pneumatophores for an adequate supply of oxygen, and particularly susceptible to prolonged submersion. Suffocation on a much more extensive scale has occurred in the centre of Trong Island, in the Matang For. Res., Perak, where its progressive dying off over an area that had grown to over 40 ha has recently been checked by the cutting of an extraction canal, which has allowed the accumulated surface water to drain away towards the landward side.

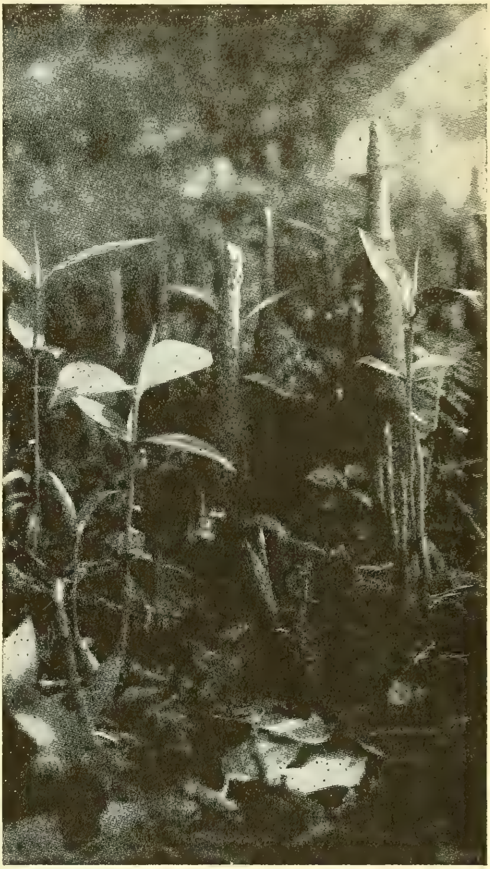


Fig. 23. Spontaneous seedlings of *Bruguiera sexangula* (LOUR.) POIR. between pneumatophores of *Sonneratia caseolaris* (L.) ENGL. in the freshwater swamp of the Botanic Gardens, Bogor (II.Q.F.), Oct. 1956 (JACOBS).

There is good reason to believe that *B. cylindrica* is a legitimate precursor of the *Rhizophoras* in most situations where accretion is proceeding on the sea-face. It is a prolific seed-bearer and healthy forests can be relied upon to regenerate themselves even after clear felling (WATSON).

According to SETTEN the pure stands in Malaya are found normally above reach of the ordinary tides and are inundated only with spring tides. The stocking of the young stands is extremely dense and these pole woods may contain from 55.000–70.000 stems per ha. SETTEN says that *bĕrus* holds the doubtful honour of achieving pride of place as the slowest growing of any commercial tree species in Malaya. From seed it takes *c.* 11–12 years to attain 6 m height, *c.* 16–17 years to attain 9 m by 5 cm diam. and *c.* 60 years to attain 30 cm diam. Its rotation should be longer than 30 years now accepted for average rotation in Malaya of mangrove forest. Heavy early thinnings are necessary to increase the rate of growth.

Uses. Timber mainly used for fire-wood; it is reddish, heavy, and close-grained. The bark is thin and of too poor quality for tanning purpose. According to HEYNE the young radicles are in some areas occasionally eaten with sugar and coconut. Fisherman say that the wood has a peculiar odour which frightens away fish; and many do not like to use it for making fish-traps.

Vern. *Bakau bĕlukap, b. bĕrus, b. putih, bĕrus, b. kĕtjil, bosang*, Mal. Pen., *burus*, M, *tandjang, t. sukun*, J, *lindur*, Md; Philippines: *bakáuan, biuas, busáin, putútan, tañgálan, tañgal-babáe*, Tag., *biuis*, Pang, *bius*, Mag., Sul., *kalapínai*, Ilk., *lañgarai*, Mag., *magtoñgog, magtuñgud*, S. L. Bis.

6. Bruguiera hainesii C. G. ROGERS, Kew Bull. (1919) 225; CRAIB, Fl. Siam. En. 1 (1931) 596; WYATT-SMITH, Mal. For. 16 (1953) 157, f. 3; DING HOU, Nova Guinea, n.s. 8 (1957) 168.—*Rhizophora caryophylloides* (*non* BURM. *f.*) GRIFF. Ic. 4 (1854) t. 642.—**Fig. 17j–l.**

Tree up to 33 m by 70 cm. Bark brown to grey, with large corky yellow-brown lenticels from base to top. *Leaves* elliptic-oblong, 9–16 by 4–7 cm, acute, base cuneate; petiole 2½–4 cm. Stipules 3½ cm long. Cymes 2–3-flowered. Peduncle short, 7–13 mm. Pedicels 6–8 mm. *Flowers* in anthesis 1¾–2¼ cm long. *Calyx* pale green, 10-lobed, tube 5 mm diam., slightly ridged outside in the upper part, lobes as long as the tube. *Petals* 7–9 mm long, villose at the lower margins, slightly pilose at the upper part of the lobes, lobes ⅓ as long as the petal, with 2–4 bristles at the apex. Calyx lobes patent at right angles in fruit. *Hypocotyl* cigar-shaped or slightly clavate, slightly curved, up to 9 cm by 11 mm.

Distr. ?India (*fide* GRIFFITH *l.c.*), S. Burma (Mergui), Siam (Chantaburi, Surat), and *Malaysia:* Malay Peninsula (Klang Isl., Selangor), and Papua (Port Moresby).

Ecol. On dry side or inland of mangrove, only inundated for a few hours at fairly high spring tides.

Vern. *Bĕrus mata buaya*, M.

Excluded

Bruguiera nubicola PRITZ. Icon. Ind. 2 (1866) 51, *nomen, sphalm.* = *Bougueria nubicola* DECNE (*Plantaginac.*).

3. CERIOPS

ARN. Ann. Mag. Nat. Hist. 1 (1838) 363.—**Fig. 24-25.**

Small to medium-sized trees. Stems with appressed stilt-roots up to 1 m tall. *Leaves* decussate, clustered at the end of the twigs, entire, coriaceous, glabrous, not black-dotted beneath; nerves obscure on both surfaces. Stipules lanceolate. *Inflorescences* solitary, subsessile to shortly peduncled, (2–)4-∞-flowered, condensed cymes. Bracteoles 2 at the base of the flower, partly connate, cupular, the free part ovate. *Calyx* deeply 5–6-lobed, ovate and acuminate. *Petals* white, 5 or 6, each embracing 2 stamens, inserted at the margin of the disk, sometimes cohering at the base by the uncinate-hairy margins, apex emarginate or truncate, fringe-like divided or with 3 clavate appendages (occasionally only 2). Disk cupular, shallowly lobed, lobes episepalous. *Stamens* twice the number of calyx lobes, inserted in the sinuations of the disk. *Ovary* semi-inferior, 3-celled, each cell with 2 ovules; style terete, simple; stigma simple or obscurely 2–3-lobed. *Fruits* ovoid, for the greater part superior. *Hypocotyls* clavate, tapering to the apex, ridged and sulcate.

Distr. Species 2, distributed in the tropics of the Old World, from eastern Africa throughout *Malaysia* to Micronesia, Melanesia, and N. Australia.

Ecol. Typical constituents of the inner mangrove.

KEY TO THE SPECIES

1. Petals with 3 clavate appendages at the apex. Anthers obtuse at the apex, *c.* ¼–⅙ the length of the filament. Calyx lobes on the fruits reflexed or widely patent. Hypocotyl 15–25(–35) cm **1. C. tagal**
1. Petals fringe-like divided at the apex. Anthers apiculate, longer than the filament or rarely as long as it. Calyx lobes in fruit erect or ascending. Hypocotyl 9–15 cm long . . . . . . **2. C. decandra**

1. Ceriops tagal (PERR.) C. B. ROB. Philip. J. Sc. 3 (1908) Bot. 306; MERR. Int. Rumph. (1917) 386; Sp. Blanc. (1918) 283; BROWN, Min. Prod. Philip. For. 1 (1920) 60; MERR. En. Born. (1921) 420; En. Philip. 3 (1923) 144; Pl. Elm. Born. (1929) 214; CRAIB, Fl. Siam. En. 1 (1931) 593; KUDO, Bot. Mag. Tokyo 46 (1932) 150, *incl. f. sasakii* (HAY.) KUDO; BURK. Dict. 1 (1935) 515; SALVOZA, Nat. Appl. Sc. Bull. Un. Philip. 5 (1936) 234; BACK. Bekn. Fl. Jav. (em. ed.) 4b (1944) fam. 102, p. 4; QUIS. Med. Pl. Philip. (1951) 652; BLAKE, Austr. J. Bot. 2 (1954) 133; BROWNE, For. Trees Sar. & Brun. (1955) 302; LEWIS, Fl. Trop. E. Afr. (Rhizophorac.) (1956) 5, f. 2.—*Mangium caryophylloides II parvifolium et III latifolium* RUMPH. Herb. Amb. 3 (1647) 119.—*Rhizophora tagal* PERR. Mém. Soc. Linn. Paris 3 (1824) 138.—*Rhizophora timoriensis* DC. Prod. 3 (1828) 32.—*C. candolliana* ARN. Ann. Mag. Nat. Hist. 1 (1838) 364, *nom. illeg.;* WIGHT, Ill. Ind. Bot. 1 (1840) 209; WALP. Rep. Bot. Syst. 2 (1843) 70; BL. Mus. Bot. 1 (1849) 142, *incl. var. spathulata* BL.; MIQ. Fl. Ind. Bat. 1, 1 (1855) 590; THWAITES, En. Pl. Zeyl. (1859) 120; OLIVER, Fl. Trop. Afr. 2 (1871) 409; KURZ, For.

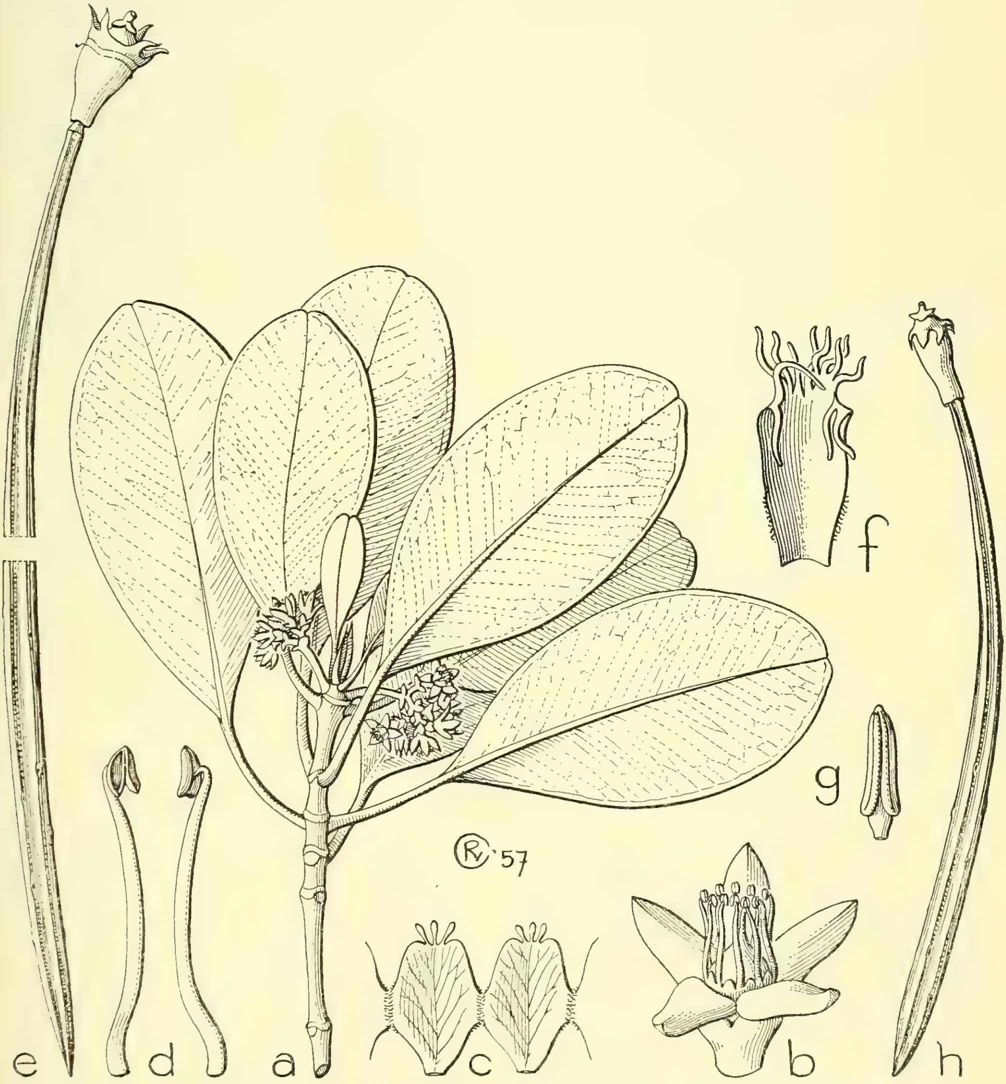


Fig. 24. *Ceriops tagal* (PERR.) C. B. ROBINSON. *a.* Habit, × 2/3, *b.* flower, corolla removed, × 3, *c.* petals, inside, × 5, *d.* stamens, × 13, *e.* hypocotyl, × 2/3.—*C. decandra* (ROXB.) DING HOU. *f.* Petal, inside, × 13, *g.* stamen, × 13, *h.* hypocotyl, × 2/3 (*a–d* HOOGLAND 4315, *e* SAUNDERS 95, *f–g* VERSTEEG 1892, *h* KOORDERS 29925).

Fl. Burma 1 (1877) 448; Henslow in Hook. *f.* Fl. Br. Ind. 2 (1878) 438; F.–Vill. Nov. App. (1880) 79; Vidal, Sinopsis Atl. (1883) 25, t. 47, f. C; Schimp. Bot. Mitt. Trop. 3 (1891) 94, t. 5, f. 6; Trim. Fl. Ceylon 2 (1894) 152; K. & V. Bijdr. 4 (1896) 284; Schimp. in E. & P. Pfl. Fam. 3, 7 (1898) 52, f. 26, J–M; Back. Schoolfl. (1911) 482; Koord. Exk. Fl. Java 2 (1912) 668; Atlas 1 (1913) t. 107; Hayata, Ic. Pl. Form. 3 (1913) 115, t. 20, *incl. var. sasakii* Hay.; Guill. Not. Syst. 3 (1914) 56; Ewart & Davies, Fl. North. Terr. Austr. (1917) 199; Ostenfeld, Dansk Bot. Arkiv 2, 8 (1918) 26; Guill. Fl. Gén. I.–C. 2 (1920) 725, f. 75, 5–8; Watson, Mal. For. Rec. 6 (1928) 46, 112, t. 19 & 20.—*? C. pauciflora* Bth. in Hook. Lond. J. Bot. 2 (1843) 218.—*C. forsteniana* Bl. Mus. Bot. 1 (1849) 143.—*C. boviniana* Tul. Ann. Sc. Nat. IV, 6 (1856) 112.—*C. lucida* Miq. Sum. (1861) 325, *incl. var. latifolia & subspathulata.* —*Rhizophora candel* (*non* L.) Blanco, Fl. Filip. (1837) 396, ed. 2 (1845) 277, ed. 3, 2 (1878) 150, t. 415.—*C. timoriensis* Domin, Bibl. Bot. 89 (1928) 444; Gardner, En. Pl. Austr. Occ. (1931) 86.—*C. somalensis* Chiovenda, Fl. Somala 2 (1932) 205, f. 125–126.—**Fig. 24a–e, 25.**

Shrub or tree up to 15(–25) m by 20 cm, often degenerating into a bushy shrub under unfavourable conditions. Stem base often with small stilt-roots. Bark light grey, fairly smooth with fine lenticular fissures. *Leaves* obovate to obovate-oblong, rarely elliptic-oblong, 5–$11^1/_2$ by 2–$7^1/_2$ cm, obtuse or sometimes slightly emarginate, base cuneate, margins often wavy; petioles $1^1/_2$–$3^1/_2$ cm. Stipules $1^1/_4$–$2^1/_2$ cm long. *Inflorescences* often on the terminal nodes of the new shoot, usually resinous, (2–)4–10-flowered. *Calyx lobes* erect in flower, widely patent, reflexed in fruit, ovate, acuminate, 4–5 mm long; tube *c.* 2 mm high. *Petals* oblong, white, turning brown, coherent at the base with uncinate hairs, limb *c.* $3^1/_2$ mm long, with 3 clavate, apical appendages *c.* $^1/_2$ mm long. *Stamens* 3–5 mm, alternately longer and shorter, anthers slightly ovoid, sagittate, much shorter than the filaments. Superior part of the *ovary* $1^1/_2$ mm high, style 2 mm, entire. *Fruit* ovoid, $1^1/_2$–$2^1/_2$ cm long, calyx lobes soon reflexed; *hypocotyl* club-shaped, sharply angular, 15–25(–35) cm long. Seeds 1(–2).

Distr. Eastern Africa, Madagascar, Seychelles, Ceylon, India, Burma (Andamans), Siam (Koh-chang, Koh-kong, Koh-chick), Indo-China (Cambodia, Cochinchina), Formosa, throughout *Malaysia* to Micronesia (Carolines: Palau, Yap), Australia (Northern Territory: Darwin, South Bay, Melville Bay; Queensland: Stradbroke Isl.), and Melanesia (? New Ireland, Solomons, and New Caledonia).

Ecol. On well drained soils, within the reach of occasional tides in the inner mangrove. Fishermen exploit it so much in Malaya that well grown trees are rare, according to Burkill. On the whole it is much more common than *C. decandra.* It is very interesting that one can break a seedling into halves and regeneration of a new plant occurs from either half, according to Cubitt.

It sometimes occurs as undergrowth in *Rhizophora* or *Bruguiera* mangrove forest, but in other places occurs in thin-stemmed, very dense, gregarious monospecific stands on well-drained soils, *cf.* Heyne, p. 1167.

In Siam recorded with aerial roots from the branches and according to Becking also in Indonesia sometimes with aerial roots.

Uses. In Malaya the bent branches are often used as knees for boats and the trunks for house-building. Watson regards it as the most durable of all the mangroves. It also makes an excellent fire-wood. In Indonesia it is used for pit-props (coal mines of P. Laut) and various other purposes. The heart-wood is yellow to orange without any sharp distinction against the sap-wood.

The Malays use the bark for tanning fishing lines, nets, and sails. It is used as dye in the batik industry for colouring red, or black in combination with indigo, as is done in Pattani and Kelantan, for cotton and matting, *cf.* Burkill, p. 517.

The tannin is not suitable for medicinal use, though occasionally used; a fragment of the bark or the old calyx is placed in the betel-quid as an astringent.

Vern. *Tĕngar*, *tĕngah*, *tangar*, M, *tingi*(*h*), J; Philippines; *tañgál*, Tag. & various lang., *ligasĕn*, *tagasa*, *tañgál-laláki*, *tanghál*, *tigasan*, Tag., *magtoñgod*, *tuñgod*, *tuñgóg*, P. Bis., *pakat*, Tagb., *roñgon*, *ruñgon*, Sbl., *tañgág*, *toñgóg*, S. L. Bis., *toñgong*, Sub., *tonggi*, Kuy, *tuñgúd*, Sulu; *palun*, *parun*, Ambon (Alf.), *bido-bido*, Galela.

Notes. Perrottet's original description is very poor and applies to both species of *Ceriops* and I have not seen a type specimen. Merrill (1923) said that *C. tagal* is abundant in Zamboanga Prov. (Mindanao), the type locality of Perrottet where *C. decandra* seems to be absent. The febrifugal medicinal use of *C. tagal*, stressed by Perrottet, is another argument to accept Perrottet's name as such use is not made of the bark of *C. decandra.*

Ceriops pauciflora Bth. has tentatively been reduced to *C. tagal*, with which it agrees in all characters save the 2-flowered cymes and slightly larger flowers (calyx *c.* 6 mm). It is only known from the type locality: New Ireland, Barclay (K).

Ceriops somalensis Chiov. was said to differ from *C. tagal* in having short filaments and triangular-tipped petals. Obviously these observations are deficient and made on too young material. The fragments of Senni 134 received through the courtesy of the Firenze Herbarium have very long filaments below the young fruit. I suppose the petals have been drawn upside down and the absence of the 3 apical appendages is due to inaccurate observation; I had no buds available.

Kanehira (En. Micr. 1935, 377) recorded this species under the wrong name *C. roxburghiana* from Micronesia; his description and figure in his Fl. Micr. (1933) 255, 447, fig. 119 leave no doubt about the identity.

I have observed one fruit with 2 hypocotyls. Occasionally there are only 2 appendages to a petal (*cf.* Koord. Atlas 1, 1913, t. 107, fig. E).

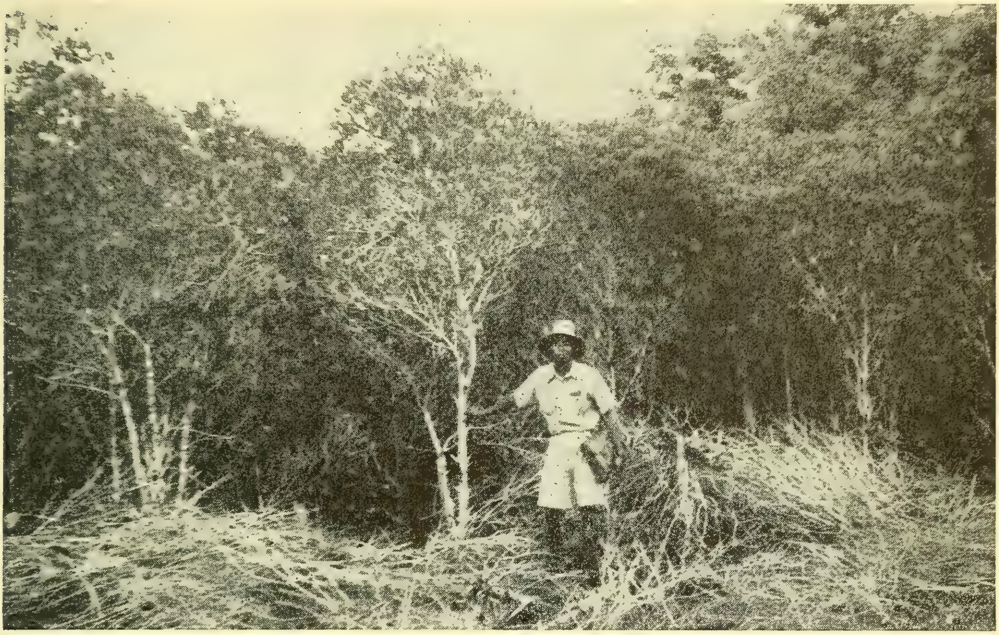


Fig. 25. Pure stand of *Ceriops tagal* covering several hundreds of ha in S. Banjuwangi, Pampang Bay (SE. Java), sharply demarcated against the interior mixed non-mangrove forest. Stand very dense, without undergrowth, cut in front, Sept. 1950 (Soetadi).

2. Ceriops decandra (Griff.) Ding Hou, *nov. comb.*—*Bruguiera decandra* Griff. Trans. Med. Phys. Soc. Calc. 8 (1836) 10; Ann. Sc. Nat. Bot. II, 10 (1838) 124.—*C. roxburghiana* Arn. Ann. Mag. Nat. Hist. 1 (1838) 364; Wight, Ill. Ind. Bot. 1 (1840) 209; Walp. Rep. Bot. Syst. 2 (1843) 70; Miq. Fl. Ind. Bat. 1, 1 (1855) 591; Kurz, For. Fl. Burma 1 (1877) 448; Henslow in Hook. *f.* Fl. Br. Ind. 2 (1878) 436; Vidal, Rev. Pl. Vasc. Filip. (1886) 126; Trim. Fl. Ceyl. 2 (1894) 153; Schimp. Bot. Mitt. Trop. 3 (1891) 94; K. & V. Bijdr. 4 (1896) 287; King, J. As. Soc. Beng. 66, ii (1897) 317; Schimp. in E. & P. Pfl. Fam. 3, 7 (1898) 52; Back. Schoolfl. (1911) 483; Koord. Exk. Fl. Java 2 (1912) 668; Atlas 1 (1913) t. 106; Merr. Philip. J. Sc. 1 (1906) Suppl. 102; Guill. Fl. Gén. I.–C. 2 (1920) 726, f. 75, 9–12; Merr. En. Born. (1921) 420; En. Philip. 3 (1923) 144; Brown, Min. Prod. Philip. For. 1 (1920) 62, t. 25 & 26; Craib, Fl. Siam. En. 1 (1931) 593; Burk. Dict. 1 (1935) 515; Hochreutiner, Candollea 6 (1936) 486; Holthuis & Lam, Blumea 5 (1942) 217; Back. Bekn. Fl. Jav. (em. ed.) 4b (1944) fam. 102, p. 4; Wyatt-Smith, Mal. For. 16 (1953) 222; Browne, For. Trees Sar. & Brun. (1955) 303.—*C. zippeliana* Bl. Mus. Bot. 1 (1849) 143.—*Rhizophora glomerulata* Zipp. *ex* Bl. *l.c.*, *pro syn.*—*Rhizophora decandra* Roxb. [Hort. Beng. (1814) 36, *nomen*] *ex* Griff. Notul. 4 (1854) 663; *cf.* also W. & A. Prod. (1834) 311; drawing in Kew Libr. Roxb. coll. 1140, *cf.* Sealy, Kew Bull. 1956, p. 376 (1957).—**Fig. 24f–h.**

Small tree up to 15 m tall, 15–20 cm diam. *Leaves* obovate or obovate- to elliptic-oblong, $4^{1}/_{2}$–10 by $2^{1}/_{2}$–6 cm, apex obtuse, rounded or ± emarginate, base cuneate; petiole 1–$2^{1}/_{2}$ cm. Stipules $1^{1}/_{2}$–$2^{1}/_{2}$ cm. *Inflorescences* usually in the axils of several nodes at the upper part of a branch, 3–5-flowered, head-like condensed. *Calyx lobes* erect both in flower and in fruit, ovate, acute, 3–4 mm, tube *c.* 2 mm high. *Petals* white, turning brownish, with broad base, folded longitudinally, hardly or not cohering, *c.* $2^{1}/_{2}$ mm long, fringe-like divided at the apex. *Stamens* 1 mm long, ± equal, anthers ovoid, seemingly much longer than the filaments as the erect anthers are dorsifixed. *Fruit* ovoid-conical, *c.* 1–$1^{3}/_{4}$ cm long, calyx lobes obliquely erect or ascending; cotyledons red, finally protruding from the fruit for *c.* 2–4 mm; *hypocotyl* club-shaped, sharply angular and sulcate, 9–15 cm.

Distr. India, Burma, Siam, Indo-China (Cochinchina), and *Malaysia:* Malay Peninsula (E. coast), Banka, Java, Borneo, Philippines, Celebes, Moluccas (Ceram), and New Guinea, not yet found in Sumatra and the Lesser Sunda Islands.

Ecol. Edges of mangrove swamps, but relatively rare, and much less common than *C. tagal.*

Uses. For fire-wood.

Vern. *Tĕngal*, *tĕngar*, M, *tingi*, *J*, *bakau lali*, Sarawak, *landing-landing*, Sarawak (Lawas); Philippines: *tañgál*, Tag., Bik., *matañgál*, *tagasa*, Tag., *bulabadiang*, *tuñgúg*, P. Bis., *tuñgúng*, C. Bis., *palun*, *parun*, Ambon, *bido-bido*, Halmaheira.

Note. According to WYATT-SMITH *l.c.* the fruits of the *Ceriops* species can be distinguished in the field by the following characters: *C. tagal*: hypocotyl hardly ridged and warty over its whole length; calyx smooth; lobes reflexed in fruit. *C. decandra:* hypocotyl distinctly ridged, only warty at the apex; calyx distinctly warty; calyx lobes erect in fruit.

4. KANDELIA

W. & A. Prod. (1834) 310.—**Fig. 26.**

Small tree. *Leaves* decussate, entire. Stipules linear. *Inflorescences* peduncled solitary, cymose, 4–9-flowered. *Calyx* deeply 5(–6)-lobed. *Petals* 5(–6), bilobed, with a long seta in the sinus, each lobe multifid. *Stamens* ∾, free, unequal in length,

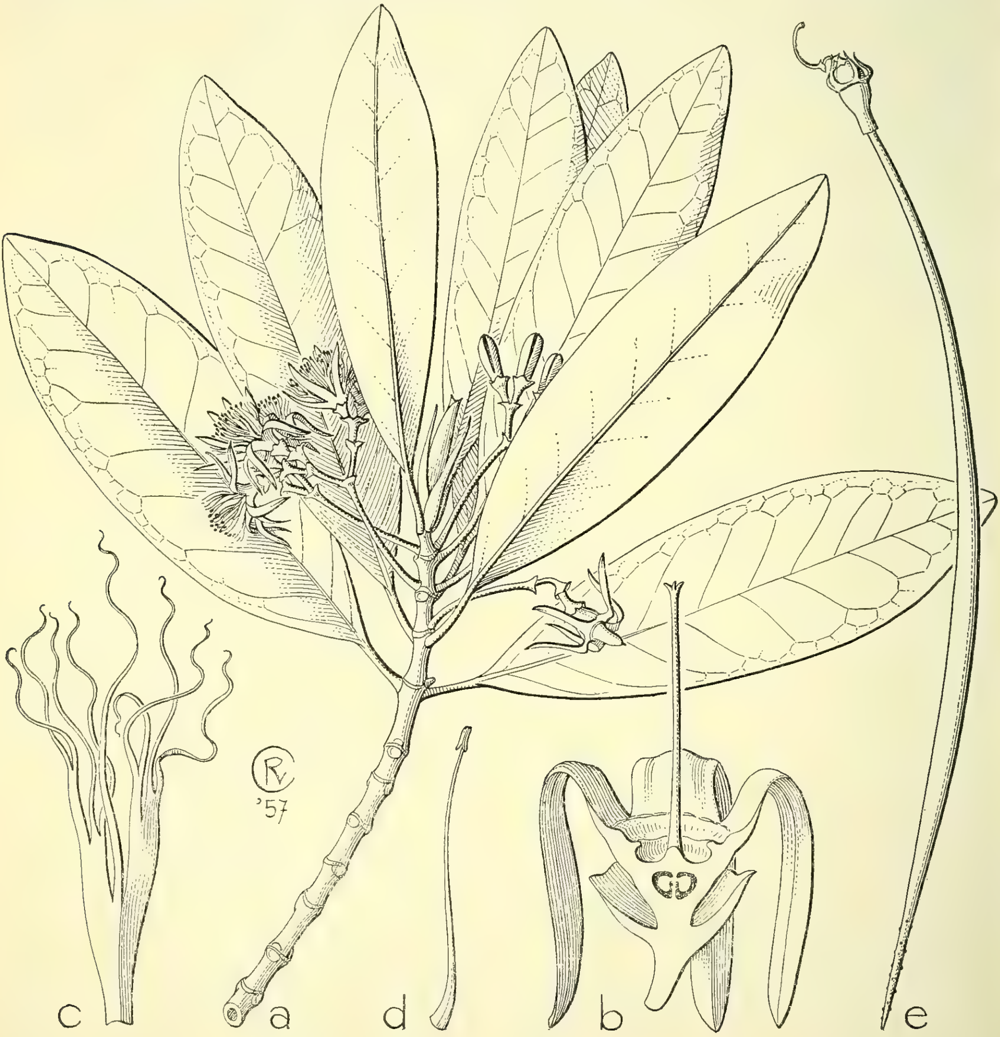


Fig. 26. *Kandelia candel* (L.) DRUCE. *a.* Habit, × ²/₃, *b.* longitudinal section of a flower (petals and stamens removed), × 3, *c.* petal, × 5, *d.* stamen, × 3, *e.* hypocotyl, × ¹/₃ (*a*, *b*, *d* SALIM A 1727, *c* CUADRA A 1415, *e* BROOKE 8826).

exserted. *Ovary* inferior, 1-celled, with 6 apical ovules. Style simple. *Fruit* ovoid, 1-seeded. *Hypocotyl* cylindric to spindle-shaped or clavate, pointed.

Distr. Monotypic, locally distributed in SE. to E. Asia (Kwantung, Hainan, Formosa, Riukiu, Kyushu) and *W. Malaysia* (Sumatra, Malay Peninsula, and Borneo). Fig. 27.

Ecol. On banks of tidal rivers in the mangrove forest.

1. Kandelia candel (L.) DRUCE, Rep. Bot. Exch. Club Br. Isl. 1913, 3 (1914) 420; MERR. En. Born. (1921) 421; KANEHIRA, Form. Trees rev. ed. (1936) 493, t. 45 (upper one), f. 455; SLOOT. Blumea Suppl. 1 (1937) 169–170, map 3; WALKER, Import. Trees Ryukyu (1952) 233, f. 145.—*Tsjeru-Candel* RHEEDE, Hort. Malab. 6 (1686) 63, t. 35.—*Rhizophora candel* LINNÉ, Sp. Pl. (1753) 443; DC. Prod. 3 (1828) 32.—*K. rheedei* W. & A. Prod. (1834) 311, *nom. illeg.*; ARN. Ann. Mag. Nat. Hist. 1 (1838) 365; WIGHT, Ill. 1 (1840) 209, t. 89; HOOK. Icon. Pl. (1841) t. 362; BL. Mus. Bot. 1 (1849) 135; MIQ. Fl. Ind. Bat. 1, 1 (1855) 585; BENTH. Fl. Hongk. (1861) 110; KURZ, For. Fl. Burma 1 (1877) 449; HENSLOW in Hook. *f.* Fl. Br. Ind. 2 (1878) 437; FORBES & HEMSL. J. Linn. Soc. Bot. 23 (1887) 293; K. & V. Bijdr. 4 (1896) 290; BACK. Schoolfl. (1911) 483; GUILL. Fl. Gén. I.-C. 2 (1920) 727, f. 75, 13 & 14; RIDL. Fl. Mal. Pen. 1 (1922) 694; WATSON, Mal. For. Rec. (1928) 49, 113, t. 21; CRAIB, Fl. Siam. En. 1 (1931) 594.—**Fig. 26.**

Shrub or small tree up to *c.* 7 m tall. Stem base thickened, generally without proper buttresses. No pneumatophores. Bark smooth, lenticellate, greyish to reddish brown, inner bark thin, pink. *Leaves* elliptic-oblong to narrowly so, or obovate-oblong, 6–13 by $2^1/_2$–6 cm, obtuse, base cuneate, margin usually reflexed; nerves 6–7 pairs, obscure beneath, distinct or slightly elevated above; petiole 1–$1^1/_2$ cm. Stipules 2 cm long. *Inflorescences* dichotomously branched, 4(–6–9)-flowered, peduncle $1^1/_2$–5 cm; pedicels 2–3 mm. *Flowers* white, at anthesis $1^1/_2$–2 cm long. Bracteoles 2–4, connate, cup-shaped and adnate to the base of the calyx. *Calyx tube* exceeding the ovary, lobes linear, acute, reflexed after anthesis. *Petals c.* 14 mm long. *Stamens* 8–13 mm, filiform. Disk cup-shaped. *Ovary* 1-celled, with 6 ovules; ovules attached mostly at the apical part of the central axis, pendulous; style filiform, with 3 stigmas. *Fruit* green, ovoid, $1^1/_2$–$2^1/_2$ cm long. *Hypocotyl* clavate, 15–40 cm long, terete, clavate.

Distr. India, Burma, Siam, Indo-China (Tonkin, Annam, and Cochinchina), China (Kwantung, Hongkong, and Formosa), Riukius, S. Japan (Kyushu: Saksuma), and *Malaysia:* NE. Sumatra, Malay Peninsula, and West N. Borneo, very local and rare. Fig. 27.

MIQUEL recorded *Kandelia* from New Guinea, but this specimen has appeared to be *Ceriops decandra.* KURZ recorded it from Banka (Nat. Tijd. Ned. Ind. 27, 1864, 150, 165) but though it might occur there I have seen no specimen and KURZ's identification may have been an error.

It has also been recorded from the Philippines, by F.-VILLAR, Nov. App. (1880) 79 and VIDAL, Sinopsis Atlas (1883) 25, t. 47, f. D, and VIDAL's material was, according to him, based on material from Bulacan Prov., Luzon, but neither MERRILL nor I have seen any material collected in the Philippine Islands. As it is known from N. Borneo and Formosa it is likely to occur there.

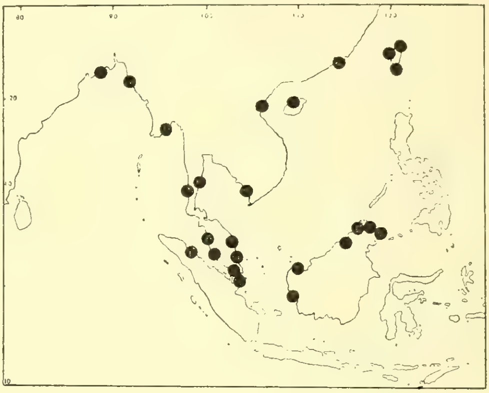


Fig. 27. Localities of *Kandelia candel* (L.) DRUCE; the localities in the Riukiu Islands and Kyushu (S. Japan) have not been drawn in this map.

Ecol. A small tree with conically thickened stem base but without buttresses or pneumatophores, sporadic on banks of tidal rivers among other mangroves but almost everywhere scarce and obviously occupying a narrow niche in the mangrove forest, rarely common in association with *Sonneratia alba* (Batu Lima R., Brunei). In 1939 STEUP found *Kandelia* as pioneer on mud-shoals in the mouth of Indragiri R. (Amphitrite Bay, Mandah courses) fronting *Rhizophora.*

Uses. Timber too small and tree too scarce to have real value, only occasionally used according to BURKILL.

Vern. *Bĕrus-bĕrus* (false *Bruguiera*), *bĕras-bĕras, pulut-pulut, mĕmpulut, pisang-pisang laut* (bastard sea banana), *mĕm-pisang*, Mal. Pen., *bĕus*, Bajau (Borneo), *lingajong, l. laut, pulut-pulut*, Brunei.

Note. This plant is easily distinguished by the indefinite number of stamens, multifid petals, and long, narrow calyx lobes which are completely reflexed in fruit. Two or more radicles (5 have been recorded) are not infrequently formed on one fruit (WATSON).

5. ANISOPHYLLEA

R.Br. *ex* Sabine, Trans. Hort. Soc. 5 (1824) 446; King, J. As. Soc. Beng. 66, ii (1897) 322.—*Anisophyllum* G. Don *ex* Hook. Niger Fl. (1849) 342, 575, *non* Haw. 1812; Baill. Adansonia 3 (1862) 22.—*Tetracrypta* Gardn. & Champ. in Hook. J. Bot. Kew Misc. 1 (1849) 314; Bth. J. Proc. Linn. Soc. 3 (1859) 72, as *Tetracarpaea, sphalm.*—**Fig. 28.**

Trees and shrubs. Leaf-axils with 4–6 superposed serial buds. *Leaves* alternate (distichous), often inequilateral, entire, isomorphous, or dimorphous (in *A. disticha* and some specimens of *A. scortechinii*), generally *curvinerved* with 3–5 longitudinal nerves (including the midrib) running from base to apex, more rarely pinnate-nerved but in that case always provided with an intramarginal vein. Stipules 0. *Inflorescences* axillary or supra-axillary, solitary or serial (supernumerary), simple or branched, spike-like, racemose, or paniculate, ebracteate or with minute bracts, brownish pubescent. Monoecious, *flowers* unisexual, polygamous or bisexual, in *A. disticha* the inflorescences either ♀ or ♂; male flowers more or less globose, female flowers cylindric and more or less quadrangular. *Calyx* lobes (3–)4(–5), lobes deltoid, acute, tube adnate to the ovary. *Petals* entire, lobed, or lacerate. *Stamens* twice as many as petals, usually unequal in length, episepalous ones longest; filaments short, subulate, in some *spp.* the epipetalous filaments adnate to the basal part of the petal; anthers small, ovoid; abortive in the females. Disk obscure, crenulate or lobed. *Ovary* inferior, 3–5-celled, each cell with 1 ovule, abortive in the ♂ flowers and consisting of 3–4 small conical or subulate appendages homologous with the styles with the ovary suppressed. Styles (3–)4, free, subulate. Ovules pendulous. *Fruits* ellipsoid to pyriform, smooth or ridged, usually 1-seeded, floral parts persistent; pericarp generally consisting of 3 layers, rather hard and fibrous, in *A. disticha* exocarp fleshy, mesocarp and endocarp bony and ridged. *Seeds* with a coriaceous testa, consisting of a solid body of which the main part is formed by a thick, hard albumen; embryo linear or slightly spindle-shaped, longitudinally embedded in the seed, possibly for the greater part consisting of a hypocotyl.

Distr. About 25 *spp.* distributed in tropical Africa, Ceylon, India, SE. Asia, *Malaysia* (Sumatra, Malay Peninsula, and Borneo), with one species in tropical South America (British Guiana, *viz. A. guyanensis* Sandwith).

It is remarkable that the Malaysian species have such clear cut areas, *A. disticha* occurring throughout the Sunda shelf area (Java excepted), the others being confined to one subarea, *viz* Malaya: *apetala, corneri, curtisii, grandis, griffithii,* and *scortechinii*, Borneo: *beccariana, ferruginea*, Sumatra: *Anisophyllea sp.*

Ecol. Primary rain-forests below 1000 m, one record of 1250 and one of 1870 m.

Uses. The wood is hard and durable. The timber of some species is used for house-beams, *cf.* Burk. Dict. 1 (1935) 161.

The fruit of the W. African species *A. laurina* is edible and is called monkey apple, *cf.* Sabine, *l.c.* In our area only *A. disticha* has a fleshy drupe but is not known to have been eaten by men.

Note. There is some doubt about the exact structure of the seed as far as could be ascertained from the Malaysian herbarium material. The pericarp consists always of three layers, the inner one being the thinnest and of hard, bony texture, the meso- and exocarp being both hard, but more fibrous, the exocarp being in some species fleshy.

The seed coat is coriaceous and envelops a solid body of endosperm and embryo, differentiated by a very thin brown layer. In cross-section both 'endosperm' and 'embryo' appear to consist of rather amorphous parenchymatic tissue. I have concluded that the outer thick layer represents the endosperm which then tightly envelops the embryo. It appeared impossible to separate embryo from endosperm and though the impression is that it almost wholly consists of the hypocotyl, this point should be left to further examination with abundant fresh material. This evaluation is contrary to Baillon's who stated (Hist. Pl. 3, 304): '*embryonis exalbuminosi carnosi radicula macropoda clavata*'. According to this interpretation the thick outer seed tissue can only represent the united cotyledons (as occur in *Rhizophora*!) tightly enveloping the thick longitudinal radicle. I believe, however, that this interpretation is wrong.

KEY TO THE SPECIES

1. Leaves of one kind.
  2. Nerves thin, pinnate, an intramarginal vein running less than 1 mm from the leaf-edge. Leaves 5–9 cm long. Fruit large. Flowers solitary, sessile. . . . . **1. A. griffithii**
  2. Besides the intramarginal vein at least 2 large nerves curved and running from the leaf-base to the apex (3–5-plinerved nervation).
    3. *All* leaves ± rhombic, distinctly unequal-sided, the apical half much broader than the basal one. Cross-veins between the curved nerves *distinctly* prominent-scalariform beneath, faintly sunken in on the upper surface. Twig-ends brownish pubescent-tomentose. (Fruit small, thin-shelled, globular to broad-elliptic, *c.* 1½–2 cm long) . . . . **9. A. scortechinii**
    3. Leaves not rhombic and not *all* distinctly unequal-sided. Cross-veins *not distinctly* prominent-scalariform beneath. Twig-ends glabrous or with a very thin, smooth, strictly appressed rusty tomentum.
      4. Twigs and undersurface of the leaves initially covered by a thin, smooth indument of strictly appressed, rusty tomentum, *glabrescent* but vestiges almost always found along the nerves or in the nerve-axils at the base. (Venation tessellate; fruits large with a thick pericarp; endocarp woody). . . . . **4. A. ferruginea**
      4. Twigs and leaves without such indument. (Leaves tessellate or not; fruits large or average; endocarp woody or not).
        5. Flowers in contracted simple or compound panicles, the flowers on very short thickish side-branches of both the main rachis and its main branches. Fruits very large, with a dense thin rusty tomentum consisting of very short hairs and scales. Main nerves 5(–3), the inner ones separating from the midrib at *c.* 1 cm above the insertion of the lower ones. Dried leaves generally discoloured, the upper surface pale yellowish-greenish, the under surface cinnamon to pale brown. (Petals entire, long-hairy all over) . . . . **5. A. grandis**
        5. Flowers in racemes, spikes or open panicles, in the latter case the few branches elongated and resembling the main axis.
          6. Leaves nigrescent, small, 5–8 by 1½–2½ cm. Petals split into filiform segments nearly to the base . . . . **3. A. curtisii**
          6. Leaves not nigrescent, larger, at least 3 cm wide. Petals entire, glabrous or sparingly ciliate along the margin.
            7. Curved main nerves about as prominent as the venation, much less prominent than the midrib. (Leaves *c.* 2 times as long as broad, under 10 cm long). . . . . . . **2. A. beccariana**
            7. Curved main nerves about as prominent as the midrib. (Leaves *c.* 2–3 times as long as broad, mostly larger).
              8. Venation prominent on both sides, but the meshes (areolae) rather irregular and not tessellate. Leaves *c.* 12–20 by 4–9½ cm, in the herbarium usually yellowish or pale brown, mostly long-caudate-acuminate. Flowers dark red or purple. Mature fruits spindle-shaped, acuminate at both ends, 5–6 by *2–2½* cm, the pericarp *c. 2* mm thick; endocarp merely a lining, woody mesocarp and exocarp both 1 mm diam. . . . . **6. A. apetala**
              8. Venation prominent and tessellate on both surfaces. Leaves 7½–13 by 2½–5½ cm, in the herbarium the upper surface rather dark brown, shorter and less abruptly acuminate on the whole. Flowers (? always) white with 2 yellow lines. Mature fruits (5–5½–)7–9 by *4–5* cm, broad-ellipsoid, slightly acuminately narrowed at both ends, pear-shaped or broad-ellipsoid, the pericarp *c. 5–9* mm diam.; endocarp 1 mm, mesocarp woody 4–6 mm, exocarp corky 1½–3 mm . . . . **7. A. corneri**
              8. Venation prominent and tessellate on both surfaces. Leaves 8–17 by 4–7 cm, in the herbarium yellowish or pale green, acute to shortly acuminate. Flowers (inadequately known) yellow. Immature fruits ellipsoid, 5½ by 2½ cm, acuminate at both ends, pericarp *c.* 4 mm diam.. . . . . **8. Anisophyllea sp.**

1. Leaves distinctly of 2 kinds, 2 rows of spreading leaves and 2 rows of small to minute, stipule-like, mostly falcate ones, generally appressed to the twig, and more or less alternating with the large leaves. (Leaves distinctly rhombic and *all* unequal-sided; twigs brownish pubescent-tomentose).
  9. Curved nerves 2–4, all rising from the leaf-base. Scalariform cross-veins distinctly prominent on the under surface. Fruits globular to broadly ellipsoid (*c.* 15–20 by 12–17 mm), pericarp smooth outside, exocarp obviously not becoming fleshy . . . . **9. A. scortechinii**
  9. Curved nerves 3, 2 outer ones rising from the leaf-base, 1 inner one emerging on the apical half of the blade from the midrib above and separate from the 2 outer ones. Scalariform cross-veins faintly prominent on the under surface. Fruits narrow-oblong, the hard mesocarp *c.* 15–18 by 5–8 mm, with (6–)8 prominent lengthwise ridges (section!), exocarp obviously fleshy, red when ripe **10. A. disticha**

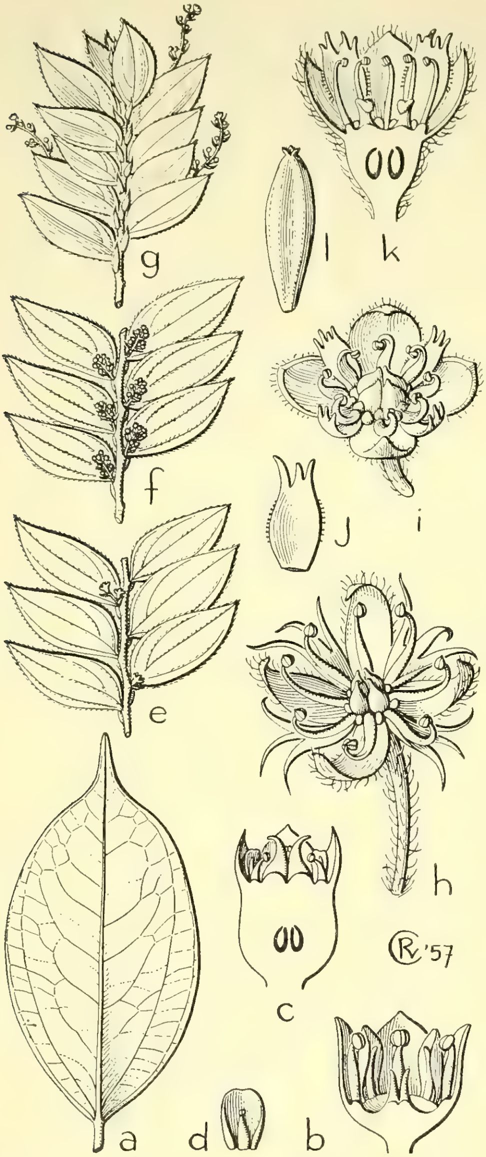


Fig. 28. *Anisophyllea beccariana* BAILL. *a.* Leaf, lower surface, × $^2/_3$, *b.* longitudinal section of ♂ flower, × 9, *c.* longitudinal section of ♀ flower, × 9, *d.* petal of ♀ flower with staminode, × 13. —*A. disticha* (JACK) BAILL. *e–f.* Flowering branches, lower surface, × $^2/_3$, *g.* flowering branch, upper surface, × $^2/_3$, *h–i.* ♂ flowers, × 9, *j.* petal, × 13, *k.* longitudinal section of ♀ flower, × 9, *l.* dried fruit, nat. size (*a, c, d* BECCARI P.B. 1001 (type), *b* DICKSON 5, *e, k* GRASHOFF 1144, *f, i, j* DUMAS 1574, *g* BÜNNEMEIJER 7336, *l* S.F. 306).

1. Anisophyllea griffithii OLIVER, Trans. **Linn.** Soc. 23 (1862) 460, t. 48; HENSLOW in Hook *f.* Fl. Br. Ind. 2 (1878) 442; KING, J. As. Soc. Beng. 66, ii (1879) 325; RIDL. Fl. Mal. Pen. 1 (1922) 702; BURK. Dict. 1 (1935) 162; CORNER, Ways. Trees (1940) 124, f. 30.

Tree up to 25 m by 60 cm. Bark light brown, smooth, becoming shallowly ridged, cracked and rugged. Young *leaves* bronze and drooping (*sec.* CORNER); mature leaves elliptic to ovate-lanceolate, rarely lanceolate, slightly asymmetric at the base, thinly coriaceous, glabrous, shining above, rather dull below; $5^1/_2$–$10^1/_2$ by 2–5 cm, shortly, bluntly acuminate, base cuneate, margin revolute when dry; midrib much stronger than the 6–8 pairs of pinnate nerves; leaf edge with a distinct intramarginal vein; veinlets slightly elevated beneath, visible but sometimes obscure above; petiole *c.* 3 mm. *Inflorescences* solitary or serial, sometimes 2–3-branched at the very base, spike-like, ± zigzag, up to 7 cm long. *Flowers* bisexual, sessile, green, slightly obovoid, *c.* 4 mm long. *Calyx* lobes 4, deltoid, *c.* 1 mm long, acute. *Petals* oblong, fleshy. *Stamens c.* 1 mm long, filaments fleshy, subulate-oblong, in the epipetalous stamens for *c.* $^1/_3$ adnate to the petals. Styles 4, subulate, *c.* 1 mm. *Fruits* broadly ellipsoid or subglobose, obtuse at each end, glabrous, smooth, $4^1/_2$–5 by $3^1/_2$–4 cm, with a woody pericarp up to $1^1/_2$ cm diam. *Seeds* globose, $1^1/_4$–$1^1/_2$ cm diam.

Distr. *Malaysia:* Malay Peninsula (Johore, Kedah, Malacca, Penang, Selangor, and Singapore).

Ecol. In lowland forests up to 230 m.

Uses. The heavy durable timber is suitable for house-beams.

Vern. *Delek tĕmbaga, kĕmpas dadeh, pĕlĕpap, poko kumpao dadĕh, sĕluang bĕrlĕring,* M.

Note. In the available specimens I found only bisexual flowers.

2. Anisophyllea beccariana BAILLON, Adansonia 11 (1875) 311; MERR. En. Born. (1921) 422.—**Fig. 28a–d.**

Medium-sized tree up to 25 m, with a narrow outline; bark rough. *Leaves* elliptic or ovate, chartaceous to thinly coriaceous, glabrous on both surfaces, $7^1/_2$–$10^1/_2$ by 3–5 cm, bluntly acuminate, base acute rarely obtuse; longitudinal nerves 5, subequal at the base, elevated beneath, depressed or distinct above; veinlets reticulate, slightly elevated beneath, plane above; petiole 4–8 mm. *Inflorescences* in groups, branched near the base, racemose, up to 10 cm long. *Flowers* unisexual, bright yellow, slightly pubescent outside. *Male flowers* $1^1/_2$ mm long, shortly pedicelled. Calyx lobes 4, deltoid, 1 mm long. Petals oblong, $^2/_3$ mm long, slightly emarginate, margins incurved. Stamens 8, 4 epipetalous, sterile, $^1/_2$ mm long, antherless or glandular at the tip; 4 episepalous, fertile, $^2/_3$ mm long; filaments thick, flat, subulate. Disk obscure. Pistil rudiments 4, subulate, $^1/_3$ mm. *Female flowers* cylindric, *c.* $2^1/_2$ mm long, slightly pubescent outside, sessile or subsessile. Calyx lobes and petals similar as in the males. Disk none. Staminodes 8. Styles 4, free, subulate, $^2/_3$ mm, thick, recurved. *Fruit* unknown.

Distr. *Malaysia:* Borneo (Sarawak).

Ecol. In forests from the lowland up to 650 m.

Vern. *Kĕrdam*, Paloh, *pei*, Kayan.

Note. The fruit-like bodies on Sar S 0250 are insect galls of the ovary which are subglobose or ellipsoid, 1½ by 1⅓ cm, with scattered lenticels.

3. Anisophyllea curtisii King, J. As. Soc. Beng. 66, ii (1897) 326; Ridl. Fl. Mal. Pen. 1 (1922) 702.

Tree 10–13 m; young branches appressed rusty-pubescent. *Leaves* elliptic-oblong, rarely slightly unequal at the base, 6–8 by 2–2½ cm, thinly coriaceous, usually glabrous on both surfaces, sometimes sparsely hairy near the base underneath, shining on both surfaces, acuminate, base cuneate; longitudinal nerves 5, starting from the apex of the petiole (sometimes 1 starting a little higher), slightly elevated beneath, plane but visible above, the marginal ones visible beneath and faint above; petiole 2–5 mm. *Inflorescences* spike-like, simple, *c.* 1 cm long. *Flowers* unisexual, shortly pedicelled, with a minute bract at the base. *Male flowers c.* 3 mm long, brownish pubescent. Calyx 4-lobed, lobes deltoid, acute, 1½ mm long. Petals *c.* 3 mm long, divided almost to the base, 5–7-fid, filiform, twisted. Stamens 1½–2½ mm. Sterile pistil *c.* ½ mm. *Female flowers* (*fide* King) 6 mm long. Calyx lobes reflexed, tube ribbed. Petals as in the males but larger and with more lobes. Styles as long as the petals. *Fruits* unknown.

Distr. *Malaysia:* Malay Peninsula (Penang: Curtis 746).

Note. Known only from the type collection. Haniff & Nur 2378 has been referred to this species by Burkill & Henderson (in Gard. Bull. S.S. 3, 1925, 370) and Ridley *l.c.* However, that specimen clearly belongs to *Lindera* (*Laurac.*).

4. Anisophyllea ferruginea Ding Hou, *nov. sp.*

Arbor, ramulis ferrugineo-tomentosis, gemmis 5 vel 6, in seriem verticalem dispositis. Folia oblongo-elliptica, vel oblongo-ovata, (7½–) 9–18½(–24) ×3½–11 cm, integra, apice breviter acuminata, basi attenuata, cuneata vel rotundata, coriacea, supra glabriuscula, subtus ferrugineo-tomentosa, demum ± glabrescentes, nervis 3–5 prominulis, venulis tessellatis. Flores parvi, unisexuales, sessiles. Fructus immaturus visus, ellipsoideus. Typus Neth. Ind. For. Serv. bb 25118, Bo.

Tree up to 31 m by 40 cm. Young branches always rusty, pubescent-tomentose. *Leaves* oblong-elliptic to oblong-ovate, coriaceous, rusty tomentose beneath rarely above, glabrescent but vestiges of indument always found on the veins or in axils of the veins at the base, (7½–)9–18½(–24) by 3½–11 cm, shortly acuminate, base attenuate to rounded, margin rarely recurved; longitudinal nerves 3–5, prominent and elevated beneath, depressed above, sometimes a faint intramarginal vein along the margin; cross-veinlets slightly elevated, venation distinctly tessellate on both surfaces; petiole 1–1½ cm, furrowed above. *Inflorescences* (inadequately known) short, branched, paniculiform, densely rusty pubescent. *Flowers* unisexual, sessile. *Male flowers c.* 1 mm long. Calyx lobes (3–)4(–5), deltoid, acute, *c.* ⅔ mm long. Petals minute, deltoid, *c.* ⅙ mm long, brownish hairy all over. Disk obscurely crenulate. Stamens *c.* ⅓ mm long, filament as long as the anther. Pistil rudiments *c.* ⅓ mm long, brownish hairy at the base. *Female flowers* slightly cylindric, quadrangular, 1½ mm long, densely brownish hairy outside. Calyx lobes and petals similar as in the males. Staminodes almost sessile, *c.* ⅙ mm long. Apex of the styles slightly curved. *Fruits* (immature) ellipsoid, obtuse at both ends.

Distr. *Malaysia:* W. & SE. Borneo (Boentok, Lower Dajak, Ketapang, Landak, Melawie, Sanggau, Tajau: Neth. Ind. For. Serv. bb 2057, 2365, 6406, 8304, 8169, 14192, 17143, 18005).

Ecol. Lowland forests up to 450 m.

Vern. *Kĕpajang*, *sangkuak*, *tĕngoda*, Dajak, *bĕlian landak*, *bulu*, *kĕpajang landak*, M.

5. Anisophyllea grandis (Benth.) Burkill, Gard. Bull. S.S. 4 (1927) 426; Dict. 1 (1935) 161; Corner, Ways. Trees (1940) 124, f. 29.—*Strychnos grandis* Wall. Cat. (1831) *no* 4454, *nomen.*—*Cocculus flavicans* Wall. Cat. (1831-32) *no* 4976, *nomen.* —*Anisophyllum grande* Benth. J. Proc. Linn. Soc. 1 (1856) 79.—*A. gaudichaudiana* Baill. Adansonia 11 (1875) 311; King, J. As. Soc. Beng. 66, ii (1897) 324; Oliv. in Hook. Ic. Pl. (1887) t. 1551; Ridl. Fl. Mal. Pen. 1 (1922) 702; Burk. & Henders. Gard. Bull. S.S. 3 (1925) 371.—*A. grandifolia* Henslow in Hook. *f.* Fl. Br. Ind. 2 (1878) 442.—*A. flavicans* Hook. *f.* & Thoms. *ex* Durand & Jacks. Ind. Kew. Suppl. 1 (1906) 468, *nomen.*

Tree up to 25 m, with rather narrow conical crown and drooping branches and leaves. *Leaves* large, broadly ovate-oblong, rarely narrowly oblong-elliptic, coriaceous, glabrous, usually yellowish green above when dry, (15–)24–30 by (4–)6–11 cm, acuminate, base abruptly acute or rounded; longitudinal nerves 5 (middle 3 stronger than the 2 outer ones), elevated beneath, plane or slightly depressed above, besides 2 intramarginal veins; transverse veinlets subparallel; petiole 6–12 mm. *Inflorescences* irregularly and unevenly branched, paniculate, up to 20 cm long, branches flattened when dry. *Flowers* unisexual, brownish pubescent outside, usually crowded on very short lateral branches. *Male flowers* shortly pedicelled. Calyx lobes 4, deltoid, acute. Petals deltoid, *c.* ¼ mm long, long brownish hairy all over. Stamens *c.* ½ mm long. Disk crenulate. Pistil rudiments subulate, sparsely brownish hairy in the lower part. *Female flowers* sessile, cylindric, more or less quadrangular, *c.* 2½ mm long. Calyx lobes and petals similar as in the males. Sterile stamens *c.* ½ mm; filaments sometimes twice as long as the anthers. Styles conical, ½ mm, recurved, densely brownish hairy in the lower part. *Fruits* pyriform, 8–12 by 5–7 cm, saccate at the base, minutely rusty-pubescent; pericarp 8–10 mm diam. *Seeds* very hard, solid and large.

Distr. *Malaysia:* Malay Peninsula (Penang, Perak).

Ecol. In forests from the lowland up to 1250 m.

Vern. *Penang peqr*, E, *dalek limau manis*.

6. Anisophyllea apetala Scort. *ex* King, J. As. Soc. Beng. 66, ii (1898) 323; Ridl. Fl. Mal. Pen. 1 (1922) 702, *p.p.*; Burk. & Henders. Gard. Bull. S.S. 3 (1925) 370; Burk. Dict. 1 (1935) 161.

Tree up to 14 m. *Leaves* broadly ovate-oblong to elliptic-oblong, 10–21 by 4–9 cm, glabrous, chartaceous to thin-coriaceous, shining above, rather dull beneath, caudate-acuminate or rarely acute, base rounded, rarely acute, margin entire; longitudinal nerves 5 (middle 3 conspicuous and elevated beneath, plane or depressed above, lateral 2 faint), besides the intramarginal veins; transverse veinlets reticulate, petiole 6 mm. *Inflorescences* spike-like, serial, usually branched at the base, up to 19 cm long. *Flowers* unisexual, usually in groups on very short lateral stalks, brownish pubescent outside. *Male flowers* $2^1/_2$ mm long, $1^1/_2$ mm pedicelled. Calyx lobes 4, deltoid, acute, 2 mm long. Petals deltoid, acute, *c.* $^1/_6$ mm long, entire, sometimes sparsely ciliate on the margins. Stamens $^1/_2$–1 mm. Pistil rudiments 4, subulate, $^1/_3$ mm long, sparsely hairy at the base. Disk 4-lobed, each lobe crenulate. *Female flowers* sessile. Calyx tube cylindric and more or less quadrangular, *c.* $1^1/_2$ mm long. Calyx lobes and petals similar as in the males. Staminodes $^1/_4$–$^1/_6$ mm. Styles 4, exserted, spread and recurved, $^2/_3$ mm, sparsely brownish pubescent at the base. *Fruits* ellipsoid or ovoid, usually tapering at each end, glabrous, with red stripes when fresh, 5–$7^1/_2$ by $2^1/_2$ cm; pericarp woody. *Seeds* ellipsoid, 3 by 1 cm.

Distr. *Malaysia:* Malay Peninsula (Johore, Perak, Selangor, Trengganu).

Ecol. In forests from the lowland up to 280 m.

Uses. The red-brown, hard, durable wood is used for house-beams.

Vern. *Dalek bukit, dalek limau manis, dalek tĕmbaga, keolundang, mĕdang bĕronok, m. bĕrunit, m. bunut,* M.

Notes. In flower structure this species does not show any appreciable difference with *A. corneri*, but the leaves, their venation, and the fruits are different. I follow Corner in distinguishing it as a separate species.

King & Gamble obviously had difficulty with this genus as they cite only a small part of the then available material, and two numbers (King's coll. 6318, 6881) which they cited under *A. apetala* belong to *A. corneri.*

There is one dubious specimen (Corner 36299) collected in the lowland forest of Johore which Corner doubts to belong to *A. corneri*; it differs by the apple-green pear-shaped fruit which is not striped when fresh (but appears to be striped in the herbarium, D.H.); the fruit measures 5 by $3^1/_2$ cm and its pericarp is as thick as that in *A. apetala.*

7. Anisophyllea corneri Ding Hou, *nov. sp.—Anisophyllea sp.*, Corner, Ways. Trees (1940) 125.

Folia elliptica-oblonga, $7^1/_2$–$13^1/_2$ × $2^1/_2$–$5^1/_2$ cm, integra, apice acuminata, basi cuneata, nervis 3 subtus prominulis, venulis tessellatis distinctis. Racemi axillares, simplices vel basi ramosi, usque ad 10 cm longi. Flores parvi, unisexuales, femineis sessilies, masculinis pedicellati. Fructus late ellipsoideus, 6–9 × 4–$4^1/_2$ cm, utrinque obtusus. Typus Corner S. F. 25927, Sing, Bo, Kep.

Small to medium-sized tree up to 23 m. Old twigs dark brown when dry. *Leaves* elliptic-oblong, chartaceous to thinly coriaceous, glabrous on both surfaces, $7^1/_2$–$13^1/_2$ by $2^1/_2$–$5^1/_2$ cm, shortly acuminate, bluntly tipped (tip 4–10 mm long), base cuneate; longitudinal nerves 3, prominent and elevated beneath, slightly elevated above; petiole 1 cm. *Inflorescences* racemose, simple or rarely branched at the base, 1–8 cm long, slightly pubescent. *Flowers* unisexual, sparsely pubescent, glabrescent. *Male flowers* c. 1 mm pedicelled. Calyx lobes 4(–5), deltoid, acute, $^2/_3$ mm long. Petals minute, glabrous, $^1/_6$ mm long; stamens $^1/_3$–$^1/_2$ mm, filaments fleshy, subulate; disk lobes 4, each at the base of a pistil rudiment and slightly embracing it. Pistil rudiments subulate, $^1/_3$ mm, glabrous. *Female flowers* sessile, $1^1/_3$ mm long. Calyx lobes and petals as in the male flowers. Calyx tube cylindric, more or less quadrangular, shortly pubescent outside. Sterile stamens $^1/_4$–$^1/_3$ mm, filament flat. Disk lobes 4, each at the base of a style and embracing it. Styles 4, brownish scaly at the base, $^1/_2$ mm. *Fruits* broadly ellipsoid, blunt at both ends, 6–9 by 4–$4^1/_2$ cm, greenish to yellow then brownish with dull red stripes, with purple stripes when dry. *Seeds* ellipsoid, 5 by 2 cm.

Distr. *Malaysia:* Malay Peninsula (*Kedah:* Abdoellah C. F. 33044; *Perak:* Burkill & Haniff S. F. 12829, Curtis 1649, Haniff & Nur S. F. 2391, Hashim 4, King's coll. 6318, 6881, Symington C. F. 25550, Wray 2625, Yeob 1365; *Trengganu:* Corner S.F. 25927 & 30178; *Pahang:* M. Zin C.F. 27740; *Selangor:* V. Bain C.F. 5203, Burkill S.F. 13470 & 13482, Desch C.F. 45075, Ja'amat C.F. 10256, Strugnell C.F. 11233, Watson 538, C.F. 24306; *Negri Sembilan:* Burkill S.F. 828, Holttum S.F. 9771; *Malacca:* Alvins 991, 1078; *Johore:* V. Bain 5211, 5958, Corner S.F. 29324 & 36999).

Ecol. In forests from the lowland up to 1000 m.

Vern. *Nipis kulit, pĕparah, sial meaun,* M.

8. Anisophyllea sp.

Tree up to 38 m by 60 cm. *Leaves* ovate to ovate-oblong or elliptic-oblong, chartaceous to thinly coriaceous, glabrous and shining on both surfaces, 8–17 by 4–7 cm, acute to shortly acuminate, blunty tipped (tips up to $1^1/_2$ cm long), base cuneate to rounded; longitudinal nerves 3(–5), conspicuous and elevated on both surfaces; petiole 3–7 mm. *Inflorescences* branched at the base, paniculiform, up to 7 cm long, branches flattened when dry, brownish pubescent, rather stout as in *A. grandis. Flowers* (inadequately known) yellow, crowded on very short lateral branches. *Female flowers* sessile, $1^1/_2$ mm long. Calyx lobes deltoid, $^2/_3$ mm long; tube cylindric and more or less quadrangular, shortly pubescent outside. Petals not seen. Sterile stamens *c.* $^1/_6$ mm long. Disk obscure. Styles 4, subulate, $^2/_3$ mm long, exserted and slightly recurved, densely brownish hairy at the lower part. *Fruits* (immature) ellipsoid,

$5^1/_2$ by $2^1/_2$ cm, with purple stripes when dry, pericarp 4 mm diam.

Distr. *Malaysia:* Sumatra (*Tapanuli:* Pariaman: TEYSMANN 2339 HB, Sibolga: Neth. Ind. For. Serv. bb 19655; *W. Coast Res.:* Neth. Ind. For. Serv. bb 7395, bb 6135, bb 5222, bb 3114, SWK I-45; *Indragiri:* Neth. Ind. For. Serv. bb 30053 & 30096).

Ecol. In primary forests from the lowland up to 400 m.

Vern. *Kalek sakam, mĕdang lawang, sakam,* Minangk.

Notes. This is in all probability a new species, but unfortunately all but two specimens are sterile, and the fertile ones (SWK I-45, bb 30096) bear only immature fruits and too fragmentary flowers respectively. The sheets are very homogeneous and have all been collected in a rather restricted coherent area in Central Sumatra. It is closest allied to *A. corneri*, but I have refrained from describing it; it is easily distinguished by the colour and size of the leaves.

The oldest collection of it is by TEYSMANN (HB 2339); his sheets were wrongly referred to the *Lauraceae* by MIQUEL who, in his Supplement Sumatra (1860, p. 142, last two lines from bottom), referred it to *Cinnamomum eucalyptoides* NEES; he was possibly misled by the (wrong) Malay vernacular *madang kulit manis.*

9. Anisophyllea scortechinii KING, J. As. Soc. Beng. 66, ii (1897) 325; RIDL. Fl. Mal. Pen. 1 (1922) 701; BURK. Dict. 1 (1935) 161; Corner, Ways. Trees (1940) 125.

Small tree up to 10 m. Young branches sometimes rusty-pubescent. *Leaves* usually of one kind (rarely with a few small, stipule-like ones appressed to the twig), falcately elliptic to slightly rhomboid, thinly coriaceous, rather silvery in living condition, shining on both surfaces, glabrous, sometimes with a few scattered, appressed, brownish hairs on both surfaces and especially on the main nerves and veins, 4–$15^1/_2$ by $1^1/_2$–6 cm, acuminate, base obliquely cuneate; longitudinal nerves usually 5, rarely the middle one forked, middle 3 prominent and elevated beneath, depressed or plane above, marginal 2 slightly elevated below, visible or obscure above; cross-veinlets distinctly prominent-scalariform beneath, faintly depressed on the upper surface. *Inflorescences* racemose or spike-like, 1–7 cm long. *Flowers* polygamous, brownish pubescent outside. *Male flowers* 1 mm pedicelled, minutely bracteate at the base. Calyx lobes 4(–5), ovate, *c.* 1 mm long, acute. Petals 3-fid at the apex, $^3/_4$ mm long; stamens *c.* $^1/_2$ mm. Disk deeply lobed. Pistil rudiments conical. *Bisexual flowers* sessile or subsessile, cylindric, *c.* 2 mm long. Calyx lobes $^1/_2$ the length of the calyx, deltoid, acute. Petals 2–3-fid at the apex. Stamens 8, equal in length. Styles conical, *c.* $^3/_4$ mm, rusty hairy at the base; stigmas subcapitate. *Fruits* ellipsoid, obtuse on both ends, $1^1/_2$–2 by $1^1/_4$–$1^3/_4$ cm; pericarp woody, persistent, $1^1/_2$ mm diam.; calyx lobes reflexed. *Seeds* ellipsoid, $1^1/_2$ by 1 cm.

Distr. *Malaysia:* Malay Peninsula (Dindings, Johore, Kedah, Pahang, Perak, Singapore, and Wellesley) and Lingga.

Ecol. In forests from the lowland up to 230 m.

Vern. *Kayu ribu-ribu*, M.

Notes. In *A. scortechinii*, though closest allied to *A. disticha*, the reduced, stipule-like leaves are much less in number and less frequent than in the latter species. For this reason it has been entered in the key in two places.

10. Anisophyllea disticha (JACK) BAILLON, Adansonia 11 (1875) 311; HOOK. *f.* Fl. Br. Ind. 2 (1878) 442; KING, J. As. Soc. Beng. 66, ii (1897) 322; SCHIMP. in E. & P. Pfl. Fam. 3, 7 (1898) 56, f. 30; MERR. En. Born. (1921) 422; RIDL. Fl. Mal. Pen. 1 (1922) 701; BURK. & HENDERS. Gard. Bull. S.S. 3 (1925) 370; CORNER, Ways. Trees (1940) 122, fig. 28.—*Haloragis disticha* JACK, Mal. Misc. 2 (1822) 19; reimpr. Calc. J. Nat. Hist. 5 (1843) 336.—*Anisophyllum trapezoidale* BAILL. Adansonia 3 (1862) 24, 36.—*Anisophyllea rhomboidea* BAILL. Adansonia 11 (1875) 310; MERR. En. Born. (1921) 422.—**Fig. 28 e–l.**

A miniature tree up to $7^1/_2$ m by 10 cm. Branches graceful, drooping, generally arranged in distant whorls; upright main stems only provided with the stipule-like dwarf leaves. Twigs brownish pubescent, all lateral branches provided with leaves of several successive flushes. *Leaves* dimorphous, thin, very distichous, closely set with touching margins, the main upright stems and branches only with small leaves. Large leaves oblong-rhomboid, subfalcate, only on the lateral branches, densely brownish pubescent on both surfaces of the young leaves, glabrescent, $1^1/_2$–9 by $^1/_2$–3 cm, acute at both ends; midrib slightly elevated beneath, depressed above; 1 or 2 longitudinal nerves on each side of the midrib, visible beneath, obscure above; transverse veinlets obscure on both surfaces. Small leaves stipule-like, falcate, generally appressed to the upper side of the twig, and more or less alternating with the large leaves on the lateral twigs, stipule-like, *c.* 5 mm long. *Inflorescences* either with ♂ or ♀ flowers, flowers pinkish white. *Male inflorescences* fasciculate or racemose, up to 7 cm long, rarely branched in the axils of the large leaves, turned to the underside of the twigs. *Male flowers c.* 2 mm long, yellowish, shortly pedicelled, minutely bracteate at the base. Calyx deeply (3–)4(–5)-lobed, lobes deltoid, $1^1/_4$ mm long, acute, brownish appressed-hairy outside. Petals obovate, irregularly 3–5-fid, $1^1/_4$ mm long. Stamens small as compared with other *spp.* Disk deeply lobed. Pistil rudiments subulate. *Female inflorescences:* flowers usually solitary, very rarely in a short, up to 2 cm long, spike-like inflorescence. *Female flowers* sessile, *c.* 2 mm long. Calyx lobes and petals similar as in the males. Staminodes alternating with the disk lobes. Style columnar *c.* $^1/_2$ mm, glabrous; stigma capitate. *Drupes* bright red when fresh, oblong, hanging singly or in pairs from the underside of the twigs, sessile, $1^3/_4$–$2^1/_2$ cm long, the stone yellow-white, 1–2 by $^1/_2$–1 cm, acute at both ends, with 6–8 grooves and ridges; hard pericarp 1–$1^1/_2$ mm diam.

Distr. *Malaysia:* Sumatra, Lingga Isl., Malay Peninsula, and Borneo.

Ecol. Common species in low woods and secondary forests, in wet places, on granitic sands, and on ridges, sometimes occurring up to 714 m, one collection said to have been found at 1785 m (Mt Kinabalu), *fl.* April-Aug., *fr.* throughout the year.

Uses. The hard wood of the main stem is used for making walking sticks and shafts of pikes, spears, and lances. An infusion of the leaves is used against diarrhoea and dysentery. NOORUDIN reported that in Borneo the roots of this plant are boiled together with jintan itam (seeds of *Nigella sativa* L.) and bawang merah (*Allium cepa* L.) for drinking to relieve weariness; also the leaves of it are grinded with the same ingredients for external application towards the same purpose.

Vern. *Leechwood,* E, *pokok kanchil, kaju pachat, kaju ribu-ribu, raya bĕrangkat, rambai ayam, balam ayam,* Mal. Pen., *ibu ibu,* Djambi, *tsul tsul,* Lingga, *kaju kantjul, k. ribu,* Palemb., *mĕmpiding, sĕmpiding, nasi-nasi, sapit,* Banka; Borneo: *piambat,* Murut, *ambun,* Kedayan, *kĕribu,* W. Born.

Notes. The size of leaves is very variable, ranging from 9 by 3 to 1½ by ½ cm. All specimens from the Malay Peninsula have small leaves and their size is usually less than 3½ by 1½ cm. As far as could be ascertained on the available material, the male and female flowers are borne on separate inflorescences.

A specimen of *A. disticha* in K marked as 'Luzon, LOBB' has been cited by ROLFE (J. Bot. 23, 1885, 212) as a Philippine plant. MERRILL (Philip. J. Sc. 10, 1915, Bot. 191) has pointed out that no representative of *Anisophyllea* is known from the Philippines and that the LOBB specimen must have been erroneously localized; it may have come from Borneo.

6. COMBRETOCARPUS

HOOK. *f.* in B. & H. Gen. Pl. 1 (1865) 683.—**Fig. 29.**

Tree. *Leaves* alternate, entire. Stipules 0. *Inflorescences* solitary or rarely fasciculate (branched from the very base), inserted on a tubercular basis. *Calyx* lobes 3(–4). *Petals* 3(–4), linear, entire, rarely laciniate. *Stamens* 6(–8). *Ovary* trigonous, cuneate to the base, lepidote, inferior, 3(–4)-celled, each cell with 2 ovules. Styles 3(–4), subulate, free. *Fruit* trigonous-fusiform, widely 3(–4)-winged, 1-celled, 2 cells aborted, 1-seeded. *Seed* narrow spindle-shaped (compressed in the herb. when not well developed), a solid whole, without a sharp demarcation between endosperm and embryo under the microscope; embryo obviously central and longitudinal, fusiform.

Distr. Monotypic. *Malaysia:* Sumatra, Riouw (Karimon Island), Banka, Billiton, and Borneo.

Ecol. In water-logged soils of peat-swamp and kĕrangas forests at low altitude.

1. Combretocarpus rotundatus (MIQ.) DANSER, Bull. Jard. Bot. Btzg III, 10 (1929) 345; DURANT, Rep. For. Brunei (1933) 3, 6, 29, 41, 44, tab.; AIRY-SHAW in Hook. Ic. Pl. (1937) t. 3335; BROWNE, For. Trees Sar. & Brun. (1955) 303, t. 41.—*Macrosolen rotundatus* MIQ. Sum. (1861) 138 & 346.—*C. motleyi* HOOK. *f.* in B. & H. Gen. Pl. 1 (1865) 683; ENDERT, Tectona 13 (1920) 122; DIELS & HACK. Bot. Jahrb. 60 (1926) 294–316; HEYNE, Nutt. Pl. (1927) 1173; BURK. Dict. 1 (1935) 643; MARCO, Trop. Woods *no* 44 (1935) 20.—**Fig. 29.**

Tree up to 25 m by 80(–100) cm, easily producing coppice shoots. Bark grey, usually pale, fissured. Buttresses none or small. *Leaves* coriaceous, obovate, elliptic, broad-elliptic, to suborbicular, 8–14½ by 5½–9 cm, apex rounded, base cuneate; nerves 6–10 pairs, slightly elevated beneath, flat above; petiole 7½–15 mm. Young leaves dark red; fallen leaves usually drying grey above and yellowish below. *Inflorescences* 1½–6½ cm peduncled, including the latter up to 9 cm long; pedicels *c.* 6 mm. *Flowers* yellow. *Calyx* lobes ovate, obtuse, 2½–4 by 2 mm, outside lepidote in the apical part, slightly ciliate on the margin. *Petals c.* 2 mm long. *Stamens* inserted between the lobes of the disk, filament filiform, *c.* 2–2½ mm; anther ovoid, versatile. Disk annular, obscurely 6–lobed. *Ovary c.* 2 mm; *fruit* including the wings 1½–2 by 2–3 cm, wings semicircular, membranous, with parallel, transverse veins. *Seed* elongate-fusiform.

Distr. *Malaysia:* Sumatra (Palembang, Tebing-tinggi), Riouw (Karimon Isl.), Banka, Billiton, and Borneo.

Ecol. From near sea-level up to 100 m, on sandy soils, peat swamps, freshwater swamps, and along the coast.

A distinctly gregarious tree of fairly large size confined to coastal swamp forest common from Borneo to Palembang and adjacent islands, in Brunei associated with *Dactylocladus* & *Gonystylus,* in Palembang with *Campnosperma* & *Shorea albida.*

According to BROWNE (*l.c.* p. 7) it may be dominant in the peat-forests 'padang paya' of Sarawak and Brunei in similar places as *Shorea albida var.* or as a co-dominant of *Sh. albida* (alan);

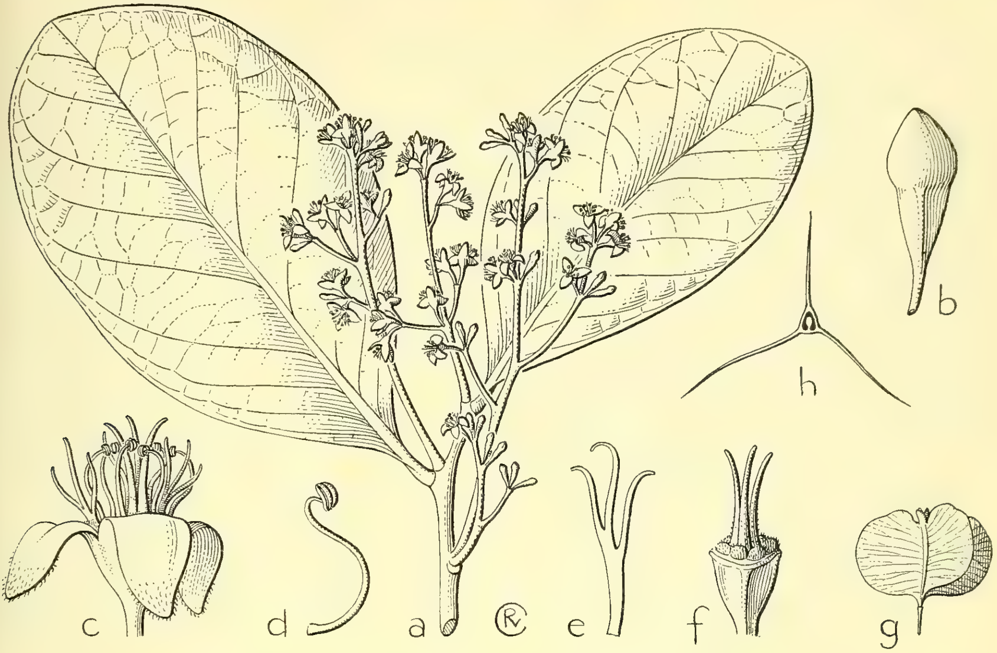


Fig. 29. *Combretocarpus rotundatus* (Miq.) Dans. *a.* Habit, × 2/3, *b.* bud, × 7, *c.* flower, × 7, *d.* stamen, × 13, *e.* petal, × 13, *f.* gynoecium, × 7, *g.* fruit, × 2/3, *h.* cross-section of a fruit, × 4/3 (*a* partly after Endert 302 partly after Shaw, *b–f* Endert 302, *g* Mondi 286, *h* after Shaw).

he says it also occurs on dry kĕrangas soils and in the mixed swamp forest type (*l.c.* p. 303). Over considerable areas, particularly in Baram and Brunei, it may average more than 5 large trees per ha. Stems of old trees are in some localities hollow and produce upward curved, short 'hunger roots' in the lower part of the bole from fissures in the bark. Generally it is small-sized but this is often compensated by abundance.

In South Sumatra Endert (*l.c.*) found it in peat-forests in the Musi delta associated with *Campnosperma macrophylla* and *Shorea sp.*

Kĕruntum coppices are remarkably vigourous, and posts used for fencing and similar purposes often take roots and sprout (*cf.* Browne *l.c.*); the young red leaves of the coppices are conspicuous. Branches of wind-blown trees may easily take root and when the old stem in the course of time disintegrates, there may be eventually 4–6 young trees standing in its place, a most remarkable way of vegetative reproduction (Browne, *l.c.* t. 41; Diels & Hackenberg, *l.c.* p. 295).

Uses. The reddish-brown heart-wood is fairly hard and heavy; logs sink in water. It is locally highly favoured for heavy interior construction; strength properties appear to be roughly equivalent to those of teak or mĕrbau, easy to saw and work. It has a reputation for durability under cover. Large supplies are available and it deserves much more attention than it now receives (Browne).

Vern. *Kaju tanah*, W. Borneo, *pĕrĕpat paya*, *kĕruntum*, Brunei, *pĕrĕpat-pĕrĕpat*, Bajau, N. Borneo, *marapat*, Dayak (Ngadju), *puru*, Sampit; *pĕrpat darat*, Billiton, *pragat darah*, *tĕruntum batu*, Banka, *pĕrpat*, Palemb.

7. CARALLIA

Roxb. Pl. Corom. 3 (1811) 8, t. 211, *nom. gen. conserv.;* R. Br. in Flinders, Voy. Bot. 2, app. 3 (1814) 549, *nomen*; Bl. Mus. Bot. 1 (1849) 131; Benth. J. Proc. Linn. Soc. Bot. 3 (1859) 67 & 74.—*Kare Kandel* Adans. Fam. Pl. 2 (1763) 88, 532, *nom. illeg.*—*Diatoma* Lour. Fl. Coch. (1790) 296, *nom. gen. rejic.*—*Barraldeia* Thouars, Gen. Nov. Madag. (1806) 24, *nom. gen. rejic.*—*Demidofia* Dennst. Schlüss. Hort. Malab. (1818) 31, *non* Gmel. 1791.—*Baraultia* Spreng. Syst. 2 (1825) 313, *nom.*

illeg.—*Symmetria* BL. Bijdr. (1826–27) 1130.—*Petalotoma* DC. Prod. 3 (1828) 294.—*Karekandelia* ADANS. *ex* O.K. Rev. Gen. 1 (1891) 234.—*Sagittipetalum* MERR. Philip J. Sc. 3 (1908) Bot. 247.—**Fig. 30–32.**

Shrubs or trees, a single *sp.* occasionally with small stilt-roots at the base of the stem. Twigs solid. *Leaves* decussate, petioled, entire to dentate or serrate, papyraceous to thinly coriaceous, black-dotted beneath; midrib sulcate above, prominent below. Stipules lanceolate. *Inflorescences* sessile or peduncled, cluster-like condensed or lax, di- or trichotomously branched, sometimes reduced to 2, or even a single flower. Bracteoles 2, free and caducous or at least connate at the base and persistent. *Flowers* sessile or pedicelled. *Calyx* lobes 5–8, deltoid, acute to acuminate. *Petals* 5–8, unguiculate, caducous or persistent. *Stamens* twice the number of petals, persistent, free or towards the base connate into a tube (*C. papuana*), unequal in length, the short ones oppositisepalous, the long ones oppositipetalous; filaments subulate, flat or slightly fleshy; anthers ovoid or subglobose. Disk annular, fleshy. *Ovary* inferior, 5–8-celled, each cell 2-ovuled, or 1-celled with a central axis and 10–12 pendulous ovules inserted at its top; style filiform or slightly conical; stigmas discoid or capitate, grooved or obscurely lobed. *Fruits* pulpy, globose, ellipsoid or obovoid, 1-celled, 1(–2–5)-seeded. *Seeds* ellipsoid or reniform, albuminous, areolate; embryo straight or curved.

Distr. About 10 *spp.* in Madagascar, Ceylon, India, SE. Asia, throughout *Malaysia* to northern Australia and Melanesia (Solomon Isl.).

Ecol. On lowland ridges, hills, and in swampy places up into the mountains to *c.* 1800 m.

Morph. Stilt-roots have been observed to occur occasionally in *C. brachiata* (KOORDERS, BACKER, BROWNE); KOORDERS's specimen was collected in the Kampar swamp forest in Central Sumatra. ENDERT observed the same in Borneo.

Nomencl. *Carallia* is a conserved generic name, but the citations in the Rules of Nomenclature (Paris Code 1956) are unsatisfactory.

Carallia was not described by R. BROWN, in Flinders, Voy. Bot. 2, app. 3 (1814) 549, but was merely referred to as a *nomen nudum.* The proper description and plate had been given by ROXBURGH himself three years earlier.

Kare Kandel ADANS. Fam. Pl. 2 (1763) 88, 532, based on RHEEDE's name and description (H.M. 5, t. 13), is an illegitimate name according to art. 68 (4) and need not to be mentioned among the rejected names of which *Diatoma* LOUR. and *Barraldeia* THOUARS should stand.

The leaf margin is in this genus either entire, crenulate, or dentate; juvenile specimens of some species, notably *C. brachiata*, are sometimes densely and sharply dentate; the taxonomic value of the leaf margin is, hence, not particularly significant.

KEY TO THE SPECIES

1. Cyme(s) and flowers sessile. (Leaves thin-coriaceous.) . . . . **1. C. coriifolia**
1. Cyme(s) at least short-peduncled. Flowers sessile or pedicelled. (Leaves papyraceous to thin-coriaceous.)
  2. Bracts and bracteoles semi-amplexicaulous, not connate, caducous in or after anthesis. **2. C. eugenioidea**
  2. Bracts and bracteoles persistent, at least connate at the base.
    3. On top of the common peduncle 2 or 3 simple or forked branches, each branch densely covered by decussate and deltoid or semi-orbicular bracts or bracteoles, the internodes between which are *invisible* from the outside; usually some of the bracteoles with solitary, sessile flowers. Leaves entire.
      4. Leaf-base usually rounded, more or less abruptly set off from the petiole. Petals with a claw *c.* 2½ mm long, lamina elliptic, 1½ by 1 mm, shortly fimbriate (ovate and sessile when young). Filaments fleshy, connate about halfway up into a ventrally grooved tube . . **3. C. papuana**
      4. Leaf-base cuneate-attenuate, gradually narrowed into the petiole. Petals with a claw 1 mm long, lamina transversely oblong, 0.6 by 1 mm, slightly emarginate. Filaments thin, subulate, free. **4. C. hulstijnii**
    3. Inflorescences distinctly cymose, each pair or triplet of bracts with 2 or 3 flowers or axes with *clearly* visible internodes, each ultimate cyme 3-flowered, the central flower bractless, sessile, the

lateral flowers pedicelled, sustained by cup-shaped, connate or partly connate bracteoles. Leaf margins distinctly fimbriate-dentate, serrulate, denticulate, very shallowly dentate-crenate, or entire.

5. Petals sagittate, persistent. Calyx lobes inside with short hairs. Seed obovoid or ellipsoid; embryo straight.
    6. Inflorescences only in the axils of the upper leaf pair on each shoot. Disk divided in the upper half into deltoid lobes. Leaves serrulate to denticulate. . . . . **5. C. borneensis**
    6. Inflorescences in the axils of each or several successive leaf pairs on each shoot, not confined to the terminal pair. Disk crenulate. Leaves fimbriate-dentate . . . . . **6. C. suffruticosa**
5. Petals suborbicular or obovate-spathulate, caducous in or after anthesis. Calyx lobes inside glabrous. Seed reniform or curved, embryo curved.
    7. Flowers 6–8 mm long, not resinous. Petals obovate-spathulate, 3–3$^1/_2$ by 1$^1/_2$–2 mm. Ovary 1-celled. Fruits obovoid, 6 by 3 mm, ridged . . . . **7. C. calophylloidea**
    7. Flowers *c.* 3 mm long, usually resinous. Petals suborbicular, 1–2 mm diam. Ovary 5–8-celled. Fruits globose, 5–7 mm diam. . . . . **8. C. brachiata**

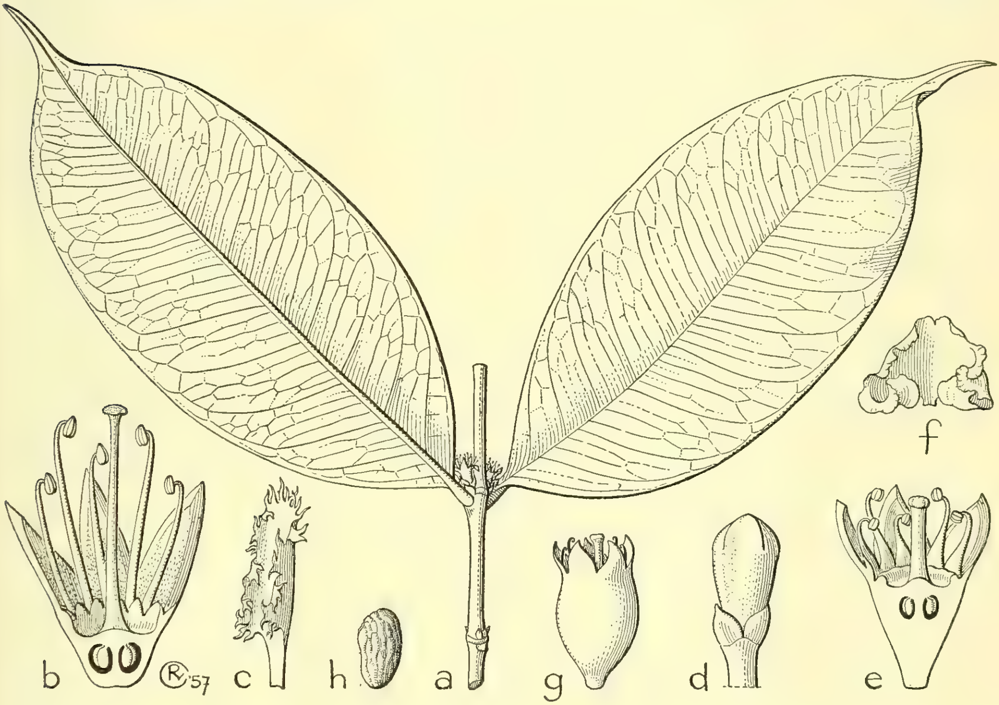


Fig. 30. *Carallia coriifolia* RIDL. *a.* Habit, × $^2/_3$, *b.* longitudinal section of flower (petals removed), × 5, *c.* petal, × 7.—*C. eugenioidea* KING. *d.* Bud, × 4, *e.* longitudinal section of flower (petals removed), × 4, *f.* petal, × 7, *g.* fruit, × 2, *h.* seed, × 2 (*a–c* HAVILAND 1797, *d, f, h* PURSEGLOVE 4244, *e, g* SCORTECHINI *s.n.*).

1. Carallia coriifolia RIDL. Kew Bull. (1938) 283. —**Fig. 30a–c.**

Small tree. *Leaves* ovate-oblong to elliptic-oblong, entire, 7–17 by 3–6 cm, shining and deep-brown when dry, acute to acuminate (acumen up to 2 cm long), base cuneate or rarely rounded; nerves 7–11 pairs, slightly elevated on both surfaces, sometimes obscure on the upper surface; petiole thick, $^1/_2$–1 cm. Stipules 1$^1/_2$–2$^1/_2$ cm long. *Inflorescences* and flowers sessile, 1–4-flowered; bracts and bracteoles crowded together, decussate, ovate, amplexicaulous and embracing the lower part of the flower. *Flowers* 7–8 mm long, green, petals, stamens, and style exserted. *Calyx* lobes 5 or 6, lanceolate, 2$^1/_2$–3$^1/_2$ mm long, with a tuft of hairs at the tip, shortly brownish hairy within. *Petals* sagittate, 4$^1/_2$ mm long, fimbriate, conduplicate, base acute and involute, unguiculate. Disk cup-shaped, halfway divided into deltoid lobes. *Stamens* filiform, 8–10 mm; anthers ovoid, slightly apiculate. *Ovary* 1-celled, ovules 10–12, pendulous, attached on the axis; style filiform, 10 mm; stigmas capitate. *Fruits* oblong-ellipsoid, 12 by 7 mm, 1-celled, 1-seeded, the floral parts persistent. *Seeds* obovoid, obtuse at both ends, areolate, 9 by 4¹/₂ mm; embryo straight.

Distr. *Malaysia:* W. Borneo (Sarawak, Sintang, Kapuas).

Ecol. Rain-forests at low altitude.

2. Carallia eugenioidea KING, J. As. Soc. Beng. 66, ii (1897) 320 (*eugenoidea*); RIDL. Fl. Mal. Pen. 1 (1922) 697.—*C. montana* RIDL. J. Fed. Mal. St. Mus. 6 (1915) 145; Fl. Mal. Pen. 1 (1922) 697.—*C. euryoides* RIDL. Fl. Mal. Pen. 1 (1922) 698.—**Fig. 30d–h.**

Shrub or small tree, up to 8 m. *Leaves* usually at the branch ends, obovate, obovate-oblong, or elliptic-oblong, 4–8 by 1¹/₂–4¹/₂ cm, shining above, rather dull beneath, thinly coriaceous, acuminate to abruptly acute, rarely rounded, base cuneate, margin entire or rarely crenulate; nerves 7–10 pairs; petiole *c.* 5 mm. Stipules 5–7 mm long. *Inflorescences* cymose, once or twice branched, 2¹/₂–5 cm peduncled. *Flowers* green, yellowish-green, or white; pedicels up to 7 mm, sometimes the central flower of the ultimate cyme sessile. *Calyx* lobes 5, deltoid, acuminate, 2–3 mm long. *Petals* suborbicular, 2 mm diam., shortly unguiculate. Disk fleshy, slightly crenulate. *Stamens* 1¹/₂–2 mm; filament subulate; anthers slightly apiculate. *Ovary* campanulate, 3–5 mm long, 5-celled, each cell with 2 ovules; style 2¹/₂ mm; stigma capitate, slightly 5-grooved. *Fruits* slightly obovoid, 4–5 by 3 mm. *Seed* oblong-ovoid, areolate, corrugate, 3 by 1¹/₂ mm; embryo straight.

Distr. *Malaysia:* Malay Peninsula and Central Sumatra (Mt Sago).

Ecol. This species has rather seldom been collected and as far as these specimens go they show a rather remarkable vertical distribution, having been found in the Malay Peninsula at low altitude (*c.* 200–300 m) with rather thin, narrow leaves (once noted on a quartzite ridge) and further at much higher altitude (*c.* 1400–1700 m) with coriaceous, more blunt, and broader leaves. The Sumatra collection was made between 1500 and 1800 m and approaches the type of leaf as found in the Malayan mountains.

Note. The single collection from Sumatra (JACOBS 4685) is a young flowering specimen, which matches the present species very well; the bracts and bracteoles are still on the inflorescences, which may be due to the young stage.

3. Carallia papuana DING HOU, *nov. sp.*

Affinis C. hulstijnii sed foliis basi rotundatis diversa; petala unguiculata, 2¹/₂ mm longa, lamina elliptica, 15 × 1 mm, breviter fimbriata; filamenta crassiuscula, infra ad dimidium in tubum canaliculatum connata. Typus DOCTERS VAN LEEUWEN 9530, L; SING.

Small tree, 4–6 m. *Leaves* elliptic-oblong to ovate-oblong, chartaceous, 12–20 by 5¹/₂–8¹/₂ cm, entire, shortly acuminate, base rounded; nerves 7–12 pairs, slightly elevated on both surfaces; petiole 6–10 mm. Stipules 1¹/₂–2 cm long. *Inflorescences* cymose, up to *c.* 2 cm long, 7–11 mm peduncled. *Flowers c.* 5 mm long, white. *Calyx* lobes 5, deltoid, acuminate, sparsely short-whitish hairy inside. *Petals c.* 2¹/₂ mm long, obovate-spathulate, erose, unguiculate. *Stamens* fleshy, 2–3 mm, anthers small, oblong and obtuse. Disk thin, crenulate. *Ovary* 5-celled, each cell with 2 pendulous ovules; style conical, *c.* 2¹/₂ mm; stigma obscure. *Fruit* unknown.

Distr. *Malaysia:* West New Guinea (Mamberamo: DOCTERS VAN LEEUWEN 9530, 11343).

Ecol. On hill ridge at 75 m.

4. Carallia hulstijnii VALETON, Bull. Jard. Bot. Btzg III, 2 (1920) 347.

Leaves narrow elliptic-oblong, 14–19¹/₂ by 5–7 cm, entire, bluntly acuminate, base cuneate-attenuate; petiole *c.* 1 cm. Stipules 1³/₄–2¹/₄ cm long. *Inflorescences* cymose, up to 3 cm long, peduncles ¹/₂–1¹/₄ cm. *Flowers* 4 mm long. *Calyx* lobes 5 or 6, deltoid, *c.* 2 mm long, acute. *Petals* transversely oblong, unguiculate, with claw *c.* 1 mm long and wide. *Stamens* 1–1¹/₂ mm; anthers ovoid, slightly apiculate. Disk thick, crenulate. *Ovary* 5–6-celled; style filiform, 2 mm, stigma discoid, obscurely lobed. *Fruit* unknown.

Distr. *Malaysia:* (Moluccas: Sula Isl.) once collected.

5. Carallia borneensis OLIVER in Hook. Ic. Pl. (1896) t. 2459; MERR. En. Born. (1921) 421.——*Sagittipetalum mindanaense* MERR. Philip. J. Sc. 3 (1908) Bot. 247.—*Sagittipetalum palawanense* ELM. Leafl. Philip. Bot. 5 (1913) 1830.—*C. mindanaensis* MERR. En. Philip. 3 (1923) 146.

Tree up to 24 m by 45 cm. Bark finely fissured, pale brown. *Leaves* broad-elliptic, suborbicular to obovate or elliptic-oblong, acuminate to shortly abruptly acuminate (tip acute or rounded), 5¹/₂–10 by 2¹/₂–7 cm, shallowly crenulate, base cuneate to broad-cuneate; nerves 6–8 pairs, slightly elevated beneath, obscure or visible above; petiole 7 mm. Stipules linear, 1¹/₂ cm long. *Inflorescences* cymose up to 3¹/₂ cm long, (di-)trichotomously branched, ³/₄–2 cm peduncled, sometimes with only 2, or even a single flower, in the ultimate cymes the lateral flowers pedicelled and with 2 to 3 bracteoles united into a basal cup, central flower sessile and without bracteoles. *Flowers* white or pale green, 7–8 mm long. *Calyx* lobes 6, lanceolate, 3–4 mm long, shortly whitish hairy within. *Petals, stamens,* and style exserted. Petals sagittate, 3–5 mm long, unguiculate, fimbriate, conduplicate, base acute and inflexed. Filaments filiform, 3¹/₂–5 mm; anthers ovoid, slightly apiculate. Disk cup-shaped, fleshy, halfway divided into deltoid lobes. *Ovary* cylindric or cuneate, 2¹/₂–4 mm long, 1-celled, with 12 ovules; ovules pendulous, borne at the top of the central axis; style filiform 4–6 mm, stigmas capitate. *Fruit* oblong-ellipsoid 1³/₄ by 1 cm, crowned by the persistent floral parts, base abruptly narrowed, 1-celled, 1-seeded. *Seeds* oblong-ellipsoid or obovoid, 9 by 6 mm, black, slightly areolate.

Distr. *Malaysia:* Borneo, Philippines (Palawan, Mindanao), and (once found) in W. New Guinea (Lake Amaru).

Ecol. Primary forests at low altitude.

Vern. *Karibas*, Bandjermasin, *kĕmuning hutan*, Dusun, *koroh*, Papua.

6. Carallia suffruticosa RIDL. J. As. Soc. Str. Br. *no* 61 (1912) 6; Fl. Mal. Pen. 1 (1922) 698; BURK. Gard. Bull. S.S. 4 (1927) 77, *p.p.;* BURK. & HANIFF, Gard. Bull. S.S. 6 (1930) 198; BURK. Dict. 1 (1935) 449.—*C. fascicularis* GUILL. Not. Syst. 3 (1914) 24; Fl. Gén. I.-C. 2 (1920) 733, f. 75, 18–22.

Shrub or small tree, 2–3 m. *Leaves* elliptic-oblong to narrow elliptic-oblong, papyraceous, 10–18 by 4–6$^1/_2$ cm, acuminate, base cuneate to subrotundate, margins distinctly fimbriate-dentate; nerves 8–13 pairs, slightly elevated on both surfaces; petiole 1–1$^1/_2$ cm. Stipules 7–10 mm long. *Inflorescences* cymose, 1$^1/_2$ cm long, 5 mm peduncled. *Flowers* white or red. Bracteoles decussate, ovate, keeled, persistent. *Calyx* 5–7-lobed, lobes lanceolate, acuminate, 3–4 mm long, shortly hairy within. *Petals* sagittate, unguiculate, *c.* 4 mm long, slightly emarginate, conduplicate, base acute and inflexed. *Stamens* 3–4 mm; anthers ovoid, obtuse, rarely slightly apiculate. *Ovary* 1-celled, with 10–12 ovules; style 4$^1/_2$ mm; stigma discoid. *Fruits* wine-red, ellipsoid, sometimes slightly curved, 15 by 6 mm, 1-celled, 1-seeded, crowned by the remains of the floral parts. *Seeds* oblong, slightly curved, 11 by 4 mm, brown.

Distr. Indo-China (Cochinchina) and *Malaysia:* Malay Peninsula (Selangor, Perak, Trengganu).

Ecol. In lowland forests.

Uses. The leaves are used by the Malayans both internally and externally. "In the form of an infusion of the leaves, it is taken internally for worms, coughs, and after child-birth as a protective medicine; in the form of a decoction it is employed for bathing in fever; and as a poultice of the pulped leaves it is applied to boils" (*cf.* BURK. Dict. *l.c.*).

Vern. *Sisek puyoh, sisek puyu, mĕransi, rĕdip pĕpuyoh, tulang daing.*

Notes. BURKILL (Gard. Bull. S.S. 4, 1927, 77) said that *C. spinulosa* RIDL. does not adequately differ from the *C. suffruticosa* RIDL. He also referred his own collection (4690) to the latter, which actually is *C. brachiata.* The type specimen of *C. spinulosa* RIDL. is RIDLEY 11858 which clearly belongs to *C. brachiata.* Sterile specimens of *C. brachiata* with denticulate leaves can hardly be distinguished from the present species.

7. Carallia calophylloidea DING HOU, *nov. sp.*

Folia lato elliptica vel oblongo-elliptica, 6–12 × 3–6$^1/_2$ cm, integra, apice acuta vel breviter acuminata, basi cuneata vel rotundata, nervis primariis numerosis subparallelis. Cymae usque ad 10 cm longae, pedunculis 3–6 cm longis. Calycis tubus campanulatus. Petala obovato-spathulata, 2$^1/_2$–3$^1/_2$ × 2 mm, unguiculata, irregulariter denticulata. Stamina 3–4 mm longa, antheris apiculatis. Ovarium uniloculare, ovulis ab apice axis pendulis. Fructus obovatus, leviter costatus, 1-spermus. Semina anguste reniformia. Typus HALLIER 2199, Bo.

Leaves broadly elliptic or elliptic-oblong, 6–12 by 3–6$^1/_2$ cm, thin coriaceous, shining above, rather dull beneath, entire, acute to shortly acuminate (tip acute to obtuse), base cuneate to rounded; nerves numerous and parallel, slightly elevated on both surfaces; petiole slender, 12–15 mm. Stipules 7–10 mm long. *Inflorescences* distinctly cymose, up to 10 cm long, 3–6 cm peduncled, (di)trichotomously branched. Bracts and bracteoles 2 or 3, united at the base into a cup, their free parts ovate, acute. Lateral *flowers* of the ultimate cymes pedicelled and bracteolate, the central flowers ebracteolate and sessile. Flowers 6–8 mm long. *Calyx* lobes 5–6(–7), lanceolate, 4 mm long. *Petals* obovate-spathulate, 2$^1/_2$–3$^1/_2$ by 2 mm, unguiculate, erose. Disk fleshy. *Stamens* 3–4 mm long, filaments subulate, flat; anthers distinctly apiculate. *Ovary* 1-celled, with 10–12(–14) ovules, pendulous; style 4 mm long; stigma discoid, grooved and obscurely lobed. *Fruits* obovoid, excluding the persistent floral parts 7 by 3$^1/_2$–4 mm, lengthwise ridged outside, 1-seeded. *Seed* reniform, curved, black, 5 by 3 mm, areolate.

Distr. *Malaysia:* W. Borneo (Sg. Smitau: HALLIER 1264; Sg. Kenibung: HALLIER 1317; Sg. Kenepai, P. Malaju: HALLIER 8646).

8. Carallia brachiata (LOUR.) MERR. Philip. J. Sc. 15 (1919) 249; En. Philip. 3 (1923) 146; CRAIB, Fl. Siam. En. 1 (1931) 597; MERR. Comm. Lour. (1935) 281; BURK. Dict. 1 (1935) 448; HOLTHUIS & LAM, Blumea 5 (1942) 114, 119; BLAKE, Austr. J. Bot. 2 (1954) 133.—*Kare-kandel* RHEEDE, Hort. Mal. 5 (1685) 25, t. 13.—*Kare Kandel* ADANS. Fam. Pl. 2 (1763) 88, 532.—*Diatoma brachiata* LOUR. Fl. Coch. (1790) 296, ed. Willd. (1793) 362.—*C. lucida* ROXB. Corom. Pl. 3 (1811) 8, t. 211; Hort. Beng. (1814) 92 (*Corallia*); DC. Prod. 3 (1828) 33; W. & A. Prod. (1834) 312; GRIFF. Trans. Med. Phys. Soc. Calc. 8 (1836) 11; Ann. Sc. Nat. Bot. 10 (1838) 124; WIGHT, Ic. 2 (1843) t. 605; BL. Mus. Bot. 1 (1849) 130; KURZ, For. Fl. Burma 1 (1877) 447; KING, J. As. Soc. Beng. 66, ii (1897) 319; BACK. Schoolfl. (1911) 486; GUILL. Fl. Gén. I.-C. 2 (1920) 732, f. 75, 23–25; MERR. En. Born. (1921) 421; CRAIB, Fl. Siam. En. 1 (1931) 599; CORNER, Ways. Trees (1940) 522, f. 177 & 178. —*Demidofia nodosa* DENNST. Schlüss. Hort. Mal. (1818) 31, *no* 13.—*Baraldeia madagascariensis* DC. Prod. 1 (1824) 732.—*C. lanceaefolia* ROXB. Hort. Beng. (1814) 37, *nomen* (*lanceofolia*); DC. Prod. 3 (1828) 33; WIGHT, Ic. 2 (1843) t. 604; BENTH. J. Proc. Linn. Soc. Bot. 3 (1858) 75; HENSLOW, in Hook. *f.* Fl. Brit. Ind. 2 (1878) 439; GUILL. Fl. Gén. I.-C. 2 (1920) 733.—*Symmetria obovata* BL. Bijdr. (1826-27) 1131.—*C. integerrima* DC. Prod. 3 (1828) 33; BL. Mus. Bot. 1 (1849) 129; MIQ. Fl. Ind. Bat. 1, 1 (1855) 594; THWAITES, En. Pl. Ceyl. (1859) 120; BENTH. J. Proc. Linn. Soc. Bot. 3 (1858) 74; Fl. Hongk. (1861) 111; BAILL. Adansonia 3 (1862-63) 37; HENSLOW, in Hook. *f.* Fl. Br. Ind. 2 (1878) 439; F.-VILL. Nov. App. (1880) 80; VIDAL, Sin. Atlas (1883) 25, t. 47, f. E; Rev. Pl. Vasc. Filip. (1886) 126; FORBES & HEMSL. J. Linn. Soc. Bot. 23 (1887) 294; TRIM. Fl. Ceyl. 2 (1894) 155; K. & V. Bijdr. 4 (1896) 301; SCHIMP. in E. & P. Pfl. Fam. 3, 7 (1898) 53, f. 27, A–D;

MERR. Philip. J. Sc. 1 (1906) Suppl. 102; KOORD. Exk. Fl. Java 2 (1912) 669; Atlas 1 (1913) t. 109; EWART & DAVIES, Fl. North. Terr. Austr. (1917) 199; MERR. Sp. Blanc. (1918) 284; RIDL. Fl. Mal. Pen. 1 (1922) 696.—*Petalotoma brachiata* DC. Prod. 3 (1828) 295.—*C. sinensis* ARN. Nov. Act. Ac. Caes. Leop.-Car. 18 (1836) 335; Ann. Mag. Nat. Hist. 1 (1838) 371.—*C. ceylanica* ARN. Nov. Act. Ac. Caes. Leop.-Car. 18 (1836) 334; Ann. Mag. Nat. Hist. 1 (1838) 371.—*C. corymbosa* WIGHT *ex* ARN. Ann. Mag. Nat. Hist. 1 (1838) 371, *nom. illeg.*—*C. barraldeia* W. & A. *op. cit.* p. 370, *nom. illeg.*—*C. integrifolia* GRAHAM, Cat. Pl. Bombay (1839) 68.—*Bruguiera nemorosa* BLANCO, Fl. Filip. ed. 2 (1845) 275, ed. 3, 2 (1878) 147.—*C. celebica* BL. Mus. Bot. 1 (1849) 131; MERR. En. Born. (1921) 421.—*C. symmetrica* BL. *l.c.* 130, *nom. illeg.*—*C. confinis* BL. Mus. Bot. 1 (1849) 129, *incl. var. pauciflora;* MIQ. Fl. Ind. Bat. 1, 1 (1855) 595, *incl. var. latifolia*; Sum. (1861) 326, *incl. var. oxyodon;* MERR. En. Born. (1921) 421.—*C. cuspidata* BL. Mus. Bot. 1 (1849) 129; MERR. En. Born. (1921) 421.—*C. multiflora* BL. *l.c.* 131.—*C. timorensis* BL. *l.c.* 128.—*C. cerisopsifolia* MIQ. Analecta pt 3 (1852) 8.—*C. multiflora* MIQ. Fl. Ind. Bat. 1, 1 (1855) 594, *non* BL. 1849.—*C. madagascariensis* TUL. Ann. Sc. Nat. IV, 6 (1856) 117.—*C. floribunda* MIQ. Fl. Ind. Bat. 1, 1 (1858) 1088.—*C. calycina* BTH. J. Linn. Soc. 3 (1859) 75.—*Stalagmites lamponga* MIQ. Sum. (1861) 496.—*Garcinia cymulosa* MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 208.—*Karekandelia brachiata, calycina, celebica, confinis, cuspidata, lanceaefolia et multiflora* O.K. Rev. Gen. 1 (1891) 235.—*C. arguta* K. & V. Bijdr. 4 (1896) 301.—*C. scortechinii* KING, J. As. Soc. Beng. 66, ii (1897) 319; RIDL. Fl. Mal. Pen. 1 (1922) 697.—*C. spinulosa* RIDL. J. Str. Br. R. As. Soc. *no* 82 (1920) 184; Fl. Mal. Pen. 1 (1922) 698.—*C. cuprea* RIDL. Kew Bull. (1938) 282.—*C. viridiflora* RIDL. Kew Bull. (1938) 282.—**Fig. 31–32.**

Tree up to 50 m by 70 cm. Bark deeply fissured, corky, gray to dark warm-brown, ridges invariably riddled by small black ants, occasionally buttressed and with adventitious roots to 1 m tall. *Leaves* elliptic-oblong, broadly-elliptic, obovate to obovate-oblong, rarely suborbicular or oblanceolate, 5–15 by 2–10 cm, papyraceous to thin-coriaceous; in the herbarium shining above, rather dull beneath, yellowish green to dark brown, entire, serrate, or denticulate, acute to shortly acuminate (acumen up to 1 cm long), base cuneate; nerves 8–12 pairs; petiole 1 cm. Stipules 1–2½ cm long. *Inflorescences* solitary, di- or trichotomously branched, 1–6 cm long, usually shining by secreted resin; peduncles short, up to 2½ cm. *Flowers* white or greenish, 3 mm long, shortly pedicelled or sessile. Bracteoles 2 or 3, entirely connate or rarely partially united into a cup at the base of the flower. *Calyx* deeply (4–)6–7(–8)-lobed, lobes deltoid. *Petals* suborbicular, obscurely bilobed, crenate, unguiculate, including the claw *c.* 1½ mm long. *Stamens c.* 2 mm long, anthers ovoid, small, filament usually glabrous rarely scaly. Disk annular, obscurely crenulate. *Ovary* semi-inferior, the free part ovoid, 5–8-celled, each cell with 2 ovules; style filiform 1½-2½ mm, stigma discoid, obscurely grooved or lobed. *Fruits* globose *c.* 7 mm diam., translucent pink to red when ripe. *Seeds* reniform.

Distr. Widely distributed from Madagascar to Ceylon, India, Siam, Burma, China (Kwangtung, Hainan), Hongkong, and Indo-China (Tonkin), throughout *Malaysia*, to New Britain, the Solomon Isl., and northern Australia.

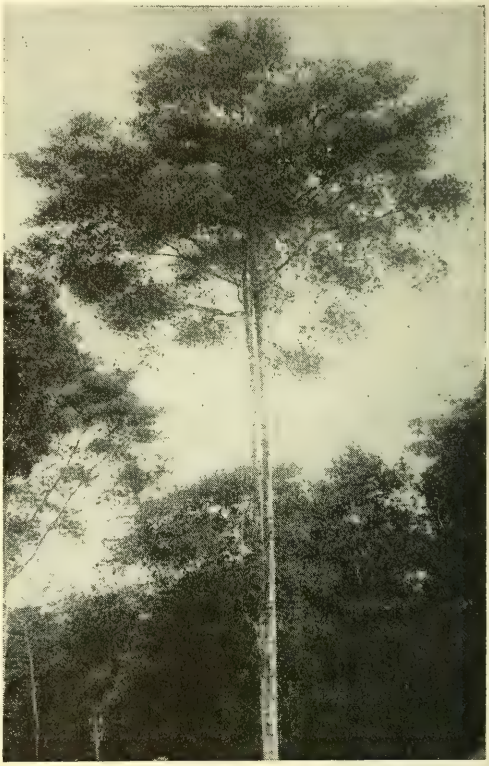


Fig. 31. *Carallia brachiata* (LOUR.) MERR. Planted specimen, For. Res. Institute, Kepong, Malaya, Jan. 1952 (HENDERSON).

Ecol. In rain-forest, more rarely in savannahs and edges of freshwater swamp forests, from the lowland up to 1800 m. In swampy forest it may occasionally produce adventitious aerial roots. According to CORNER remarkably like a *Eugenia.* Sometimes flowering in juvenile state.

Uses. Timber very handsome, moderately heavy, according to BURKILL used for building purposes in the Malay Peninsula; it makes very satisfactory picture-frames, and is most suitable for ornamental work, such as veneered panels for railway carriages, being not liable to insect attack. Also in the Philippines it is esteemed for durable cabinet work, for furniture, musical instruments, posts, and structural timber. Unfortunately it is, though of a common tree, nowhere available in quantity.

Various minor medicinal uses are known, BURKILL, *l.c.* 448.

Vern. Sumatra: *Bĕlidah*, *maransi*, *ringgit darah*, *sĕpat*, M, *ambaradé*, *tinggiran bata*, Batak, *kukur*, Gajo, *maransi*, *tinggiran rimbo*, Minangk., *sĕmĕragi*, Kubu Distr., *hĕrkat*, *kandis pulan*, *manggris*, *tĕnggeris*, Banka, *gandang*, *ganding*, *mĕrpoi*, *mĕrpuing*, *tĕngkawa*, *bongbong*, *junggut kĕli*, *kĕsingi*, *mĕransi*, *mĕ(r)singa*, *mundar*, *siseh puyoh*, Mal. Pen.; *ki kukuran*, *ki tamijang*, S, *bibis*, *gigil*, *kĕdalèn*, *kĕlumpit*, *kukuran*, *krintjing*, *liris*, *ki kukuran*, *kukurang*, *sumjak*, *pututan*, *sĕpat*, *tandjang girang*, *t. gunung*, J, *kotjèngal*, Md, *djanggut kĕli*, M; Borneo: *bĕlĕngkĕching*, *dabong*, *massulie*, *mundar*, *patjar*, M, *bara*, *bĕranggae*, *tulangular*, Dajak, *ganggang putih*, *tulang ular*, Bandjar., *kitirkitir*, Kwijau, *mundar burung*, Loa Djanan, *sawar bubu*, Bettoton, *tampilas*, Dusun, *aru*, Central E. Born.; Philippines: *anosep*, *kamaäan*, *karaékan*, *kulingmanók*, Tag., *bakáuan-gúbat*, *mañgua*, Mang., *katolit*, Ilk., *magtuñgod*, *malibasag*, Mbo., *tandul*, Sulu; Celebes: *Marabia* = *barabia*, Bug., *moro-*

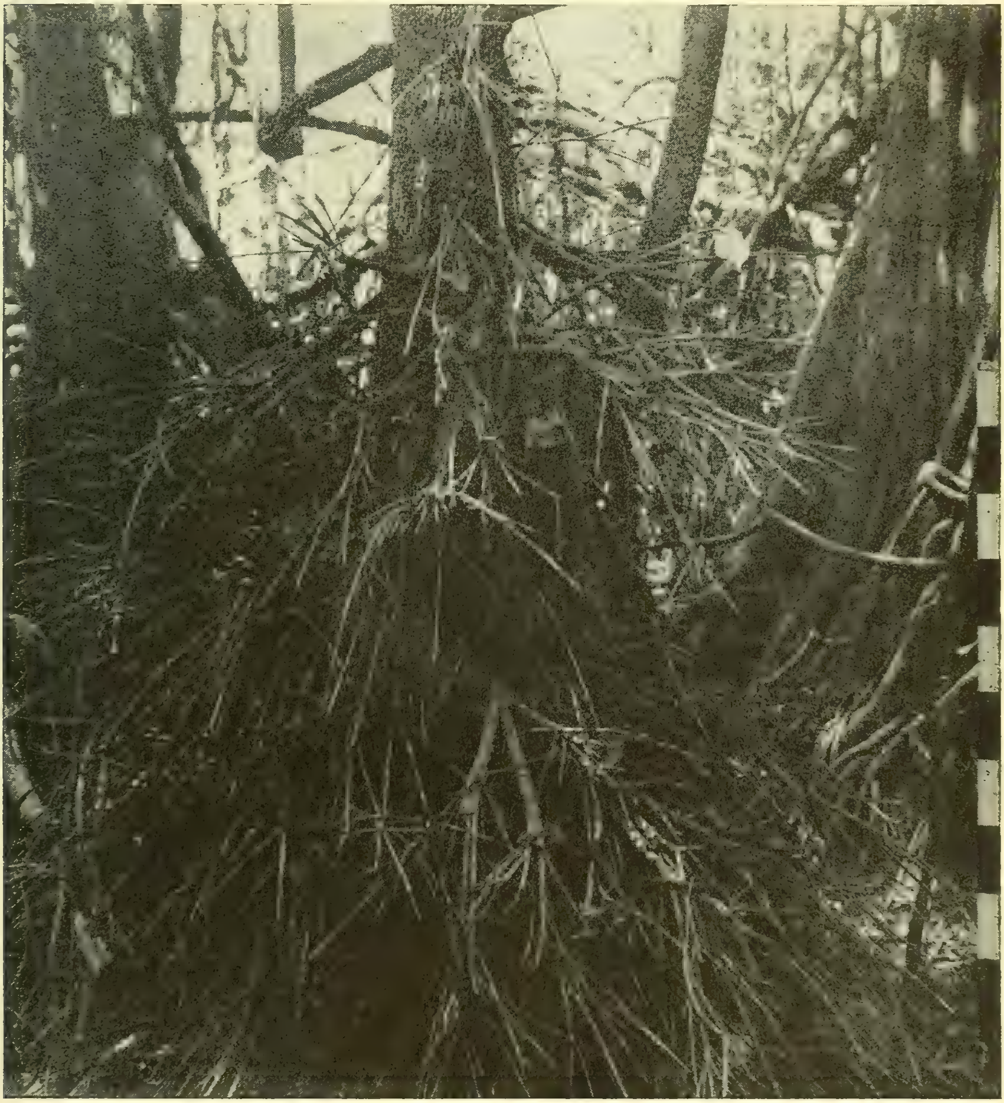


Fig. 32. *Carallia brachiata* (LOUR.) MERR. in the Bornean rapah-swamp forest develops occasionally abundant aerial roots at the stem-base. Kutei, E. Borneo, 1925 (ENDERT).

huho-motea, Tobelo, *kĕndis rĕndai*, *bawachi*, Minah. (Alf.); Moluccas: *utala*, Ceram, *aitabuin*, Aru; New Guinea: *angaur*, Bbembi, *hanaw*, Pemboa, *ngarsar*, Marind, *joseh*, Koropa, *kaisi*, Okena, *kanana*, Rawa, *konak*, Mamberamo Mts, *kwarean*, Wanigela, *tawa-ulo*, Dawa Dawa, *tongatong*, Madang, *uvila*, Upper Waria, *waku*, Onjob.

8. GYNOTROCHES

BLUME, Bijdr. (1825) 218; HASSK. Cat. Hort. Bog. (1844) 213, as *Gynaecotrochus*, *corr. etym.;* BL. Mus. Bot. 1 (1849) 126.—*Dryptopetalum* ARN. Ann. Mag. Nat. Hist. 1 (1838) 372.—**Fig. 33.**

Shrub or tree. Young branchlets hollow. *Leaves* decussate, entire. Stipules lanceolate. *Flowers* tiny, solitary on short stalks, fascicled in short, condensed and tubercular clusters, bracteolate. Pedicels articulated. *Calyx* deeply 4–5-lobed. *Petals* 4–5, obovate rarely elliptic, unguiculate, divided into filamentous appendages at the upper third or half. *Stamens* 8–10, free. *Ovary* superior, slightly ridged, at the base connate with the calyx, 4–6-celled, each cell with 3–8 ovules; style simple. *Fruit* a berry, few- to many-seeded, globose, sometimes oblong, much wrinkled when dry. *Seeds* with fleshy endosperm; embryo linear, axile.

Distr. Monotypic, from Burma (Upper Tenasserim) and Siam throughout *Malaysia* (not yet recorded from the Lesser Sunda Islands) to Micronesia (Carolines: Tjaparna, Ponape), and Melanesia (Solomons and New Britain).

Ecol. Primary and secondary forests, up to 2250 m.

1. Gynotroches axillaris BL. Bijdr. (1825) 219; Mus. Bot. 1 (1849) 127, t. 31, *incl. var. parvifolia;* BENTH. J. Proc. Linn. Soc. 3 (1859) 76; MIQ. Fl. Ind. Bat. 1, 1 (1855) 592; KURZ, For. Fl. Burma 1 (1877) 451; HENSLOW, in Hook. *f.* Fl. Br. Ind. 2 (1878) 440; KING, J. As. Soc. Beng. 66, ii (1897) 321; SCHIMP. in E. & P. Pfl. Fam. 3, 7 (1898) 51, f. 26, A–E; K. & V. Bijdr. 4 (1896) 308, *incl. var. obtusa l.c.* 310; BACK. Schoolfl. (1911) 486; KOORD. Exk. Fl. Java 2 (1912) 667; Atlas 1 (1913) t. 108; MERR. En. Born. (1921) 420; En. Philip. 3 (1923) 144; CRAIB, Fl. Siam. En. 1 (1931) 599; KANEHIRA, En. Micr. (1935) 377; BURK. Dict. 1 (1935) 1121; BACK. Bekn. Fl. Java (em. ed.) 4b (1944) fam. 102, p. 2; CORNER, Ways. Trees (1940) 522, f. 179; BROWNE, For. Trees Sar. & Brun. (1955) 305.—*Microtropis? coriacea* WALL. Cat. *no* 4338 (1831), *nomen.*—*Dryptopetalum coriaceum* ARN. Ann. Mag. Nat. Hist. 1 (1838) 373.—*G. dryptopetalum* BL. *incl. var. lanceolata* BL. Mus. Bot. 1 (1849) 127.—*G. micrantha* BL. *incl. var. tuberculata* BL. *op. cit.* 127.—*G. reticulata* A. GRAY, in Wilkes, Bot. U.S. Expl. Exped. 1 (1854) 607.—*G. parvifolia* MERR. Publ. Gov. Lab. Philip. *no* 35 (1905) 46; En. Philip. 3 (1923) 144, not based on *G. axillaris* BL. *var. parvifolia.*—*G. puberula* MERR. Philip. J. Sc. 10 (1915) Bot. 333; En. Philip. 3 (1923) 144.—*G. lanceolata* MERR. Philip. J. Sc. 11 (1916) Bot. 21; En. Philip. 3 (1923) 144.—**Fig. 33.**

Tree up to 15–30(–45) m by 30–50 cm, but very often rather small, and occasionally shrubby; 1–2 m high specimens have been found with flowers and fruit. Bark transversely fissured, grey to blackish; young branches hollow, brown coloured, sometimes pubescent; nodes ± swollen. *Leaves* variable in shape (ovate, ovate-oblong, elliptic-oblong, obovate oblong, or lanceolate), $4^1/_2$–20 by $1^1/_2$–9 cm, bluntly or shortly acuminate to acute, acute rarely obtuse at the base, usually glabrous, rarely pubescent beneath or only on the nerves and veinlets, sometimes lepidote on both surfaces, shining and dark brown when dry; nerves 5–9 pairs, ascending along the margins, veinlets prominent beneath, flat to slightly prominent above; petiole $^1/_2$–1 cm. Stipules $1^1/_2$ cm long, sometimes pubescent. Bracteoles sometimes pubescent and condensed into short, tubercular glomerules. *Flowers* greenish-white, few to 16, subsessile to 5 mm pedicelled, bisexual, but obviously occasionally male by abortion. *Calyx* lobes 4–5, ovate, $1^1/_2$–$2^1/_2$ by $1^1/_2$–3 mm, with a tuft of hairs at the apex. *Petals* 2–$2^1/_2$ by $^3/_4$ mm. Disk cup-shaped or nearly flat, crenulate to 8–10-lobed. *Stamens* 8–10, attached on the margin of the disk or just beneath it; filaments incurved, 1–$1^1/_2$ mm; anthers subglobose to ovoid, obtuse or slightly apiculate. *Ovary* ovoid, sometimes abortive; style columnar, short, up to 2 mm; stigma discoid and 4–8-lobed or slender with spreading lobes. *Berries* red, then shiny black, pulpy, usually globose and *c.* 3 mm diam., rarely oblong and 5–7 by 3–5 mm, calyx lobes erect or completely reflexed. *Seeds* ellipsoid, $1^1/_2$ by $^1/_2$ mm, areolate.

Distr. From S. Burma (Upper Tenasserim) and S. Siam (Nakawn Sritamarat) throughout *Malaysia* to Australia, Melanesia (Solomon Isl.: Ysabel & Bougainville Isl.; New Britain), and Micronesia (Carolines: Tjaparna, Ponape), not yet recorded from Central to E. Java and the Lesser Sunda Islands.

Ecol. Marshy places, swamps, particularly along creeks in tall rain-forests, slopes of partially

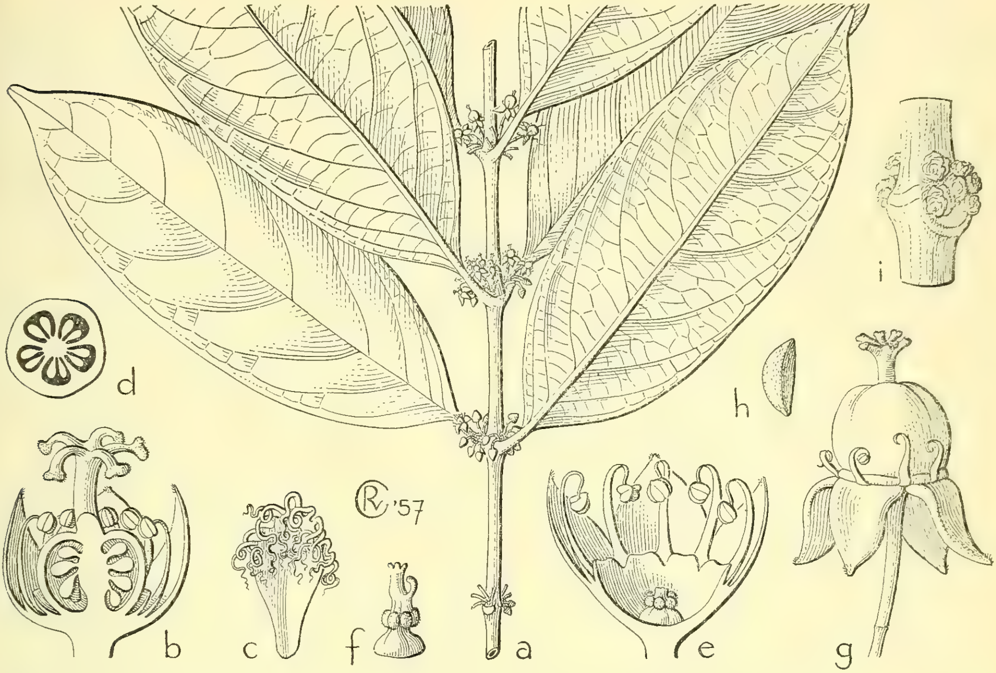


Fig. 33. *Gynotroches axillaris* BL. *a.* Habit, × 2/3, *b.* longitudinal section of ♀ flower (petals removed), × 10, *c.* petal, × 10, *d.* cross-section of ovary, × 10, *e.* longitudinal section of ♂ flower (petals removed), × 10, *f.* pistil rudiment of ♂ flower, × 13, *g.* fruit, × 5, *h.* seed, × 10, *i.* a node showing condensed bracts, × 5/3 (*a, g* VAN STEENIS 5101, *b, d* RICHARDS 1430, *c, e, f* RICHARDS 1565, *h* POLAK 733, *i* KOORDERS 1117).

open virgin forests, and very common in secondary forests, from the lowland up to 2250 m.

It clearly avoids regions subject to a seasonal climate as it is absent from Central Java to Timor; in Java it is confined to the Res. of Bantam, Bogor, and Preanger, one specimen being found in an everwet forest in S. Banjumas.

HOSOKAWA found *G. axillaris* common in the mossy hill forest of the Micronesian islands Ponape and Kusaie together with *Alsophila* where it produces aerial roots from the boughs of the crowns (Mem. Fac. Sc. Kyushu Univ. E 1, 1952, 65–82).

Uses. The brownish-white timber is of little use and not durable, it is occasionally used under roof, further for blades of oars, and sometimes for rafters and house-posts.

Vern. *Bulu-bulu* (in common with several superficially similar trees), *bĕbulu, junggut kĕtjil mata kĕli, mĕmalu kĕtjil, mĕmbulu, mĕrbulu*, Mal. Pen., *kata kĕli*, M (Sum.), *sibeuruwah, surimanuh*, Simalur (Tapah dial.), *kaju bulu*, Kubu Distr., *mĕngkĕli, mĕnsollong, tĕlundju, sabar bulu*, Banka, *kukuran*, S, *kupi-kupi*, Brunei, *mĕmbuloh, sabar baku*, Sarawak; Philippines: *kibal, malakulambisan*, Tag., *auai*, Mbo., *bayasbas, doyok-dóyok, talingan*, C. Bis.

Notes. This species is very widely distributed and is markedly variable in leaf-size and shape. Some specimens collected above 1000 m have small and obovate leaves and larger flowers and fruits. The filamentous appendages of the petals are usually in a fringe at the upper third or half, or sometimes there are 9 of them, 3 at the apex, and 3 at the margin of each side (BRASS 2475, LAM 1797). There is a remarkable variability in the structure of the ovary, namely in the placentation: the ovules are fascicled and attached at the top (ACHMAD 163), at the base (LAM 1972), or at the middle (BRASS 2495) of the axis, or even along the axis (RICHARDS 1430). The stigmas vary from discoid and obscurely grooved to deeply divided into linear and spreading lobes.

The remarkable 'looseness' in floral characters of this monotypic genus suggests a promising matrix for future phylogenetical development into several more restricted, rigid types.—VAN STEENIS.

Excluded

Gynotroches membranifolia MIQ. Analecta pt 3 (1852) 7 (T. METZ 713 in Pl. Hohenack.) = *Dryptopetalum membranaceum* MIQ. in Pl. Hohenack. *no* 713 *in sched.* = *Blepharistemma corymbosum* [BENTH. in Wall. Cat. *no* 6320, *nom. nud.*] WALL. *ex* BENTH. J. Proc. Linn. Soc. Bot. 3 (1858) 65, 78 = *Blepharistemma membranifolia* (MIQ.) DING HOU, *nov. comb.*

BENTHAM omitted reference to MIQUEL's publication and only cited the unpublished provisional name MIQUEL had attached to the type *exsiccata* METZ 713. As far as I know no evaluation of MIQUEL's name was ever proposed and it has fallen into oblivion. The tracing of its identity I owe to Dr R. C. BAKHUIZEN VAN DEN BRINK *f.*

9. PELLACALYX

KORTH. Tijd. Nat. Gesch. Phys. 3 (1836) 20.—*Plaesiantha* HOOK. *f.* in B. & H. Gen. Pl. 1 (1865) 681.—*Crateriantlius* VAL. *ex* HEYNE, Nutt. Pl. 4 (1917) 196, *nom. semi-nud., cf.* STEEN. Bull. Jard. Bot. Btzg III, 17 (1948) 457.—**Fig. 34–35.**

Trees. Young branches hollow. *Leaves* decussate, entire, obscurely serrulate, or rarely serrate, densely or sparsely pubescent with stellate-hairs rarely mixed with simple ones, or simple hairs only, sometimes glabrescent or subglabrous. Stipules with not overlapping margins, minutely stellate-hairy outside. *Flowers* fascicled or on branched glomerules, 2–8 together, rarely solitary, with minute bracteoles. *Calyx* (incl. ovary) tubular, lobes (3–)4–5(–6), lower part of the tube inside always hairy. *Petals* densely puberulous outside, inserted on the margin of the calyx tube; apex denticulate to fringed in various degree. *Stamens* twice as many as petals, inflexed, inserted on the margin of calyx tube, subulate or deltoid, connate at the base or free, 1- rarely 2-seriate, unequal, 5 long, 5 short (except in *P. pustulatus*); anthers suborbicular. *Ovary* inferior, 9–10(–12)-celled, each cell with 8–25 fasciculate ovules; style columnar, usually pilose; stigma discoid or capitate, obscurely 8–10-lobed. *Fruit* a subglobose, few- to many-seeded berry, 1 to several in each axil. *Seeds* oblong or ellipsoid, black; endosperm fleshy; embryo linear, axile.

Distr. Species 7 or 8, distributed in Burma, Siam, S. China (Yunnan), and *Malaysia:* Sumatra, Malay Peninsula, Borneo, North Celebes, and the Philippines.

In continental Asia *P. yunnanensis* H.H.HU seems rather disjunct from the Siam-Burmese generic frontier; it has been described on a fruiting specimen; no material was available to me.

In Malaysia 4 of the 6 species have rather restricted areas in one island or district, but they seem to me all perfectly good species.

Ecol. In forests from the lowland up to 1300 m.

KEY TO THE SPECIES

1. Flowers 4–merous, very rarely with a few 3- or 5-merous flowers together with the 4-merous ones. Calyx mostly glabrous outside, the tube inside with only very short straight hairs in the lower half. Petals denticulate at the upper end. (Flowers 2–3 mm wide).
  2. Leaves usually obovate rarely obovate-oblong, 7–11(–15) by 3½–5 cm. Nerves 5–7 pairs. Stipules 3–5(–7) mm. Style not ridged . . . . **1. P. lobbii**
  2. Leaves usually elliptic-oblong rarely obovate, 12–18½ by 3–6½ cm. Nerves 9–11 pairs. Stipules 10–12 mm. Style distinctly ridged . . . . **2. P. saccardianus**
1. Flowers 5–merous, very rarely with a few 4- or 6-merous flowers together with the 5-merous ones. Calyx usually densely or sparsely stellate-pubescent, rarely glabrous outside, the tube inside with a zone of woolly or villous hairs (except in *P. symphiodiscus*), its bottom covered with very short straight hairs. Petals always with filamentous or subulate appendages at the upper end. (Flowers 4–6 mm wide.)
  3. Calyx tube very short, not longer than broad, base acute. Calyx lobes about half as long as the tube. Free filaments isomorphic, 1–seriate, equal in size and shape . . . . . . **3. P. pustulatus**
  3. Calyx tube always longer than broad, base rounded or slightly truncate. Calyx lobes always shorter than the tube. Free filaments dimorphic, alternately shorter and longer, 1- or 2-seriate.
    4. Stamens 2-seriate. Filaments of the outer whorl united at the base, free part of the filaments alternisepalous and slightly incurved at the apex; stamens of the inner whorl with an extremely short (knob-like) filament, inserted distant from the sinuses. Calyx tube with only short, straight hairs inside in the lower part. Undersurface of the leaves with stellate hairs mixed with simple ones. Fig. 35b–c. . . . . **4. P. symphiodiscus**
    4. Stamens 1-seriate, free filaments alternately shorter and longer. Calyx tube inside with a zone of woolly or villous hairs above the short and straight ones.

5. Leaves thin, underneath distinctly pubescent with simple, long, white hairs. Nerves *c.* 8 pairs. Style usually exserted and glabrous at the upper third . . . . **5. P. parkinsonii**
5. Leaves chartaceous to firmly chartaceous, underneath with densely or sparsely stellate hairs. Nerves 9–14 pairs. Style 1/3–1/2 the length of the tube, pilose or covered with short hairs throughout.
    6. Leaves usually with a rather dense, rarely sparse indument of rusty, stellate or more or less lepidote hairs, very rarely subglabrous or mixed with some simple hairs. Calyx tube inside with a zone of woolly hairs. Petals 1½–2 mm long, the upper end usually with a few short appendages up to 1½(–2½) mm. Calyx lobes reflexed in anthesis . . . . **6. P. axillaris**
    6. Leaves underside usually subglabrous with scattered, lepidote-like, minute stellate hairs. Calyx tube inside with a zone of villous hairs. Petals 2½–3½ mm long, the upper end always fringed with many rather long appendages 3–5 mm. Calyx lobes erect in anthesis . . **7. P. cristatus**

1. Pellacalyx lobbii (HOOK. *f.*) SCHIMP. in E. & P. Pfl. Fam. 3, 7 (1893) 54.—*Plaesiantha lobbii* HOOK. *f.* in Benth. & Hook. *f.* Gen. Pl. 1 (1865) 145.—**Fig. 34.**

Tree up to 35(–45) m by 40(–65) cm, sometimes with buttresses 1½–5 m high. Bark grey to brown, regularly polygonally fissured. *Leaves* obovate, obovate-oblong, 7–11(–15) by 3½–5 cm, entire to remotely serrulate, glabrous, sometimes lepidote above, rarely puberulous on the midrib and nerves on both surfaces, abruptly acute, base cuneate; nerves 5–7 pairs, slightly elevated beneath, plane above; petiole 6 mm. Stipules 3–5(–7) mm long. *Calyx* (incl. ovary) narrow, 6½–8 by 2–3 mm, glabrous or sparingly pubescent with minute, stellate hairs without, green, (3–)4(–5)-lobed, lobes deltoid, 1½–2 mm long, acuminate. *Petals* white, slightly obovate, 1½–2 mm long, slightly dentate in the upper half. *Ovary* 9-celled, style 3 mm long, slightly pilose. *Fruit* green, subglobose, *c.* 8 mm diam., calyx lobes erect, very rarely reflexed. *Seeds* ellipsoid, 1–2 by 1 mm.

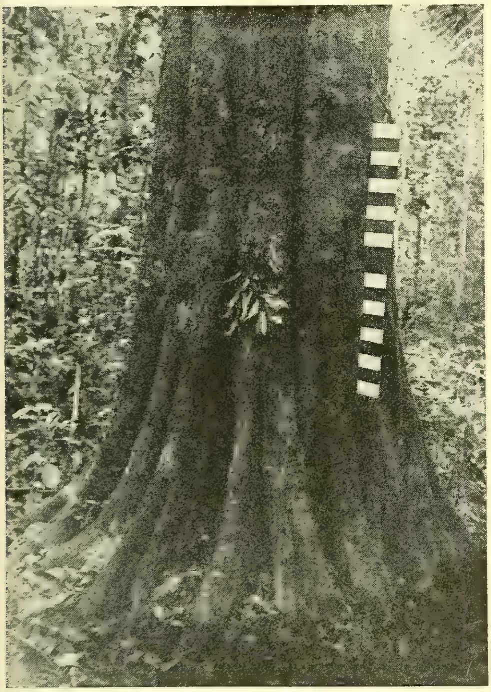


Fig. 34. Stem-base of *Pellacalyx lobbii* (HOOK. *f.*) SCHIMP. in the forest reserve Bajunglintjir, Aug. 1919 (ENDERT).

Distr. *Malaysia:* Borneo (common), and Sumatra (Palembang, Asahan).

Ecol. A rather small tree of open hill-sides and undulating country at low altitudes. *Fl.* Jan.–April, *fr.* Jan.–Dec.

Uses. Wood fairly heavy, yellowish-brown, occasionally used for rafters and fuel.

Vern. *Bulu-bulu, bĕbulu, mĕmbulu rimba, pianggu jantan, johor, lĕmak kĕtam,* Mal. Pen., *bulu, rĕbung,* Sum., *kaju bulu,* Palemb., *pasĕrujan gunugo, rasu,* Dyak.

Note. *P. lobbii* is closely related to *P. saccardianus*, and most specimens of it were misidentified as belonging to the latter species.They can easily be separated by the leaf shape and the floral structure.

2. Pellacalyx saccardianus SCORT. Nuov. Giorn. Bot. Ital. 17 (1885) 145; HEMSL. in Hook. Ic. Pl. 16 (1886) t. 1546; RIDL. Fl. Mal. Pen. 1 (1922) 699; CORNER, Ways. Trees (1940) 524, f. 181, *p.p.*

Small tree up to 15 m by 25 cm. Young branches puberulous. *Leaves* elliptic-oblong to rarely obovate, 12–18½ by 3–6½ cm, entire, rarely with fascicles of hairs or serrulate, usually glabrous, rarely with minute stellate hairs on the veins, sometimes also on both surfaces of the young blades, shortly acuminate, base rounded to cuneate; nerves and veins elevated beneath, visible or slightly elevated above; petiole 8–10 mm. Stipules 10 mm long. *Calyx* (incl. ovary) glabrous or short-sparingly hairy outside, 5½–9 by 3 mm, (3–)4(–5)-lobed, lobes deltoid, 2 mm long, acuminate, tube cylindric *c.* 3 mm long. *Petals* obovate, 1½–2½ mm long, apex rounded sometimes slightly emarginate and denticulate. *Ovary* 9-celled; style distinctly ridged, 3 mm long, with short, straight hairs; stigma discoid and slightly lobed. *Fruits* subglobose, glabrous, 10 mm diam., greenish-yellow when ripening. *Seeds* 1–1½ mm long, ellipsoid.

Distr. *Malaysia:* Malay Peninsula.

Ecol. Common in damp lowland forests up to 950 m; *fl.* May-Dec., *fr.* June-Nov.

Vern. *Huka hurgu, kayu johor, mĕmbuloh rimbah, piango jantan,* M.

Note. The leaf size and shape in *P. saccardianus* is more variable than in *P. lobbii*. CORNER recorded that the leaves may be occasionally in whorls of three.

3. Pellacalyx pustulatus MERR. Publ. Gov. Lab. Philip. *no* 35 (1905) 47; Philip. J. Sc. 1 (1906) Suppl. 103; En. Philip. 3 (1923) 148.

Tree up to 18 m by 25 cm. Young branches sparingly puberulous. *Leaves* elliptic, ovate or slightly obovate, entire or rarely obscurely glandular-toothed, 11–17 by 4–7 cm, abruptly acute, base cuneate, midrib elevated beneath, depressed above; nerves 6–8 pairs, slightly elevated beneath, distinct above; petiole *c.* 1 cm, glabrous, or slightly pubescent. Stipules 6–8 mm long. *Calyx* (incl. ovary) subcampanulate, acute to the base, sparingly stellate-puberulous or glabrous; lobes 5(–6), deltoid, acute, 2–3 mm long; tube short 2 mm long, densely villous within, its bottom covered with short straight hairs, the long hairs falling off in fruit, the short ones persistent. *Petals* white, obovate rarely suborbicular, 2–3$^1/_2$ mm long, apex obtuse, sometimes with 1–3 subulate appendages, base narrowed. *Stamens* equal. *Ovary* 1$^1/_2$ mm long, 9-celled; style 1$^1/_2$–3 mm, glabrous or with sparse straight hairs at the base; stigma discoid, 8–9-lobed, or 4-5-lobed and then each lobe bifid, lobes slender, reflexed. *Fruits* globose, 12–15 mm diam. *Seeds* elliptic-oblong, obtuse at both ends, 2 by 1 mm, slightly areolate.

Distr. *Malaysia:* Philippines (Leyte, Luzon, Mindanao, and Samar), and N. Celebes (Minahasa).

Ecol. Primary forests from the lowland up to 900 m.

Vern. Philippines: *magatalo,* Mago, *mamatog,* Tag., *pamaluian,* Bag.

4. Pellacalyx symphiodiscus STAPF, Kew Bull. (1898) 224; MERR. En. Born. (1921) 422.—**Fig. 35a–e.**

Shrub or small tree up to 12 m tall. Branches and branchlets covered with rusty-stellate hairs. *Leaves* ovate-oblong to obovate-oblong, 9–19 by 3$^1/_2$–7 cm, shortly acuminate to acute, base rounded or acute, margin with tufted hairs, sometimes glabrous; midrib and nerves elevated beneath, slightly depressed or plane above; petiole 4–10 mm, with minutely stellate hairs. Stipules 13 mm long. *Calyx* (incl. ovary) cylindric or slightly campanulate-tubular, 9–12 by 4–5 mm, densely stellate-hairy outside, lobes 5(–6), deltoid, *c.* 2 mm long, acuminate, lower part of the tube inside with short, straight hairs; pedicels 6–10 mm. *Petals* obovate-oblong, 1$^1/_2$–2$^1/_2$ mm long, the top fringed with filamentous, up to *c.* 2 mm long appendages. *Ovary* half the length of the calyx tube; style columnar, *c.* $^3/_4$ the length of the calyx tube, covered with short, straight hairs, stigma capitate,

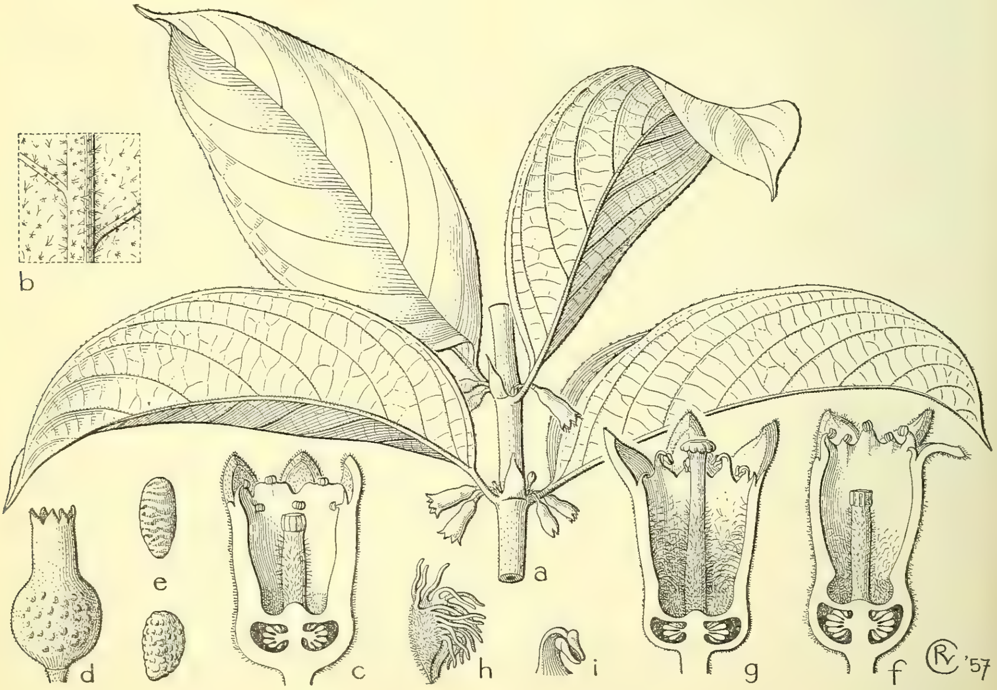


Fig. 35. *Pellacalyx symphiodiscus* STAPF. *a.* Habit, × $^2/_3$, *b.* undersurface of a portion of leaf, × 5, *c.* longitudinal section of flower (petals removed), × 3, *d.* young fruit, × $^4/_3$, *e.* seeds, × 13.—*P. axillaris* KORTH. *f.* Longitudinal section of flower (petals removed), × 3.—*P. parkinsonii* FISCHER. *g.* Longitudinal section of flower (petals removed), × 3, *h.* petal, × 7, *i.* stamen, × 11 (*a, b, d, e* RAMOS 1427, *c* HAVILAND b.q.v.f., *f* HAVILAND & HOSE *s.n.* = 2312, *g–i* KERR 12134).

slightly grooved. *Fruits* subglobose, *c.* 9 mm diam., calyx lobes erect. *Seeds* ellipsoid, $1^1/_2$ mm long, slightly transversely striate.

Distr. *Malaysia:* Borneo (Sarawak).

Vern. *Mura buloh.*

5. Pellacalyx parkinsonii FISCHER, Kew Bull. (1927) 311, with fig.; CRAIB, Fl. Siam. En. 1 (1931) 599.—**Fig. 35g–i.**

Tree up to *c.* 18 m tall. Branchlets sparsely pubescent with minutely stellate hairs. *Leaves* elliptic or elliptic-oblong, 10–19 by 5–7 cm, entire, thinly white-hairy beneath, with rather scattered, short, simple hairs above, especially on the midrib and nerves, abruptly acute, base rounded or cuneate; midrib elevated beneath, depressed above; nerves slightly elevated beneath, visible above; petiole 7–10 mm, pubescent. Pedicel *c.* 7 mm. *Calyx* (incl. ovary) oblong, 8–12 by 3–5 mm, minutely stellate-hairy outside; lobes 5(–6), ovate, acuminate, 2–3 mm long; tube inside villous in the lower half down to *c.* 1 mm of the basal part which is, as the bottom, covered with very short, straight hairs. *Petals* white, obovate (suborbicular when young), 2–3 mm long, fringed with filamentous, *c.* 1–$1^1/_2$ mm long appendages in the upper half or third. *Ovary c.* $^1/_4$–$^1/_6$ of the length of the calyx tube, 10-celled; style columnar, 6–8 mm, slightly exserted, covered with short, straight hairs below, glabrous in the upper third; stigma capitate, flat, slightly lobed. *Fruit* unknown.

Distr. Burma (Mergui, Victoria Isl.), Siam (Kamala, Pato), not yet found in *Malaysia.*

Ecol. In forest from the lowland up to 1200 m.

6. Pellacalyx axillaris KORTH. Tijd. Nat. Gesch. Phys. 3 (1836) 20, t. 2; GRIFF. Notul. 4 (1854) 429; Ic. Pl. Asiat. (1854) t. 486, f. 1; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1088; BENTH. J. Proc. Linn. Soc. Bot. 3 (1858) 76; HENSLOW, in Hook. *f.* Fl. Br. Ind. 2 (1878) 440; SCHIMP. in E. & P. Pfl. Fam. 3, 7 (1898) 54, f. 27, O–P; KING, J. As. Soc. Beng. 66, ii (1897) 320; RIDL. Fl. Mal. Pen. 1 (1922) 699; VAL. Bull. Jard. Bot. Btzg III, 2 (1920) 346-347, t. 8–9, *incl. var. serratifolia;* MERR. En. Philip. 3 (1923) 148; CORNER, Ways. Trees (1940) 523, f. 180.—*Craterianthus fimbripetalus* VAL. *ex* HEYNE, Nutt. Pl. 4 (1917) 196, *nom. semi-nud.*, based on HALLIER 121B (Bo), *cf.* STEEN. Bull. Jard. Bot. Btzg III, 17 (1948) 457.—**Fig. 35f.**

Tree up to 24 m by 60 cm, trunk straight, monopodial, rather slender, buttresses up to 1 m. Branches stiffly horizontal, twigs rusty pubescent. *Leaves* drooping, oblong rarely obovate-oblong, 10–20 by 5–6 cm, densely stellately rusty-pubescent beneath, scattered hairy and glabrescent to glabrous above, acute, abruptly acute, or rarely acuminate, base obtuse to rounded, margin entire to serrulate; midrib prominently elevated beneath, slightly elevated above, nerves 9–12 pairs, ascending, elevated beneath, plane or slightly depressed above; petiole 5–8 mm. Stipules 1–$1^1/_2$ cm long, rusty pubescent. Inflorescence densely rusty-pubescent. Pedicels 1–2 cm. *Calyx* (incl. ovary) oblong, *c.* 10 mm long, base acute, densely pubescent without; lobes 5(–6) deltoid, $1^1/_2$ mm long; tube densely woolly hairy inside at the base. *Petals* yellowish green or white, broad-elliptic, obtuse rarely emarginate, sometimes the apex with filamentous appendages $1^1/_2$(–$2^1/_2$) mm long, soon caducous. *Ovary c.* 1 by 4 mm, 10-celled; style 3 mm, pilose. *Fruits* ovoid or subglobose, *c.* 10 by 8 mm, (*c.* 18 by 16 mm when fresh *sec.* CORNER), calyx lobes reflexed. *Seeds* oblong, obtuse at both ends, *c.* $1^1/_2$ by 1 mm, obscurely striate.

Distr. *Malaysia:* Sumatra, Malay Peninsula, Borneo, and the Philippines (Mindanao).

Ecol. Common in damp lowland primary and secondary forests, especially along streams, up to 1300 m. According to CORNER, *l.c.*, it develops in swampy ground loop-like breathing roots like some mangrove trees. *Fl.* April-Dec., *fr.* Jan.-June.

Uses. According to HEYNE the timber is red, hard, and heavy and would be durable under roof.

Vern. *Bulu-bulu* (in common with *Diospyros* and other trees), *abu-abu air*, *buloh*, *bĕbuloh*, *kaju bulu*, *k. baro*, *mĕmbuloh*, *bĕrbulu*, *mata kĕli*, *piangu jantan*, Mal. Pen., *bĕbulu*, *mèrah bulu*, Sum. E.C., *kaju bulu*, Palemb., *kaju mèrah kuku*, Banka, *mĕrbuloh*, Sarawak, *kiramu*, *mĕndĕrakan*, Borneo.

Note. CORNER recorded the flowers occasionally 6-merous.

7. Pellacalyx cristatus HEMSL. in Hook. Ic. Pl. 16 (1886) t. 1546; RIDL. Kew Bull. (1938) 282.

Small tree up to *c.* 9 m tall. *Leaves* narrowly oblong to ovate-oblong, 10–17 by 3–5 cm, gradually acuminate, base rounded, rarely cuneate, margin serrulate to serrate; midrib elevated beneath, depressed above; nerves elevated beneath, visible above; young leaves with minute, scale-like, short, stellate hairs on both surfaces, glabrescent; petiole 7–10 mm. Stipules $1^1/_2$ cm long. Pedicels *c.* 7 mm. *Calyx* (incl. ovary) green, 7–12 by 4 mm, with scattered, minute, scaly, stellate hairs outside; lobes 5(–6), deltoid, 2 mm long; tube cylindric, slightly contracted at the middle, with a zone of villous hairs near the base. *Petals* green, elliptic, $2^1/_2$–$3^1/_2$ mm long, the upper end fringed with filamentous appendages up to 5 mm long. *Ovary c.* 2 mm long, 10-celled; style columnar, slightly ridged, covered with short straight hairs; stigma capitate, slightly grooved. *Fruits* subglobose, *c.* 1 cm in diam., calyx lobes erect. *Seeds* ellipsoid, transversely striate, *c.* $1^1/_2$ mm long.

Distr. *Malaysia:* Borneo (Dallas, Mt Kinabalu, Sarawak, and Landak).

Ecol. On mountain ridges, 400–900 m.

Excluded

Cremnobates RIDL. Trans. Linn. Soc. Bot. 9 (1916) 41 = *Schizomeria, cf.* SCHLTR, Bot. Jahrb. 55 (1918) 194 (*Cunoniac.*).

Legnotis lanceolata BLANCO, Fl. Filip. (1837) 445 = *Decaspermum fruticosum* FORST., *cf.* MERR. Sp. Blanc. (1918) 287.

CONNARACEAE (P. W. Leenhouts, Leyden)

Trees, shrubs, or (most Mal. *spp.*) lianas. Indument of simple hairs, rarely dendroid (*Connarus spp.*), often mixed with capitate-glandular hairs. *Leaves* spirally arranged, exstipulate, imparipinnate, rarely unifoliolate. Base of the petiole and petiolules thickened. Leaflets usually not strictly opposite, penninerved to triplinerved,entire, the base often slightly peltate. *Inflorescences* axillary, pseudoterminal or terminal, paniculate, bracteate; pedicels articulated near the apex. *Flowers* 5(–4)-merous, hypogynous, bisexual (rarely by abortion unisexual and then dioecious), heterotri- or -distylous. *Sepals* usually (in Mal. *spp.* always) free or confluent at the very base only. *Petals* free. *Stamens* free or coherent at the base, in 2 whorls, inner (epipetalous) ones nearly always smaller, not rarely sterile or staminodial, sometimes partly absent; anthers dorsifixed in the lower half, curving outwards in anthesis, dehiscing lengthwise and introrse. *Pistils* (8–)5(–3) or 1, epipetalous, free; ovary 1-celled, with 2 nearly basal to axillary, collateral, orthotropous or anatropous (in Mal. *Connarus*) ovules, one of which sometimes small and sterile. *Fruits* dry or more or less fleshy, one-seeded, usually opening by a ventral slit, sometimes also dehiscing along the dorsal side, rarely circumsciss at the base, sometimes indehiscent. *Seed* large, always with an arilloid, with or without endosperm; cotyledons thick, flat.

Distribution. Genera 16, with an estimated number of *c.* 300–350 species, the family circumtropical, but predominantly developed in Africa, in *Malaysia* represented by 6 genera and *c.* 40 species.

Ecology. Most Malaysian representatives are lianas or scandent shrubs, frequenting open places in the forest, forest-edges, river-banks, *etc.;* a few are medium-sized rain-forest trees. In contrast with the African species among which are many treelets and shrubs from parklands and savannahs, no Malaysian representatives are found in similar habitats in the Lesser Sunda Islands.

Pollination is probably usually performed by insects. The flowers are white to cream-coloured or pinkish, and small, but form together often rather conspicuous inflorescences, which are usually placed near the ends of the twigs. Moreover, the flowers are often reported to be fragrant and in all probability contain honey; at least in *Ellipanthus* the outer side of the staminal tube is sometimes gland-like thickened and is reported to secrete nectar.

In the whole family the flowers are distinctly heterostylous. J. H. HEMSLEY (Fl. Trop. E. Afr., Connar. 1956, 2) wonders whether (part of) these flowers are functionally unisexual. A tendency towards dioecism is only known from the genus *Ellipanthus.* In the other genera the stamens as well as the ovaries, in short-styled as well as in long-styled flowers seem to be fertile. As, however, the flowering period of an individual plant is short, and they are flowering only once a year, it is difficult to solve this problem in the herbarium. It deserves the attention of field botanists.

Dispersal of fruits will probably be effected by birds. The colours of ripe, open fruits are very conspicuous with a typical contrast between pericarp and seed: fruit orange to scarlet, sometimes inside bright green, seed partly protruding, shining brown to black, partly (rarely entirely) covered by the fleshy, yellow to orange arilloid.

Anatomy. SCHELLENBERG, Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 80; MOLL & JANSSONIUS, Mikr. 3 (1914) 5 (*Ellipanthus*); SCHELLENBERG, Pfl. R. Heft 103 (1938) 3; HEIMSCH, Lilloa 8 (1942) 168; METCALFE & CHALK, Anat. Dicot. 1 (1950) 471.

Mucilaginous cells are present in the epidermis of many species. In Malaysia they are especially large in the upper surface of the leaflets of *Agelaea*, leaving when dried minute pits which are easily observed with a hand lens.

Secretory cavities filled with mucilage or with brown resinous material are known to occur in the parenchyma in several genera. In Malaysia they are specially conspicuous in *Connarus*, both in the mesophyll of the leaflets and in the floral parts: sepals, petals, and filaments (see COSTERUS, Ann. Jard. Bot. Btzg Suppl. 2, 1898, 109).

Uses. See BRILL & WELLS, Philip. J. Sc. 12 (1917) A, 184.

Morphology. The *inflorescence* seems to be essentially axillary and paniculate. The development apparently goes according to two schemes. Firstly, by the grouping together towards the ends of the twigs and by the reduction of the upper leaves to bracts, the inflorescences may become pseudo-terminal (vegetative terminal bud present and often developing after the flowering period) or terminal (no vegetative terminal bud present). Secondly, the inflorescences may remain axillary and become fasciculate (sometimes even pseudo-umbellate) by the reduction of the peduncle; in this case all branches are often of about the same length, and together inserted on a knob. This is often found in ramiflorous species.

The *arilloid*. SCHELLENBERG (Pfl. R. Heft 103, 1938, 13) obviously wrongly interpreted the fleshy appendages of the seed as a true aril. PLANCHON already, in his study of true and false arils (Ann. Sc. Nat. III, Bot. 3, 1845, 298) made mention of *Connarus* as an example of a false aril. The most important point in this respect is that the 'aril' is always attached to the testa, and never, as far as I have observed, to the funicle. In many cases the 'aril' is even split on the side facing the hilum leaving the funicle free. Moreover, as far as I could see, the 'adnate aril' is always the testa itself, there is no separate testa beneath. Its margin and marginal lobes, which are developed in a later ontogenetical phase may be free, however, *e.g.* in *Ellipanthus tomentosus ssp. kingii*. These facts strengthen the opinion that the fleshy structure represents an arilloid. Phylogenetically the primitive situation might have been the 'pseudobaccate' structure in which the greater part of the testa is developed into a sarcotesta. The genus *Rourea* offers all stages from the nearly complete sarcotesta towards its reduction to a small spot just opposite the hilum. From this most reduced phase can be derived the *arillode*, which loosely envelopes the whole seed as found in *subg. Palliatus*. This arillode only develops in a late ontogenetical stage; young seeds only show the small sarcotestal part. The anatropous, laterally attached seeds of *Connarus* also clearly show the independence of the 'aril' from the funicle: here the arilloid is distinctly developed around the micropyle, more or less as a caruncle, and usually remains too small even for reaching the funicle! As a whole the situation in *Connaraceae* seems comparable with that in the *Sapindaceae*, as studied by VAN DER PIJL (Acta Bot. Neerl. 6, 1957, 618).

SPERLICH (Sitz. Ber. Ak. Wiss. Wien 120, 1911, 349) and FUNKE (Ann. Jard. Bot. Btzg 40, 1929, 61–64) gave some anatomical details on the leaf-joints and the latter stated in passing that by this structure he could distinguish between *Connaraceae* and *Leguminosae*. No mention has been made in literature as far as I can ascertain whether the leaflets of *Connaraceae* perform sleeping movements as is typical for numerous *Leguminosae* (at least of the subfamily *Papilionateae*). According to observations by Messrs JACOBS and BISSET in Kebun Raya Indonesia (March 1958) *Santaloides mimosoides* shows distinct sleeping movements, the others not or only in juvenile leaves.

Taxonomy. The present revision of the Malaysian *Connaraceae* differs considerably from the monograph by SCHELLENBERG (Pfl. R. Heft 103, 1938). My objections against the latter monograph are of two kinds:

1. SCHELLENBERG's specific (and sometimes also his generic) delimitation is in my opinion often far too narrow. This is especially demonstrated in such genera as *Rourea* and *Connarus*. SCHELLENBERG himself was apparently aware of this tendency as appears from his study on Bornean species (Bot. Jahrb. 59, 1924, Beibl. *no* 131, p. 22).

2. A much more serious objection is that the relationships, as given in the monograph, are, in my opinion, sometimes artificial. This concerns both the subdivision of the genera and that of the family.

In *Connarus* and *Rourea* the microspecies, which in my opinion form one Linneont and can in cases hardly be discriminated, as for example *Connarus grandis* and *C. trifoliatus*, often turned out to have been referred to different sections or even subgenera.

The subdivision of the family into tribes rests, I believe, on an unsound basis. SCHELLENBERG's basic principle has been the distinction between axillary versus terminal inflorescences. As far as I have seen these extremes are often gradingly joined. A good example is that of the genera *Agelaea* and *Castanola* which correspond in many characters, but are placed by SCHELLENBERG far apart in the tribes *Agelaeeae* and *Castanoleae* respectively, as the former are characterized by terminal, the latter by axillary inflorescences. The study of large collections of *Agelaea* learned, however, that within this genus this character is rather variable: in *A. trifolia* GILG the inflorescence is pseudoterminal, provided with a distinct terminal bud, which develops after the flowering period, resulting into axillary infructescences. On the other side I could not find any trace of a vegetative terminal bud in for example *A. obliqua* BAILL. An other case in point is provided by comparison of the genera *Jaundea*, *Byrsocarpus*, *Santaloidella*, and *Santaloides*, placed by SCHELLENBERG as highly developed representatives in the tribe *Byrsocarpeae*, with *Rourea*, considered by him to belong to the tribe *Connareae*. I could not find any important difference between these five genera except in the development of the arilloid; and as to this character they distinctly form one series (for details see *sub Rourea*).

In a much earlier publication (Mitt. Bot. Mus. Un. Zürich *no* 50, 1910) SCHELLENBERG gave in my opinion a more satisfactory evaluation of relationships.

Affinity with other families. SCHELLENBERG does not find reason to deviate from the current opinion to tie the *Connaraceae* to the affinity of *Rosaceae-Leguminosae*. Wood-anatomically HEIMSCH prefers to look for their relationship with the *Sapindaceae*, and this is obviously also the opinion of HUTCHINSON who incorporated them in his *Sapindales*.

It has also been occasionally suggested to affiliate them to the *Oxalidaceae* with which some species and genera have been confused in the past, but ERDTMAN rejects this relation on the strength of palynological arguments without giving other positive evidence.

Notes. *Connaraceae* are often confused with the *Leguminosae*, especially with the genus *Derris*. The only reliable difference between the two families is found in the ovules, which are collateral in the *Connaraceae*, serial in the *Leguminosae*. A character which nearly always can be used is also the absence of stipules in the *Connaraceae* and their presence in the *Leguminosae* (with a few very rare exceptions). Attention is called here to the bracts in fasciculate axillary inflorescences which in *Connaraceae* are often placed similar to stipules and can easily be confounded with them.

The genus *Ellipanthus* is by superficial resemblance sometimes confused with *Dichapetalum*.

Specific delimitation turned out to be often very difficult, especially in *Rourea* and *Connarus*. Identification of incomplete material is frequently impossible: properly both flowers and fruits are necessary for satisfactory identification.

In widely distributed variable species it has mostly not been possible to distinguish subspecies or varieties by name because of the presence of intergrading specimens prohibiting a clear distinction of taxa. In case these 'races' can be more or less defined and occupy a geographical area of their own I have, for convenience, indicated by short descriptions their salient characters, but merely referred to them by α, β, γ, and so on.

KEY TO THE GENERA

1. Pistils 4–5, usually more than 1 fruit per flower (if there is only one fruit, some undeveloped pistils are often still present at the base). Calyx usually accrescent.
  2. Upper surface of the dried leaflets with many minute pits. Leaves 3-foliolate. Fruits usually warty to papillose . . . . **2. Agelaea**
  2. Upper surface of the dried leaflets not pitted. Fruits smooth.
    3. Calyx distinctly imbricate, also in flower, immediately after flowering conically contracted in a peculiar way, accrescent and hard in fruit and (in Mal. *spp.*) usually cupular in shape, enclosing the base of the fruit. Fruit 1 per flower (very rarely 2; no pistil remains at the base). Seed (in Mal. *spp.*) usually enveloped by a loose arilloid . . . . **4. Rourea**
    3. Calyx only in the bud more or less imbricate, not conically contracted immediately after flowering, not appressed to the fruit. Usually more than 1 fruit per flower (and undeveloped pistils always still present). Seed provided with a sarcotesta.
      4. Petals about as long as the sepals or shorter, not folded inwards in bud. Calyx not accrescent. Fruits more or less fleshy, oblique to slightly acuminate, pericarp inside densely pubescent. Seeds with endosperm. Leaflets not emarginate at the apex . . . . **1. Cnestis**
      4. Petals lorate, many times longer than the sepals, in bud folded inwards. Calyx in fruit conspicuous. Fruits dry, uncinate-acuminate at the apex, pericarp inside glabrous. Seeds without endosperm. Leaflets emarginate at the apex . . . . **3. Roureopsis**
1. Pistil 1 per flower. Calyx not accrescent.
  5. Inflorescences axillary, small, often glomerulous. Tissue of floral parts without glands; epidermis without glandular-capitate hairs. Seeds with endosperm. Leaves unifoliolate . . **5. Ellipanthus**
  5. Inflorescences terminal, large, paniculate. Sepals, petals, and stamens with glands in their tissue; epidermis often with glandular-capitate hairs. Seeds without endosperm. Leaves rarely partly unifoliolate . . . . **6. Connarus**

1. CNESTIS

JUSS. Gen. (1789) 374; SCHELLENB. Pfl. R. Heft 103 (1938) 28; ANDREAS & PROP, Blumea 7 (1954) 602.—*Thysanus* LOUR. Fl. Coch. (1790) 284.—**Fig. 1.**

Lianas or scandent shrubs, rarely small trees. *Leaves* imparipinnate. *Inflorescences* axillary (in Mal. *spp.*) or terminal, solitary or consisting of fascicled branches inserted on knobs; bracts minute, scale-like to lanceolate. *Flowers* bisexual (?), 5-merous, heterotri- or -distylous. *Sepals* (in Mal. *spp.*) slightly confluent at the base, lanceolate, acute, imbricate in bud. *Petals* (in Mal. *spp.*) with indented and incurved tip. *Stamens* 10, free, all fertile, though the inner ones slightly shorter. *Pistils* 5, ovary pubescent. *Fruits* up to 5 per flower, usually some reduced, more or less pear-shaped, slightly beaked, opening by a longitudinal ventral slit, outside densely minutely tomentose, inside appressed-pilose; pericarp thick, probably more or less fleshy when fresh; calyx not enlarged. *Seed* 1, flattened bean-shaped, partly surrounded by a sarcotesta in the basal part opposite the hilum; endosperm present.

Distr. About 40 *spp.*, mainly in tropical Africa and Madagascar, 2 *spp.* in SE. Asia and *W. Malaysia*.

Ecol. The *Malaysian* species are usually lianas in the forest.

Nomencl. SCHELLENBERG subdivided the genus into 2 sections and 4 subsections; both *Malaysian* species belong to *sect. Eucnestis* SCHELLENB., *subsect. Aequipetalae* SCHELLENB. As the type species of

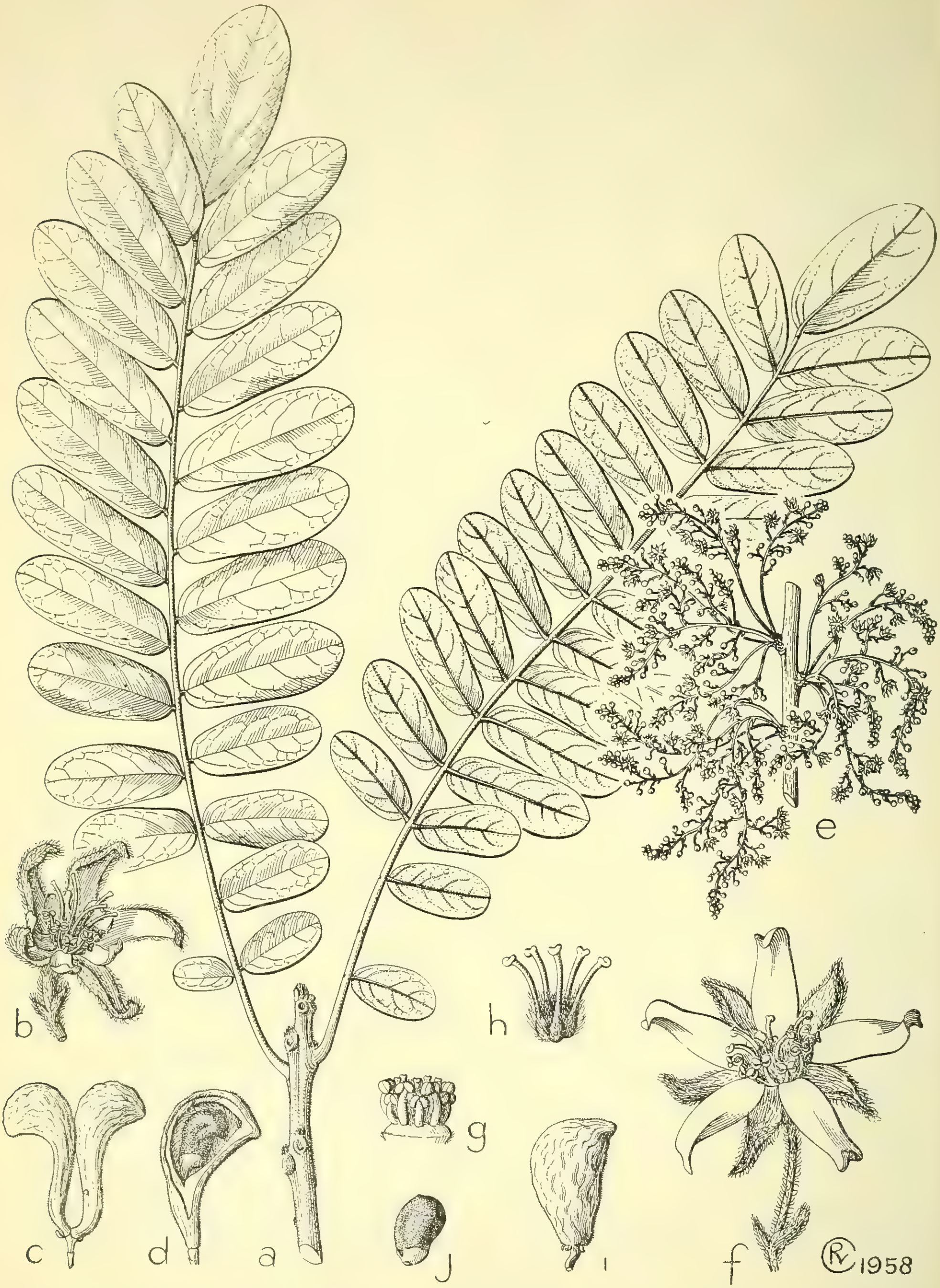


Fig. 1. *Cnestis platantha* GRIFF. *a*. Habit, × 1/2, *b*. flower, × 5, *c*. fruits, × 1/2, *d*. *ditto*, opened, × 1/2.—*C. palala* (LOUR.) MERR. *ssp. diffusa* (BLANCO) ANDREAS. *e*. Part of twig with inflorescences, × 1/2, *f*. flower, × 5, *g*. stamens and pistils in short-styled flower, × 7, *h*. long-styled pistils, × 7, *i*. fruit × 1/2, .seed, × 1/2 (*a–b* KING's coll. 6466, *c* VAN STEENIS 9337, *d* GUSDORF 157, *e–h* BS 26943, *i–j* ELMER 21482).

Cnestis indicated by him (*C. corniculata* LAMK) is in his system inserted in *sect. Ceratocnestis*, these sectional epithets must be revised. I have refrained from doing this as it would have necessitated a complete revision of the genus, both taxonomically and nomenclatorally, which falls outside the scope of this work.

Morph. The pubescence of both Malaysian species consists of simple hairs, not rarely intermingled with capitate-glandular hairs.

The *leaflets* of the Malaysian species are minutely pellucid glandular-punctate.

The *flowers* of the Malaysian species are scentless and apparently have a reddish calyx and white to creamy petals. The *fruits* are described as apricot-like in shape, size, and colour, the latter changing from yellow to scarlet. The *seeds* are black with a bright-yellow sarcotesta.

Taxon. The two *Malaysian* species have been delimited in a different way by nearly every author; therefore the interpretation of the literature is rather difficult. I fully agree with ANDREAS & PROP who, on the basis of an extensive analysis of many characters, consider the relative length of the corolla and the calyx as the only trustworthy differential character. This entails that only flowering material can be identified with certainty. The range of variation, shown by the vegetative parts and by the fruits, is different for the two species, but there is so much overlapping that these characters can be used only in extreme cases.

KEY TO THE SPECIES

1. Petals about as long as the sepals or slightly longer. Branches of the inflorescence racemose, slender, 1–3 of them much longer than the other ones. Fruits up to *c.* 4 cm long, usually rather stout. **1. C. palala**

1. Petals about half as long as the sepals. Branches of the inflorescence paniculate, all of about the same length. Fruits 4½–7 cm long, usually more slender . . . . **2. C. platantha**

1. Cnestis palala (LOUR.) MERR. J.R. As. Soc. Str. Br. *no* 85 (1922) 201; En. Philip. 2 (1923) 240; SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 23; MERR. Trans. Am. Phil. Soc. n.s. 24, 2 (1935) 184; SCHELLENB. Pfl. R. Heft 103 (1938) 36, f. 4, *p.p.;* RIDL. Kew Bull. (1938) 275, *p.p.;* ANDREAS & PROP, Blumea 7 (1954) 612.—*Thysanus palala* LOUR. Fl. Coch. (1790) 284, *excl. syn.* RUMPH.; ed. 2 (1793) 349.—*C. corniculata* (*non* LAMK) BLANCO, Fl. Filip. (1837) 386; ed. 2 (1845) 270; ed. 3, 2 (1878) 138.—*C. diffusa* BLANCO, Fl. Filip. (1837) 386; MERR. Philip. J. Sc. 4 (1909) Bot. 127; SCHELLENB. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 14, *p.p.;* MERR. Sp. Blanc. (1918) 164; SCHELLENB. Pfl. R. Heft 103 (1938) 38.—*C. polyphylla* (*non* LAMK) BLANCO, Fl. Filip. ed. 2 (1845) 270; ed. 3, 2 (1878) 137.—*C. ramiflora* GRIFF. Notul. 4 (1854) 432; HOOK. *f.* Fl. Br. Ind. 2 (1876) 54, *p.p.;* KURZ, For. Fl. Burma 1 (1877) 329; VIDAL, Sinopsis (1883) Atlas t. 39 f. c; KING, J. As. Soc. Beng. 66, ii (1897) 21, *p.p.;* PIERRE, Fl. For. Coch. 5 (1898) t. 376 C; LECOMTE, Fl. Gén. I.-C. 2 (1908) 44, f. 7 f; RIDL. Fl. Mal. Pen. 1 (1922) 554, *p.p.*—*C. platantha* (*non* GRIFF.) KURZ, For. Fl. Burma 1 (1877) 328.—*Rourea rugosa* (*non* PLANCH.) F.-VILL. Nov. App. (1880) 56.

ssp. **diffusa** (BLANCO) ANDREAS, Blumea 7 (1954) 613.—*C. diffusa* BLANCO.—*C. corniculata* (*non* LAMK) BLANCO.—*C. polyphylla* (*non* LAMK) BLANCO. —Fig. 1e–j.

Liana, sometimes shrub or treelet. Branchlets densely buff-tomentose, as are the petioles, rhachises, petiolules, and the inflorescences. *Leaves c.* 10–15-jugate; petiolules up to 1 mm. Lateral *leaflets* oblong to (ob)lanceolate, usually with parallel margins (the more elliptic lower pairs excepted), 4–9½ by 1½–3½ cm, terminal ones elliptic, 6–9½ by 2–3½ cm, all thin-chartaceous, above glabrous or on the midrib short-tomentose, beneath on the midrib densely, furthermore sparsely, short-pubescent; base cordate, in the lateral leaflets oblique; apex blunt to slightly acuminate; nerves (5–)8 pairs, nearly transverse, curved, distinctly looped and joined at some distance from the margin, inconspicuous. *Inflorescences* axillary, partly ramiflorous, in fascicles of 5 to more, slender, racemose to narrowly paniculate, rather many-flowered branches, 1–3 of them 4–8 cm long, the other ones up to 2½ cm. *Sepals* 3 mm, pubescent on both sides. *Petals* oblong-ovate, 3–4 mm long, glabrous except a hair-tuft outside just above the base. *Stamens* glabrous. *Fruits* 1(–4) per flower, pear-shaped, rounded or slightly beaked, faintly curved, 3½–4 by 2–2¼ cm.

Distr. *Malaysia:* Sumatra (E. coast), Lingga Arch., Malay Peninsula (the prevailing species), Borneo (rare), and the Philippines (Luzon, Lubang, Burias, Cebu, Semirara Isl.).

The other subspecies, *subsp. palala*, mainly differs by the straight, distinctly beaked fruits and the often smaller number of leaflets. It occurs in SE. Asia (Andaman Isl., Burma, Siam, and Indo-China).

Ecol. In rain-forests and thickets, along streams, up to 200 m. *Fl.* (Oct.–)Jan.–March (–Apr.), *fr.* May-July.

Vern. *Andor balimbing*, Sum., *blimbing hotan, kĕlidong*, Mal. Pen.; Philippines: *palo santo, palo taulo*, Spanish, *ibaibaan, kalakalamyásan, piaspiàsan*, Tag., *salsaladái*, Ilk., *tovotagotumi*, P. Bis.

Note. The Philippine specimens differ slightly from the above description. The main differences are: nerves 6–10 pairs, straight to curved; long branches of the inflorescences 3–6 cm long; pubescence of the inflorescence and of the calyx partly capitate-glandular; fruits smaller (2–2½ by 1–1½ cm).

2. Cnestis platantha GRIFF. Notul. 4 (1854) 434; ANDREAS & PROP, Blumea 7 (1954) 614.—*Rourea* *dasyphylla* MIQ. Sumatra (1861) 528.—*Connarus polyphyllus* MIQ. Sumatra (1861) 529.—*C. ramiflora* (*non* GRIFF.) HOOK. *f.* Fl. Br. Ind. 2 (1876) 54, *p.p.*, *et auct. div.*—*Santalodes dasyphyllum* O.K. Rev. Gen. 1 (1891) 155.—**Fig. 1a–d.**

Large liana, shrub, or treelet. Branchlets densely fulvous- to ferruginous-tomentose, as are the petioles, rhachises, petiolules, and inflorescences. *Leaves c.* 10–20-jugate; petiolules 1/2–1 1/2 mm. Lateral *leaflets* oblong-obovate to oblong, 3–8 1/2 by 1 1/2–2 1/2 cm, increasing in size upwards, terminal leaflet obovate to lanceolate, 6–8 by 2–2 1/2 cm, all thin-chartaceous, minutely pubescent on the midrib above, sparsely to rather densely woolly tomentose beneath; base of the lateral leaflets broadly rounded to subcordate, oblique, specially in the upper pairs, of the terminal one (rounded to) acute; apex rounded to acute; nerves *c.* 5–8 pairs, usually more or less ascending (to nearly transverse), curved, usually fading towards the margin, sometimes distinctly looped and joined, rather inconspicuous. *Inflorescences* ramiflorous, on knobs, in fascicles of 5–8 narrow-paniculate, many-flowered, equally long (*c.* 5–8 cm) branches. *Sepals* 3 mm long, pubescent on both sides. *Petals* elliptic, 1–1 1/2 mm long, glabrous. *Stamens* glabrous. *Fruits* 1(–2) per flower, pear-shaped, sinuously curved, slender, 4 1/2–7 by 1 1/2–2 1/2 cm, rounded at the apex.

Distr. *Malaysia:* Sumatra (the prevailing species), Malay Peninsula (Perak, rare), Borneo, and Celebes (once collected in the central part).

Ecol. In primary and secondary forests up to *c.* 500 m. *Fl.* July–Oct., *fr.* Dec.–Feb.

Uses. The seeds and possibly also the fruits are eaten.

Vern. *Baih patuh senggulin, baih sĕklat sulok, djukut abang, sinih, udjan mas,* Sum.

Notes. This species is mostly described as a large liana with drooping branches and tufted leaves. A few times it has been recorded as a large tree, but this may be based on erroneous observation.

One collector mentioned a sticky white latex, followed by a clear fluid, when cutting the branches.

Excluded

Cnestis volubilis BLANCO, Fl. Filip. (1837) 383 = *Rourea volubilis* MERR. Philip. Govt. Lab. Publ. *no* 27 (1905) 36, *pro basionym* = *Santaloides volubilis* SCHELLENB. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 51, *pro basionym* = probably no *Connaracea* (*cf.* p. 517b).

2. AGELAEA

SOLAND. *ex* PLANCH. Linnaea 23 (1850) 437; SCHELLENB. Pfl. R. Heft 103 (1938) 65.—*Castanola* LLANOS, Mem. R. Ac. Cienc. Madr. III, 2 (1859) 505; SCHELLENB. Pfl. R. Heft 103 (1938) 169.—*Hemiandrina* HOOK. *f.* Trans. Linn. Soc. 23 (1860) 171.—*Troostwykia* MIQ. Sum. (1861) 531.—**Fig. 2–3.**

Lianas (sometimes scrambling shrubs). *Leaves* trifoliolate. *Inflorescences* axillary, pseudo-terminal, or truly terminal, paniculate, usually some of the main branches nearly equally strongly developed. *Bracts* and *bracteoles* rather persistent, bracts terete, slightly thickened at the apex, bracteoles narrowly linear. *Flowers* bisexual, (4–)5-merous. *Sepals* outside minutely tomentose, inside short-appressed-pubescent. *Petals* linear, distinctly exceeding the sepals, glabrous. *Stamens* 10(–5), slightly connate at the base, episepalous ones distinctly longer than epipetalous ones, the latter rarely fully absent. *Pistils* 5 (rarely, specially in African *spp.*, some more, which are often sterile), heterodi- or -tristylous; ovary and style-base pubescent; style cylindrical; stigma minute, 3-lobed. *Fruits* not rarely more than 1 per flower, usually strongly recurved; sustained by the persistent, not accrescent calyx, often tuberculate, more or less densely tomentose, red when ripe, opening by a lengthwise slit; pericarp rather thin. *Seed* 1, shining black, partly covered by an orange or yellow arilloid; endosperm none.

Distr. About 50 *spp.* in Africa, Madagascar, SE. Asia, and *Malaysia.*

Ecol. Rain-forests, mainly at low altitudes.

Taxon. The genus can be subdivided into 2 subgenera:

Agelaea, according to SCHELLENBERG, *l.c.*, with about 46 *spp.* (according to others much less), is restricted to Africa and Madagascar.

Troostwykia (MIQ.) SCHELLENB. (Mitt. Bot. Mus. Un. Zürich *no* 50, 1910, 65), consists of one species in W. Africa, and four in Asia and Malaysia. In SCHELLENBERG's monograph this subgenus was considered to represent a separate genus for which the oldest name *Castanola* was adopted.

The main difference between the two subgenera is found in the inflorescence, which is axillary in *subg. Troostwykia*, but pseudo-terminal to terminal in *subg. Agelaea.* As already mentioned in the

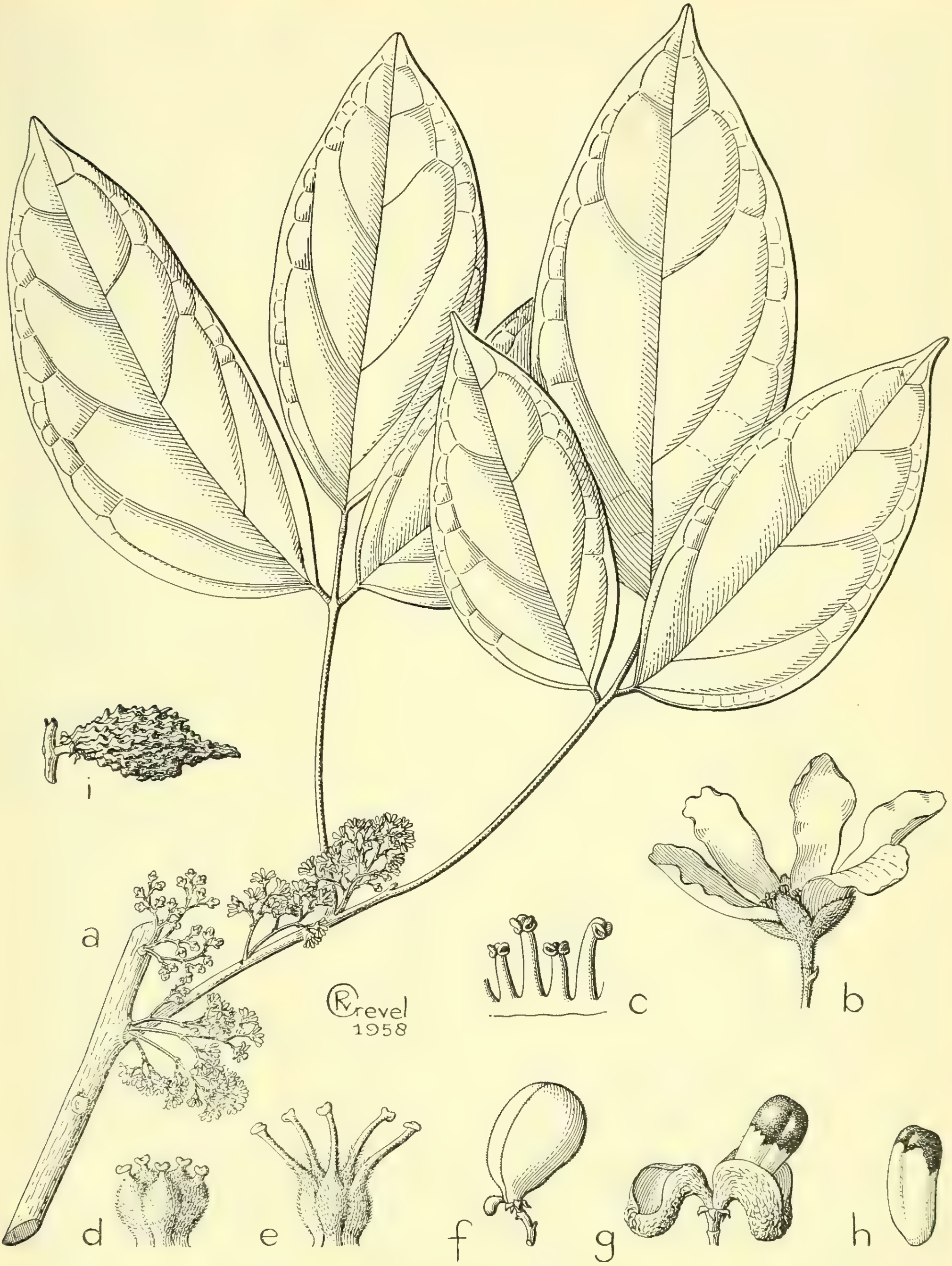


Fig. 2. *Agelaea trinervis* (Llanos) Merr. *a.* Flowering twig, × 1/2, *b.* flower, × 5, *c.* stamens from outside, × 10, *d.* short-styled pistils, × 10, *e.* long-styled pistils, × 10, *f.* fruit, nat. size, *g. ditto*, opened, nat. size, *h.* seed, nat. size.—*A. borneensis* (Hook. *f.*) Merr. *i* Fruit, nat. size (*a*, *e* herb. Becc. 3057, *b–d* Schiffner 2037, *f* Backer 26015, *g–h* Wray 48, *i* Wenzel 675).

general remarks on the family I adhere less importance to this character than advocated by SCHELLENBERG.

Subg. Agelaea is characterized by tufted hairs, which superficially look like stellate hairs; in *subg. Troostwykia* the hairs are distinctly simple and not tufted.

The species of *subg. Troostwykia* are very well characterized by densely set minute pits in the upper surface of the dried leaflets; these pits correspond with large mucilaginous cells in and below the epidermis. These cells are absent in *subg. Agelaea.*

The nearest allied genus seems to be *Pseudoconnarus* from tropical S. America which, apart from some anatomical characters, differs by the presence of endosperm.

Morph. The major part of the bracts in the inflorescence is obviously homologous with the petiole of a leaf; the terminal thickening with the aborted blade.

The flowers show a great variability, even within one inflorescence. The terminal flowers, which open the first, are most completely developed and most constant. The flowers towards the base of the inflorescence may show all kinds of deviations: a smaller or sometimes greater number of (part of) the floral parts, absence of one whorl of stamens, *etc.* Therefore, I have based my descriptions on terminal flowers at the end of the anthesis, when all parts, even the stamens, are fully grown out.

Usually several pistils of each flower enlarge initially, but all except one or two usually stop developing at an early stage.

KEY TO THE SPECIES

1. Fruits distinctly papillose, long-beaked. Twigs and petioles, at least in the young parts, densely pubescent.
  2. Leaflets elliptic to oblong, up to 20 cm long, more or less distinctly triplinerved, nerves 5–6 pairs. **3. A. borneensis**
  2. Leaflets lanceolate, up to 40 cm long, distinctly penninerved, nerves 10–14 pairs . . **4. A. insignis**
1. Fruits rugulose to warty, not or shortly beaked. Twigs and petioles (sub)glabrous.
  3. Leaflets distinctly penninerved, nerves 7–10 pairs. Lateral leaflets nearly equilateral. **1. A. macrophylla**
  3. Leaflets usually distinctly triplinerved, nerves *c.* 5 pairs. Lateral leaflets usually very oblique. **2. A. trinervis**

1. Agelaea macrophylla (ZOLL.) LEENH., *nov. comb.* —*Erythrostigma macrophyllum* ZOLL. Nat. Tijd. N.I. 14 (1857) 174.—*Connarus diepenhorstii* MIQ. Sum. (1861) 529, 207.—*Taeniochlaena diepenhorstii* KURZ, J. As. Soc. Beng. 39, ii (1870) 76.—*A. hullettii* KING, J. As. Soc. Beng. 66, ii (1897) 19; RIDL. Fl. Mal. Pen. 1 (1922) 553.—*A. diepenhorstii* KING, J. As. Soc. Beng. 66, ii (1897) 20; SCHELLENB. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 67; BACK. Schoolfl. (1911) 286; KOORD. Exk. Fl. Java 2 (1912) 340.—*A. sarawakensis* MERR. J. Str. Br. R. As. Soc. *no* 85 (1922) 199.—*Hemiandrina hullettii* SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 26.—*Hemiandrina macrophylla* SCHELLENB., *l.c.* —*Hemiandrina sarawakensis* SCHELLENB., *l.c.*—*Castanola macrophylla* SCHELLENB. Pfl. R. Heft 103 (1938) 171; BAKH. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 5.—*Castanola hullettii* SCHELLENB. Pfl. R. Heft 103 (1938) 172.—*Castanola sumatrana* SCHELLENB. Pfl. R. Heft 103 (1938) 174.—Fig. 3.

Liana, sometimes a creeping shrub or small tree (?); stem up to 4 cm thick. Branches $^{1}/_{2}$–1 cm thick, glabrous. *Leaves* glabrous to minutely ferruginous-tomentose; lateral petiolules $^{1}/_{2}$–1 cm. *Leaflets* oblong-lanceolate, 13–27 by 4–10 cm (terminal ones sometimes ovate-lanceolate, 18–30 by 6$^{1}/_{2}$–12 cm), coriaceous, sometimes minutely tomentose on the nerves beneath, lateral ones usually slightly oblique; base rounded to acute; apex shortly acuminate, acumen blunt to emarginate, nerves (5–)7–10 pairs, patent to nearly transverse. *Inflorescences* minutely pubescent, narrow-paniculate, with 2–3 branches up to 4 cm long and some shorter ones. *Flowers* offensively-smelling, heterodistylous. *Sepals* 1$^{1}/_{2}$ mm long. *Petals* 2$^{1}/_{2}$–3 mm long. *Stamens* 10, glabrous. *Pistils* 5 (rarely less or up to 8), predominantly middle-styled. *Infructescences* small, with few fruits. *Fruits* obovoid, 1$^{1}/_{4}$–1$^{1}/_{2}$ by $^{3}/_{4}$ cm, *c.* 3 mm long beaked, warty, densely tomentose. *Seeds* obovoid to cylindrical, rounded at both ends, for $^{2}/_{3}$–$^{3}/_{4}$ covered by the arilloid.

DISTR. *Malaysia:* Sumatra, Lingga Arch., Malay Peninsula, Borneo, Java, and Bali.

Ecol. Primary, secondary, and teak-forests, also on marshy soils and on limestone rocks, up to 750 m. *Fl.* mainly May–Aug., *fr.* (June–)Aug.–Dec.

Vern. *Akar tanduk, bajut simungan,* Sum., *areuj kokotokan,* S, *antjeng, kluron, ojod* (*gambir*), *tjometan, tungkul,* J, *akar malam,* Born.

Notes. The flowers are extremely variable. Though 5-merous flowers predominate, 4-merous flowers are present in most of the specimens. Part of these 4–merous flowers still possess 5 pistils. The gynaecium may be pleiomerous, but is never meiomerous. Some otherwise 5–merous flowers may have a 4-merous calyx.

2. Agelaea trinervis (LLANOS) MERR. Sp. Blanc. (1918) 164; En. Philip. 2 (1923) 239.—*Erythrostigma obliquum* ZOLL. Nat. Tijd. N.I. 14 (1857) 174, *non Agelaea obliqua* BAILL. (1866/67) *quae est Cnestis obliqua* P. BEAUV. (1804).—*Castanola trinervis* LLANOS, Mem. R. Ac. Cienc. Madr. III, 2 (1859) 503; BLANCO, Fl. Filip. ed. 3, 4 (1880) 103; SCHELLENB. Pfl. R. Heft 103 (1938) 172.—*A. walli-*

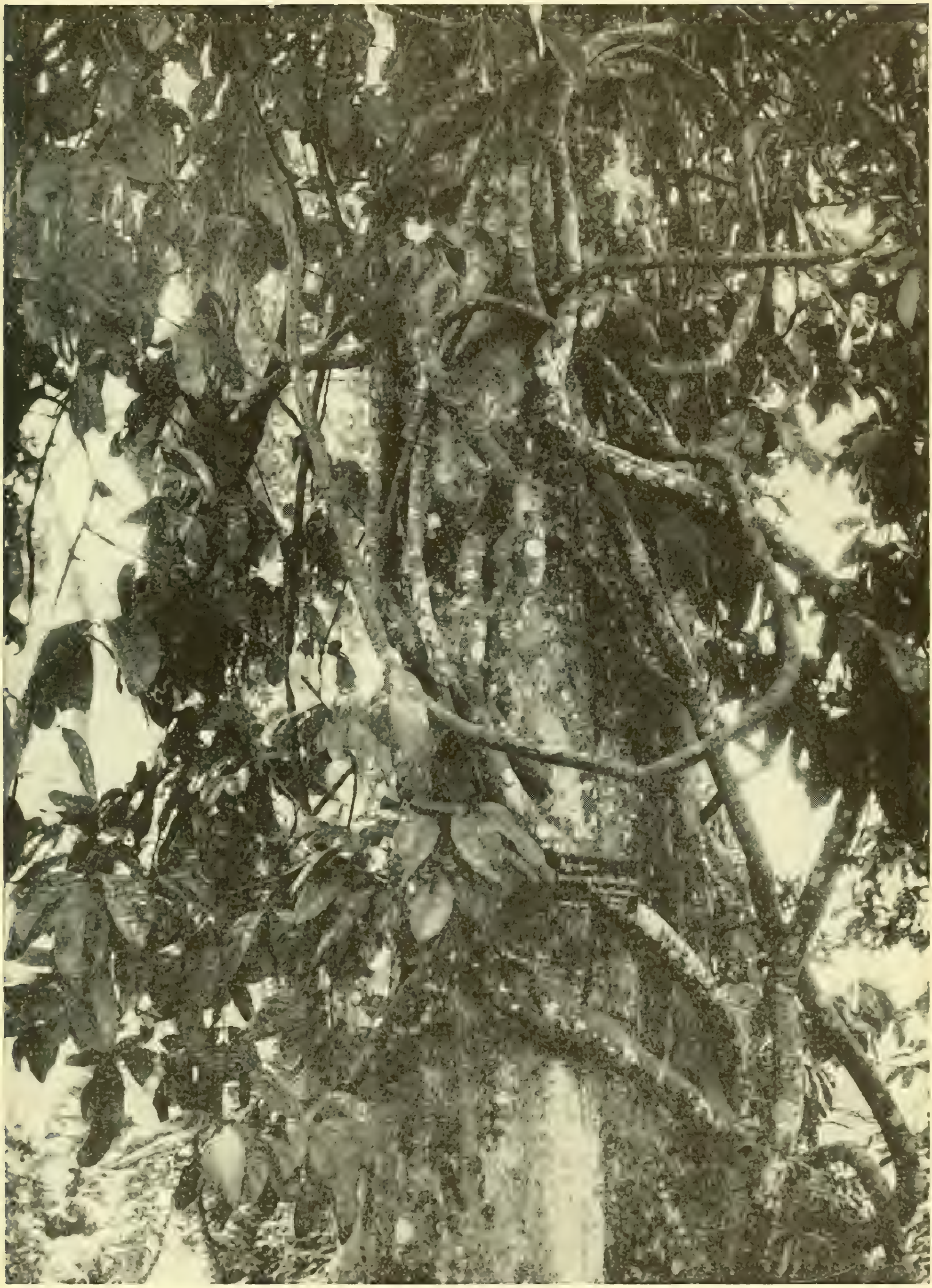


Fig. 3. *Agelaea macrophylla* (ZOLL.) LEENH. Habit of the coarse liana, cultivated in Kebun Raya Indonesia (XVII.F.18), Nov. 1957.

chii Hook. *f.* Fl. Br. Ind. 2 (1876) 47; King, J. As. Soc. Beng. 66, ii (1897) 18; Merr. Philip. J. Sc. 4 (1909) Bot. 126; Ridl. Fl. Mal. Pen. 1 (1922) 553; Burk. Dict. (1935) 71.—*A. glabrifolia* Hance, J. Bot. 14 (1876) 257.—*A. cambodiana* Pierre, Fl. Coch. 5 (1898) t. 376 A; Lecomte, Fl. Gén. I.–C. 2 (1908) 45, f. 7 d–e.—*A. densiflora* Pierre, Fl. Coch. 5 (1898) t. 376 B; Lecomte, Fl. Gén. I.–C. 2 (1908) 45.—*A. agamae* Merr. J. Str. Br. R. As. Soc. *no* 85 (1922) 198.—*Hemiandrina agamae* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 26.—*Hemiandrina obliqua* Schellenb., *l.c.*—*Hemiandrina trinervis* Schellenb., *l.c.*—*Castanola glabrifolia* Schellenb. Kew Bull. (1927) 374; Pfl. R. Heft 103 (1938) 173.—*Castanola wallichii* Schellenb. Kew Bull. (1927) 375; Craib, Fl. Siam. En. 1 (1928) 359; Schellenb. Pfl. R. Heft 103 (1938) 174.—*Castanola obliqua* Schellenb. Pfl. R. Heft 103 (1938) 172; Bakh. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 5.—*Castanola agamae* Schellenb. Pfl. R. Heft 103 (1938) 173.—**Fig. 2a–h.**

Liana or climbing shrub; stem *c.* 5 cm thick. Branches 3–4 mm thick, glabrous. *Leaves* (sub)-glabrous; lateral petiolules *c.* $^3/_4$ cm. Lateral *leaflets* usually very oblique, ovate (to oblong-lanceolate), 8–19 by $3^1/_2$–10 cm, cuneate to rounded (rarely slightly cordate) at the base, terminal ones obovate (to elliptic), 10–30 by $4^1/_2$–12 cm, broadly cuneate (rarely rounded to cordate) at the base; all leaflets coriaceous, glabrous or sometimes minutely tomentose on the nerves beneath, shortly (to rather long and slender) blunt-acuminate; nervation prominent beneath; mostly triplinerved, midrib in addition with *c.* 4 pairs of nerves in the upper half. *Panicles* dense, 2–3(–6) cm long, minutely greyish pubescent. *Flowers* (4–)5-merous, heterodistylous, fragrant. *Sepals* 2 mm long. *Petals* 5 mm long. *Stamens* 10, glabrous. *Pistils* (4–)5. *Infructescences* small, with few fruits. *Fruits* slightly oblique, obovoid, 1–$2^1/_2$ by $^1/_2$–$1^1/_4$ cm, slightly narrowed at the base, rounded (very rarely shortly beaked) at the apex, rugulose to warty, densely minutely tomentose. *Seeds* oblong-obovoid, the arilloid covering $^1/_3$–$^3/_4$ or even more of the surface.

Distr. Annam, Laos, Cochinchina, Siam, and *Malaysia:* Sumatra, Malay Peninsula, W. Java, Borneo, Philippines (Luzon, Samar, Leyte, Biliran, Mindanao), and Moluccas (Sula Isl., Ceram).

Ecol. Primary and secondary rain-forests, also along forest-edges and river-banks, up to *c.* 800 m. *Fl.* Jan.–Oct., *fr.* Jan.–Dec.

Uses. The bark and the leaves are used in native medicine; a decoction of the roots is used against rheumatism and stomach-ache.

Vern. *Andor tungir, basam*, Sum., *akar kachang bitina, a. k. jantān bukit, a. nyamok, a. pinang kĕtul* (or *bĕtul*), *a. p. kutat, a. p. kutiay, a. pregat, a. susudû, kĕlĕntit nyamok*, Mal. Pen., *akar bangikar, galiput, kamaralam, malam* (*akar*), Born.; Philip.: *dagtung*, Mbo., *tayabak, ulali*, Tag.

Notes. The flowers of this species are much less variable than those of *A. macrophylla;* 4-merous flowers are present in a few specimens only. Long- and short-styled flowers seem to be about equally frequent.

More variability is found in the fruits and seeds. An extreme in this respect is represented by '*A. agamae*' the fruits of which are distinctly warty, possess a small beak, are relatively small ($1^1/_4$ by $^3/_4$ cm), and are distinctly stipitate at the base, while the seeds are nearly entirely covered by the arilloid.

3. Agelaea borneensis (Hook. *f.*) Merr. Philip. J. Sc. 4 (1909) Bot. 127; Schellenb. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 65.—*Erythrostigma villosum* Zoll. Nat. Tijd. N.I. 14 (1857) 175, *non A. villosa* Soland. *ex* Planch. (1850).—*Hemiandrina borneensis* Hook. *f.* Trans. Linn. Soc. 23 (1860) 171, t. 28.—*Troostwykia singularis* Miq. Sum. (1861) 531, 207; Ann. Mus. Bot. Lugd. Bat. 3 (1867) 88; Boerl. Handl. 1 (1890) 320.—*A. vestita* Hook. *f.* Fl. Br. Ind. 2 (1876) 46, *nom. illeg.*; Vidal, Sinopsis (1883) t. 39 f. D; King, J. As. Soc. Beng. 66, ii (1897) 17; Back. Schoolfl. (1911) 286; Koord. Exk. Fl. Java 2 (1912) 339; Ridl. Fl. Mal. Pen. 1 (1922) 553; Henders. Gard. Bull. S.S. 4 (1928) 246; Burk. Dict. (1935) 70.—*A. everettii* Merr. Philip. J. Sc. 4 (1909) Bot. 127; Brown, Min. Prod. Philip. For. 1 (1920) 376; Merr. En. Philip. 2 (1923) 239.—*A. woodii* Merr. J. Str. Br. R. As. Soc. *no* 85 (1922) 199.—*Hemiandrina everettii* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 25.—*Hemiandrina villosa* Schellenb., *l.c.;* Heyne, Nutt. Pl. (1927) 699.—*Hemiandrina woodii* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 25.—*Castanola villosa* Schellenb. Kew Bull. (1927) 375; Pfl. R. Heft 103 (1938) 177, f. 32; Bakh. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 5.—*Castanola everettii* Schellenb. Pfl. R. Heft 103 (1938) 176.—*A. platyphylla* Elm. Leafl. Philip. Bot. 10 (1939) 3717, *nom. illeg.*—**Fig. 2i.**

Liana or scrambling shrub, sometimes a small tree; stem (2—)5–10 cm thick. Branches 3–5 mm thick, densely fulvous-tomentose when young, glabrescent. *Leaves* pubescent to subglabrous; lateral petiolules 2–4 mm long. Lateral *leaflets* oblique, elliptic (rarely ovate or obovate), 5–13 by 2–6 cm, terminal ones elliptic to obovate, 7–20 by 3–10 cm; chartaceous to subcoriaceous, sometimes bullate, more or less densely ferruginous-tomentose, specially beneath, rarely nearly glabrous; base rounded; apex blunt-acuminate (acumen $^1/_2$–$1^1/_2$ cm); midrib and nerves strongly prominent beneath; nerves 5–6 pairs, the basal ones more or less ascending. *Panicles* lax, up to 8–10 cm long, usually consisting of the main axis and some basal branches, many-flowered, fulvous-pubescent. *Flowers* (4–)5-merous, heterotristylous, fragrant. *Sepals* $1^1/_4$–$1^1/_2$ mm long. *Petals c.* $2^1/_2$ mm long. *Stamens* 10(–5), filaments minutely pubescent. *Pistils* (3–)5. *Infructescences* small, with few fruits. *Fruits* sinusoid-ovate to -ellipsoid, $1^1/_2$–$2^1/_2$ by $^3/_4$–$1^1/_4$ cm, narrowed at the base, 3–10 mm beaked at the apex, coarsely papillose by fleshy, 3–4 mm long papillae, densely short-pubescent. *Seeds* obovoid, rounded at both ends, the basal half (or less) covered by the arilloid.

Distr. *Malaysia:* Sumatra, Malay Peninsula, West and Central Java, Borneo, and the Philippines; a dubious specimen (PARKER 2264) from Burma (Tavoy Distr.).

Ecol. Primary and secondary rain-forests, also along periodically inundated river-banks and on limestone rocks, up to *c.* 700 m. *Fl.* and *fr.* Jan.–Dec.

Uses. The stems and branches are highly esteemed for making ropes; they are strong and do not decay in water, for which reason they are specially in use for rafts and bow-nets.

Vern. *Akar basau, ako (sĕbasah) itam, andor galung, kaju poyoh,* Sum., *akkar itam,* Banka, *akar kachang kachang, a. kankachang, a. mĕkachang hitam, a. nyamok, a. rusa rusa, a. tĕlur buyok, a. tulô bujok,* Mal. Pen., *akar kĕring, a. malam, langsat kaja, marangrugon, sumbalan, surong mangis, winud,* Born.; Philippines: *balagum, oñgali, uñgali,* P. Bis., *kamágsa, kamáksa,* Tag., *ñgáluk,* Ibn.

Notes. This species is specially variable in its leaves (size, shape, and pubescence) and to a lesser degree in its flowers. In one specimen (FRI T. 95) the flowers are (3–)4(–5)-merous, with only episepalous stamens. On the whole 4-merous flowers are rare, the Philippine specimens excepted. Medium-styled specimens are rare, long- and short-styled ones about equally common. The number of stamens is usually 10, but may be reduced to 5 in both long- and short-styled flowers.

The name *Agelaea vestita* is illegitimate as some synonyms were mentioned; HOOKER based it upon the oldest name, *Cnestis vestita* WALL., which is a *nomen nudum.*

4. Agelaea insignis (SCHELLENB.) LEENH., *nov. comb.*—*Hemiandrina insignis* SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 26.—*Castanola insignis* SCHELLENB. Pfl. R. Heft 103 (1938) 176.

Liana. Branchlets probably densely ferruginous-tomentose, as are the petioles and petiolules. Lateral *leaflets* oblique, ovate-lanceolate, *c.* 20–40 by 6–12 cm, terminal ones lanceolate to oblanceolate, 14–40 by 6–13 cm; thin-coriaceous, smooth to slightly bullate above, midrib on both sides densely ferruginous-tomentose, nerves beneath sparsely pilose; base of the lateral leaflets very oblique, subcordate, of the terminal ones equilateral, narrowed, rounded; apex tapering shortly blunt-acuminate; nervation strongly prominent beneath, nerves 10–14 pairs, patent, curved, distinctly looped and joined close to the margin. *Inflorescences, flowers,* and *infructescences* unknown. *Fruits* ovoid, *c.* 3 by 1½ cm, with a ¾ cm long slender beak, densely long-papillose, densely minute-tomentose. *Seeds* oblong-ellipsoid, rounded at both ends, for *c.* ⅓ covered by the arilloid.

Distr. *Malaysia:* Borneo (Sarawak: near Kuching, apparently very rare).

Ecol. *Fr.* Nov., Feb.

3. ROUREOPSIS

PLANCH. Linnaea 23 (1850) 423; SCHELLENB. Pfl. R. Heft 103 (1938) 107.—*Taeniochlaena* HOOK. *f.* in B. & H. Gen. Pl. 1 (1865) 433; SCHELLENB. Pfl. R. Heft 103 (1938) 167.—**Fig. 4–6.**

Usually lianas, sometimes shrubs or treelets. Twigs sometimes hooked. *Leaves* imparipinnate, rarely partly unifoliolate. Apex of the leaflets always distinctly emarginate. *Inflorescences* axillary, mainly in the upper leaf-axils, racemose or paniculate, usually fasciculate, small. *Bracts* lanceolate, small, appressed, densely pubescent. *Flowers* rather long-stalked, bisexual, (4–)5-merous. *Petals* linear, gradually narrowed from base to apex, thin, in bud doubled down inwards, enclosing the stamens. *Stamens* twice as many as petals, slightly confluent at the base or free, epipetalous ones slightly smaller, all fertile, glabrous. *Pistils* (4–)5(–7), heterodistylous; ovary oblique-ovoid, style cylindrical, always rather short, stigma bilobed. *Calyx* in fruit persistent, spreading, not or only slightly accrescent, red. *Fruits* up to 5 per flower, oblique-ellipsoid, opening by a ventral slit, red, the apex uncinate-acuminate; pericarp coriaceous, glabrous inside. *Seed* 1, ellipsoid, attached at the base, the hilum partly to entirely surrounded by a rather small, yellow, fleshy arilloid; no endosperm.

Distr. About 10 *spp.*, 2 of which in W. Africa, the other ones in SE. Asia (Upper Burma to S. China and Indo-China) and *W. Malaysia* (as far east as W. Java and Borneo).

Ecol. In primary and secondary forests, along river-banks *etc.*, usually at low to medium altitude.

Notes. The *arilloid* is apparently of sarcotestal nature and nearly fully adnate to the seed; only the uttermost margin is free.

Roureopsis seems to be specially related to and intermediate between *Agelaea* and *Rourea.*

KEY TO THE SPECIES

1. Leaflets numerous (rarely less than 10 pairs), the lateral ones always distinctly oblique, not acuminate. **1. R. asplenifolia**
1. Leaves up to 5(-7)-jugate, lateral ones not or only very slightly oblique, usually distinctly acuminate.
  2. Fruits glabrous. Basal pair of nerves usually strongly ascending. Inflorescences nearly always subglabrous. Pistils glabrous (very rarely sparsely pubescent) . . . . **2. R. emarginata**
  2. Fruits tomentose. Basal pair of nerves not conspicuously ascending. Inflorescences densely tomentose. Pistils woolly pubescent.
    3. Nerves 5–8 pairs. Leaflets 6–10(–18) cm long. Inflorescences *c.* 4 cm long, in fascicles of 1–5 branches. **3. R. acutipetala**
    3. Nerves 8–10 pairs. Leaflets (8–)13–18 cm long. Inflorescences *c.* 2 cm long, in fascicles of 5–10 branches . . . . **4. R. pinnata**

1. Section Roureopsis

Fruits glabrous.

1. Roureopsis asplenifolia SCHELLENB. Pfl. R. Heft 103 (1938) 111.—**Fig. 4a–c.**

Large liana. Branchlets minutely fulvous-tomentose when young, glabrescent. *Leaves* (4–)10–16(–24)-jugate, leaflets opposite to alternate, the short petiole and the rhachis densely tomentose, glabrescent. *Leaflets* subsessile, most of the lateral ones oblique-trapezoid to oblique-rhomboid, $1^{1}/_{2}$–$2^{1}/_{2}$ by $^{1}/_{2}$–1 cm, basal ones broad-ovate, 1 by 1 cm or more, terminal leaflet elliptic

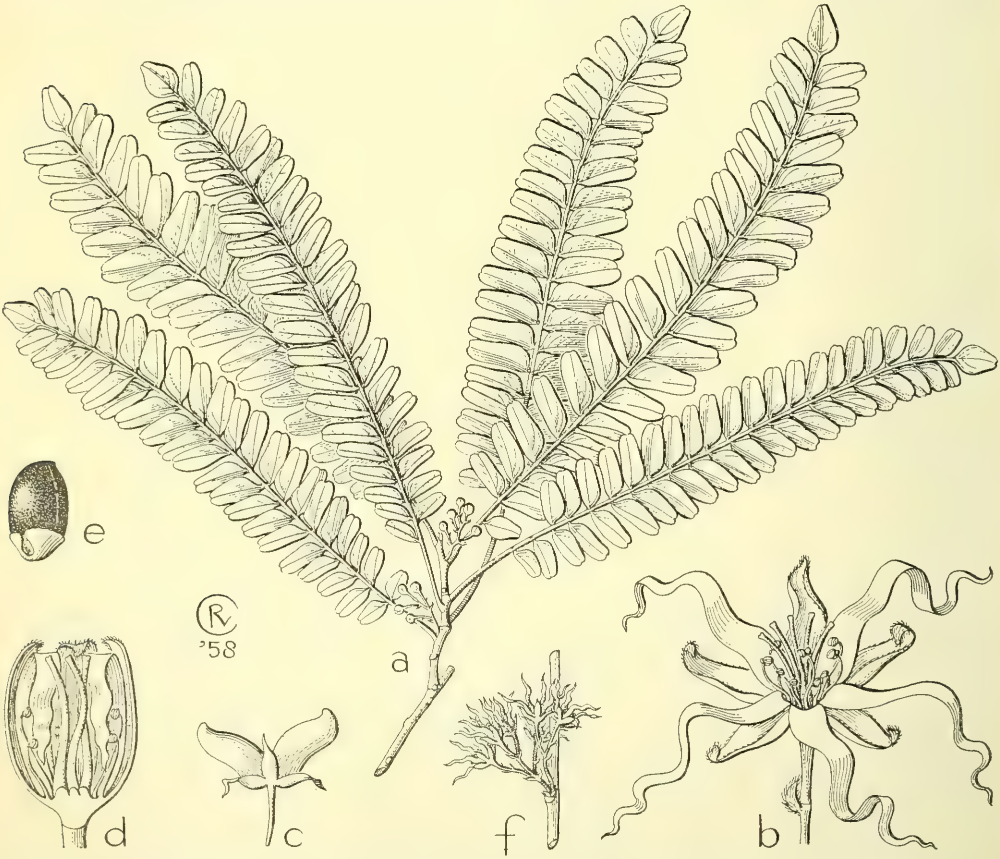


Fig. 4. *Roureopsis asplenifolia* SCHELLENB. *a.* Twig with young inflorescences, × $^{1}/_{2}$, *b.* flower, × 5, *c.* fruits, nat. size.—*R. emarginata* (JACK) MERR. *d.* Flower bud in longitudinal section, × 5, *e.* seed, nat. size.—*R. acutipetala* (MIQ.) LEENH. *f.* Inflorescence, × $^{1}/_{2}$ (*a–b* SPARE 1019, *c* SF 31978, *d* ALVINS 80, *e* Cult. Hort. Bog., *f* MÜLLER *s.n.*).

to ovate-rhomboid, 2½–2¾ by 1½ cm, all thin-chartaceous, glabrous above, minutely pubescent on the midrib beneath and along the margins, mainly near the cuneate base; apex deeply emarginate; nerves 4–5 pairs, one pair distinctly ascending, all distinctly looped and joined; veins parallel to the nerves, nearly indistinguishable from the latter. *Inflorescences* racemose, umbelliform, with about 4 flowers, *c.* 2 cm long, subglabrous to glabrous except the densely pubescent bracts; pedicels slender, *c.* ½ cm. *Flowers* 5-merous, apparently proterogynous. *Sepals* ovate, blunt, 2–2½ by 1–1½ mm, sparsely pubescent on both sides with the exception of the densely fulvous-tomentose outer side of the tip. *Petals* 7 by ⅔ mm. *Stamens* slightly cohering at the base. *Fruits* 1–2(–4) per flower, 1¼ by ¾ cm, glabrous except a few appressed hairs near the apex.

Distr. *Malaysia:* Sumatra and the Malay Peninsula.

Ecol. In forests and scrub-jungle, along river-banks, up to *c.* 200 m. *Fl.* May-July, *fr.* March, July, Oct.-Nov.

Vern. *Kaju itam*, Sum.

Note. Closest allied to *R. stenopetala* SCHELLENB. (Burma to Cochinchina) which differs by its less-jugate leaves with oblique-rhomboid, stiff-chartaceous to coriaceous leaflets, and by the much longer sepals, both in flower and in fruit. SCHELLENBERG, *l.c.* p. 110, cited also a few specimens of *R. stenopetala* from the Malay Peninsula; those which I could examine doubtless represent *R. asplenifolia.*

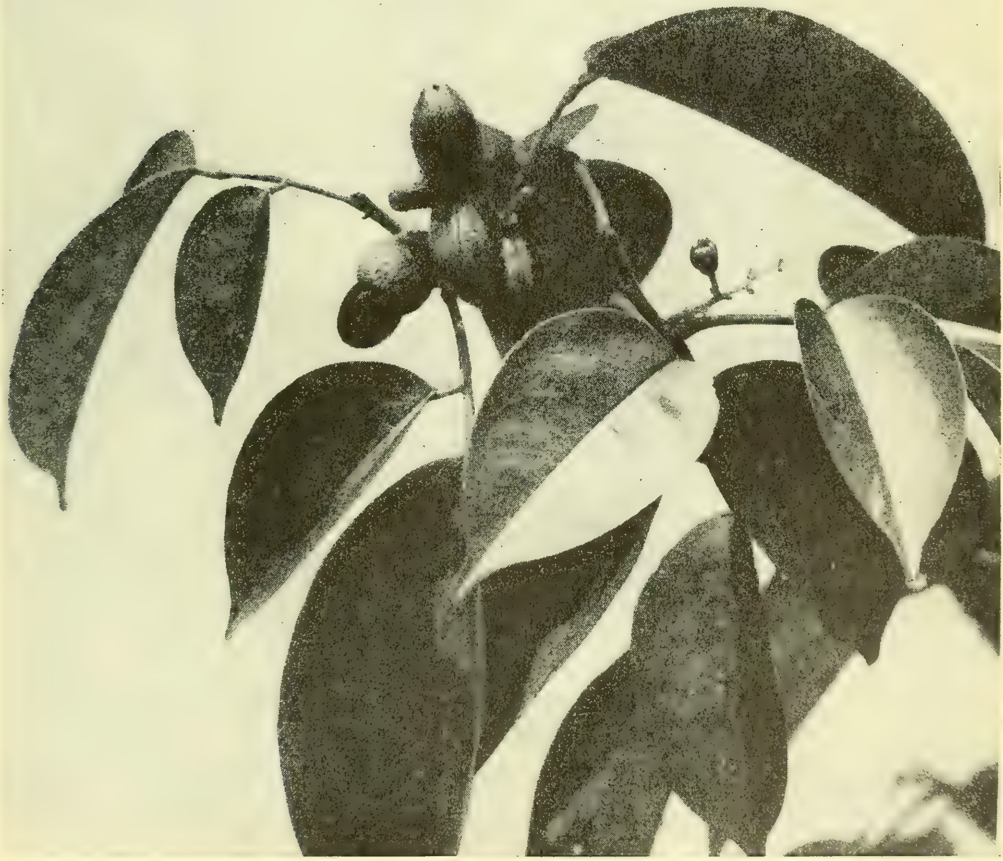


Fig. 5. *Roureopsis emarginata* (JACK) MERR. Fruiting twig of a coarse-leaved Sumatran form (γ), one fruit dehisced and the black, shining seed protruding. Cult. Hort. Bog. (XVII.F.27), Nov. 1957.

2. Roureopsis emarginata (Jack) Merr. J. Arn. Arb. 33 (1952) 220.—*Cnestis emarginata* Jack, Mal. Misc. 2, *no* 7 (1822) 42; Hook. Comp. 1 (1835) 150.—*R. javanica* Planch. Linnaea 23 (1850) 424; Walp. Ann. 2 (1851) 299; Miq. Fl. Ind. Bat. 1, 2 (1859) 661; Back. Schoolfl. (1911) 287; Koord. Exk. Fl. Java 2 (1912) 340; Schellenb. Bot. Jahrb. 59 (1924), Beibl. *no* 131, p. 27; Pfl. R. Heft 103 (1938) 113; Bakh. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 6. —*R. pubinervis* Planch. Linnaea 23 (1850) 424; Walp. Ann. 2 (1851) 299; Miq. Fl. Ind. Bat. 1, 2 (1859) 661; Hook. *f.* Fl. Br. Ind. 2 (1876) 50; King, J. As. Soc. Beng. 66, ii (1897) 16; Koord. Exk. Fl. Java 2 (1912) 340; Ridl. Fl. Mal. Pen. 1 (1922) 552; Burk. Dict. (1935) 1917; Schellenb. Pfl. R. Heft 103 (1938) 112, f. 19.—*R. scortechinii* King, J. As. Soc. Beng. 66, ii (1897) 16; Ridl. Fl. Mal. Pen. 1 (1922) 552; *non* Burk. & Henders. Gard. Bull. S.S. 3 (1925) 365 = *Rourea prainiana.* —*Taeniochlaena birmanica* Prain, J. As. Soc. Beng. 67, ii (1898) 285; Ann. R. Bot. Gard. Calc. 9 (1901) 20, t. 26.—*R. birmanica* Schellenb. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 27; Pfl. R. Heft 103 (1938) 112.—*? R. rubricarpa* Wu, Act. Phytotax. Sin. 6 (1957) 287, t. 49 f. 14.—**Fig. 4d–e, 5–6.**

Liana, up to 25 m by 1–2 cm, sometimes a shrub. Branchlets glabrous or the young parts more or less densely fulvous-tomentose. *Leaves* 1–5(–7)-jugate, glabrous or the petiole, rhachis, and petiolules more or less densely pubescent. *Leaflets* broad-ovate to elliptic, rarely obovate or oblong to lanceolate, in a few specimens oblique-rhomboid, basal ones sometimes suborbicular, upwards increasing in size but becoming narrower, 2–15 by $^{1}/_{2}$–6 cm, herbaceous to thin-chartaceous, glabrous to densely appressed-pubescent on the midrib beneath; base rounded (in basal leaflets) to acute or decurrent (in terminal leaflet); apex blunt or gradually to rather abruptly acuminate; acumen short and broad to rather long and slender, always distinctly emarginate, sometimes the midrib mucronulate; nerves 3–7 pairs, basal ones ascending (except in elliptic to oblong leaflets), the other ones nearly transverse, faintly to strongly curved, distinctly looped and joined at some distance from the margin, not very conspicuous; veins partly parallel to the nerves and nearly indistinguishable from the latter. *Inflorescences* axillary and sometimes (truly?) terminal, usually fascicles of (1–)2–3 racemes, one of which being stronger developed; racemes more or less umbelliform, up to 5 cm long, with 4–5 flowers, subglabrous (rarely densely tomentose) with the exception of the minute, densely pubescent bracts. *Flowers* 5-merous. *Sepals* ovate to oblong, rounded or acute, 4–5$^{1}/_{2}$ by 1$^{1}/_{4}$–2$^{1}/_{2}$ mm, glabrous to sparsely pubescent on both sides, mainly outside at the apex. *Petals* 6–12 by $^{3}/_{4}$–1$^{1}/_{2}$ mm, glabrous or outside with a few hairs in the upper half. *Stamens* free (or ± cohering at the base). *Pistils* glabrous (rarely thinly pubescent). *Fruits* 1–3 per flower, 1–1$^{3}/_{4}$ by $^{3}/_{4}$–1 cm, glabrous.

Distr. Yunnan, Burma, and *Malaysia:* Sumatra, Malay Peninsula, W. Java, and Borneo.

Ecol. In and along open to dense, primary and secondary forests, in scrub-jungles and along river-banks, from sea-level up to 1250 m. *Fl.* Feb.–Aug. (–Dec.), *fr.* March-May and Oct.-Jan.

Uses. The boiled leaves are used in native medicine for poulticing sore parts.

Vern. *Akar balimbing, aku sebasauw rĕnidaun,* Sum., *akar kĕdĕmut,* Banka, *a. kachang-kachang merah, a. k. bĕtina, a. kĕlichi, a. nyamok, a. tukehel,* Mal. Pen., *areuj gojal, aroj tjalintjing, kitjang aroy, tjetjer katjepet,* S.

Notes. In the broad sense as accepted here a rather variable species. It mainly consists of three forms, which are, however, neither morphologically nor geographically clearly distinguishable. I refrain emphatically from naming them and have merely indicated under which specific name the typical specimens were formerly known. These forms can, *in their typical specimens*, be characterized as follows:

α. Leaves usually 4–7-jugate; leaflets rather small, ovate, usually distinctly acuminate, acumen

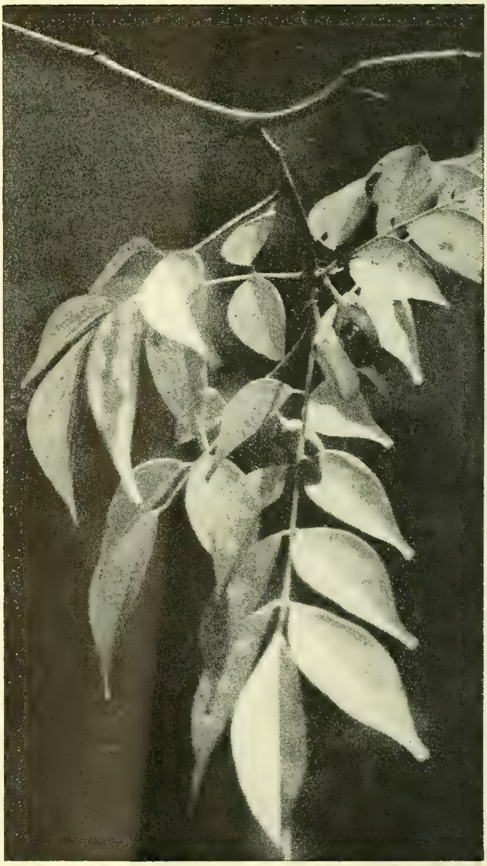


Fig. 6. *Roureopsis emarginata* (Jack) Merr. Fruiting twig of a more slender-leaved Javanese form (α) with more leaflets with emarginate acumen. Cult. Hort. Bog. (XVII. F. 23), Nov. 1957.

broad and distinctly emarginate, midrib rarely mucronulate, base rounded to subcordate; pistils always glabrous; plant fully glabrous. This form is mainly restricted to Java and Borneo, furthermore known from Banka and the Lingga Archipelago (*R. javanica*). Fig. 6.

β. Different from the first one only by the indumentum on the young twigs, the petioles, rhachises, petiolules, and at least on the midrib beneath; midrib always mucronulate. Known only from the Malay Peninsula (*R. pubinervis*).

γ. Leaves 2–4-jugate; leaflets relatively large, oblong to lanceolate, tapering acuminate, acumen slender, minutely emarginate, midrib not mucronulate, base often cuneate; pistils glabrous or thinly pubescent; plant fully glabrous. This form is known from Sumatra, a few specimens from the Malay Peninsula, furthermore from Burma and Yunnan (?) (*R. scortechinii*). Fig. 5.

The type specimen of *Cnestis emarginata*, which now seems to be lost, probably comes nearest to forma γ.

The taxonomic status of forma γ remains uncertain. *R. scortechinii* was based upon two specimens, one of which (CURTIS 1998) doubtless belongs to the genus *Rourea* (probably *R. prainiana*); the other one (SCORTECHINI 613) has only very young flowerbuds, making a detailed analysis impossible. This latter specimen matches rather well those from Sumatra, and, as far as can be judged, agrees entirely with *R. birmanica* from Upper Burma. This latter species is slightly different from typical '*R. javanica*', however, by some characters in the flowers (relatively short petals, slightly pubescent pistils) and by the partly apparently terminal inflorescences, apart from the differences in the vegetative parts. *R. rubricarpa*, finally, seems closely allied to *R. birmanica*, differs, however, mainly by its pubescence.

As to the possible synonymy of the present species with *Connarus lucidus* JACK I fully share the doubt as expressed by SCHELLENBERG (Pfl. R. Heft 103, 1938, 112).

2. Section Taeniochlaena

LEENH., *nov. stat.—Taeniochlaena* HOOK. *f* in B. & H. Gen. Pl. 1 (1865) 433; SCHELLENB. Pfl. R. Heft 103 (1938) 167.

Fruits pubescent.

3. Roureopsis acutipetala (MIQ.) LEENH., *nov. comb.—Rourea acutipetala* MIQ. Sum. (1861) 528. —*Taeniochlaena griffithii* HOOK *f.* in B. & H. Gen. Pl. 1 (1865) 434; Fl. Br. Ind. 2 (1876) 55; OLIV. in Hook. Icon. Pl. (1895) t. 2392; KING, J. As. Soc. Beng. 66, ii (1897) 20; RIDL. Fl. Mal. Pen. 1 (1922) 554.—*Taeniochlaena acutipetala* KURZ, J. As. Soc. Beng. 39, ii (1870) 76; CRAIB, Fl. Siam. En. 1 (1928) 365; BURK. Dict. (1935) 2119; SCHELLENB. Pfl. R. Heft 103 (1938) 168, f. 30.—*Santalodes acutipetalum* O.K. Rev. Gen. 1 (1891) 155.—*Taeniochlaena borneensis* SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 23; Pfl. R. Heft 103 (1938) 169.—**Fig. 4f.**

Climbing shrub or liana, sometimes treelet. Branchlets minutely pubescent when young, glabrescent. *Leaves* (unifoliolate to) 1–4-jugate. *Leaflets* oblong (to ovate), 6–10(–18) by 2½–5(–6) cm, stiff-coriaceous; base acute to rounded, sometimes slightly cordate; apex blunt to slightly acuminate, ± emarginate, acumen broad and blunt; nerves *c.* 5–8 pairs, curved, distinctly looped and joined; veins laxly reticulate, nearly invisible above. *Inflorescences* in fascicles of 1–5, paniculate or racemose, up to *c.* 4 cm long, rather many-flowered, tomentose. *Flowers* 4–5-merous. *Sepals* oblong-ovate to lanceolate, acute, 3½–7 by 1½ mm, outside tomentose, inside glabrous. *Petals* 10–11 by 1–1½ mm, glabrous. *Stamens* free. *Pistils* (4–)5(–7), ovary densely pilose. *Fruits* 1–5 per flower, 2–2½ by 1 cm, densely minutely fulvous-tomentose.

Distr. *Malaysia:* Sumatra, Malay Peninsula, and Borneo.

Note. In one inflorescence 4- and 5-merous flowers can be found. Moreover, pleiomery of the gynaecium is rather common even in one inflorescence, specially in 4-merous flowers of *subsp. borneensis.*

ssp. **acutipetala.**

Branchlets early glabrescent. Leaves entirely glabrous, up to 3-jugate. Flowers predominantly 5-merous.

Distr. Sumatra, Malay Peninsula.

Ecol. In primary and secondary forests at low altitude. *Fl.* Jan., March, and July, *fr.* (Dec.) March (May).

Uses. The very tough stems are used for tying fences. The boiled roots are used as an application for lumbago.

Vern. *Kembassouw*, Sum., *akar batu, a. bĕrombong, a. china, a. kachang bĕtina, a. k. jantan bukit, a. k. pĭraî, a. pĕrĕngat, a. sĕsudu, chĕndĕrai pait,* Mal. Pen.

ssp. **borneensis** (SCHELLENB.) LEENH., *nov. stat.* —*Taeniochlaena borneensis* SCHELLENB.

Tomentum of the branchlets rather long persistent. Leaves 2–4-jugate, petiole, rhachis, and petiolules minutely tomentose, leaflets densely appressed-pubescent on the midrib beneath, sometimes also beneath on the nerves and above on midrib and nerves. Flowers 4(–5)-merous; pistils 4–7.

Distr. Borneo; one specimen from the Malay Peninsula (Perak, KING's coll. 2668) probably also belongs to this subspecies.

Ecol. In secondary forests, up to 150 m. *Fl.* Dec.–Jan., *fr.* Oct.

Vern. *Těngirih*, Born.

4. Roureopsis pinnata (KING) LEENH., *nov. comb.* —*Agelaea pinnata* KING, J. As. Soc. Beng. 66, ii (1897) 18; RIDL. Fl. Mal. Pen. 1 (1922) 553.—*Taeniochlaena pinnata* SCHELLENB. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 30; Pfl. R. Heft 103 (1938) 169.

Liana. Branchlets minutely tomentose, gradually glabrescent. *Leaves* 1(–2)-jugate, petiole, rhachis, and petiolules minutely tomentose. *Leaflets* oblong or oblong-ovate, (8–)13–18 by ($3^1/_2$–)$5^1/_2$–$6^1/_2$ cm, chartaceous, glabrous above or on both sides tomentose on midrib and nerves; base broadly cuneate to rounded; apex slightly tapering-acuminate, acumen broad, ± emarginate; nerves 8–10 pairs, slanting, faintly curved, all except the lower ones distinctly looped and joined, veins transverse. *Inflorescences* axillary and on the older branches, in fascicles of *c.* 5–10 few-flowered racemes, $1^1/_2$–2 cm long, all densely minutely fulvous-tomentose. *Flowers* 4(–5)-merous. *Sepals* lanceolate, acute, 5 by $1^1/_2$ mm, outside thinly pubescent, inside nearly glabrous, the apex excepted. *Petals* 11 by 1 mm, glabrous. *Stamens* free. *Pistils* 4–5, ovary and the basal half of the style woolly pubescent. *Infructescences* slightly elongated, the fruit-bearing axes much thickened, only few flowers developing fruits. *Fruits c.* 3 per flower, $2^1/_2$ by 1 cm, sparsely minutely tomentose.

Distr. *Malaysia:* Sumatra (Tapanuli: Pulo Liman, once found, RAHMAT 5327), Malay Peninsula (Perak: Larut, once found).

Ecol. Open jungle at low altitude. *Fl.* Jan., *fr.* Aug.

Notes. Doubtless most closely allied to *R. acutipetala*, but distinctly different. The specimen from the Malay Peninsula is distinctly more pubescent than the specimen from Sumatra.

Excluded

Taeniochlaena polyneura SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 24; Pfl. R. Heft 103 (1938) 169.—The type of this species (MOTLEY 685 *p.p.* in herb. K) consists of a young twig with inflorescences of *R. acutipetala ssp. borneensis* and an older twig with a leaf of *Lansium domesticum* JACK (*Meliac.*). As these leaves play an important part in the description of this 'species', the name is illegitimate and should be discarded.

4. ROUREA

AUBL. Hist. Pl. Guiane 1 (1775) 467, t. 187; SCHELLENB. Pfl. R. Heft 103 (1938) 194; *nom. cons. prop.*—*Santaloides* LINNÉ, Fl. Zeyl. (1747) 192, *p. maj. p.;* LINNÉ *ex* O.K. Rev. Gen. Pl. 1 (1891) 155 (*Santalodes*), *nom. illeg.;* SCHELLENB. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 46; Pfl. R. Heft 103 (1938) 119; J. H. HEMSL. & BULLOCK, Taxon 5 (1956) 57, *nom. cons. prop.*—*Kalawael* ADANS. Fam. Pl. 2 (1763) 344, *nom. rejic. prop.*—*Byrsocarpus* SCHUM. & THONN. Kongl. Dansk. Vid. Selsk. Skrift. IV, 3 (1827) 246; SCHELLENB. Pfl. R. Heft 103 (1938) 146.—*Jaundea* GILG, Notizbl. Berl.-Dahl. 1 (1895) 66; SCHELLENB. Pfl. R. Heft 103 (1938) 161. —*Santaloidella* SCHELLENB. Pfl. R. Heft 103 (1938) 118.—**Fig. 7–9.**

Lianas or erect shrubs, sometimes small trees; part of the twigs often hooked. *Leaves* imparipinnate, rarely unifoliolate. *Inflorescences* axillary, often together pseudo-terminal (to truly terminal?), paniculate. *Bracts* ovate-lanceolate, acute. *Bracteoles* lanceolate, small, fimbriate. *Flowers* bisexual, 5-merous. *Sepals* distinctly imbricate, ovate, acute, outside usually minutely pubescent, ciliate along the margin, barbulate at the apex, inside glabrous. *Petals* lanceolate, 2–3 times as long as the sepals, thin, glabrous. *Stamens* 10, confluent at the base, glabrous, episepalous ones distinctly longer than epipetalous ones; filaments filiform. *Pistils* 5, heterotristylous; ovary oblique-ovoid, pubescent or glabrous; style slender, stigma capitate, faintly 2-lobed. *Calyx* in fruit accrescent, coriaceous or hard. *Fruits* 1 (very seldom 2) per flower, ellipsoid to ovoid, usually slightly recurved, delicately striate lengthwise, glabrous (in Mal. *spp.*), usually opening lengthwise by a ventral slit, rarely pericarp tearing loose irregularly ± circumsciss at the base; pericarp thin, coriaceous to very hard. *Seed* 1, ellipsoid to subglobular, usually flattened, either the testa itself partly or nearly entirely fleshy, or the seed enveloped by a fleshy arillode; no endosperm.

Distr. About 90–100 species (acc. to SCHELLENBERG, Pfl. R. Heft 103, 1938, but probably much less) in the tropics of Central and S. America, Africa (also Madagascar), SE. Asia, *Malaysia*, NE. Australia, and Melanesia (to and including Samoa).

Ecol. Primary and secondary rain-forests, especially along the edges, along river-banks, roads, *etc.*; mainly at low altitudes.

According to J. H. HEMSLEY (in Fl. of E. Trop. Afr.) the fruits are eaten by birds and monkeys, which apparently are very fond of them.

Uses. A decoction of the roots of some species is used as a medicine against stomach-ache and dysentery; of some other species, this decoction is poisonous, and is used for killing dogs. The arillode is eaten. See BURK. Dict. (1935) 1950.

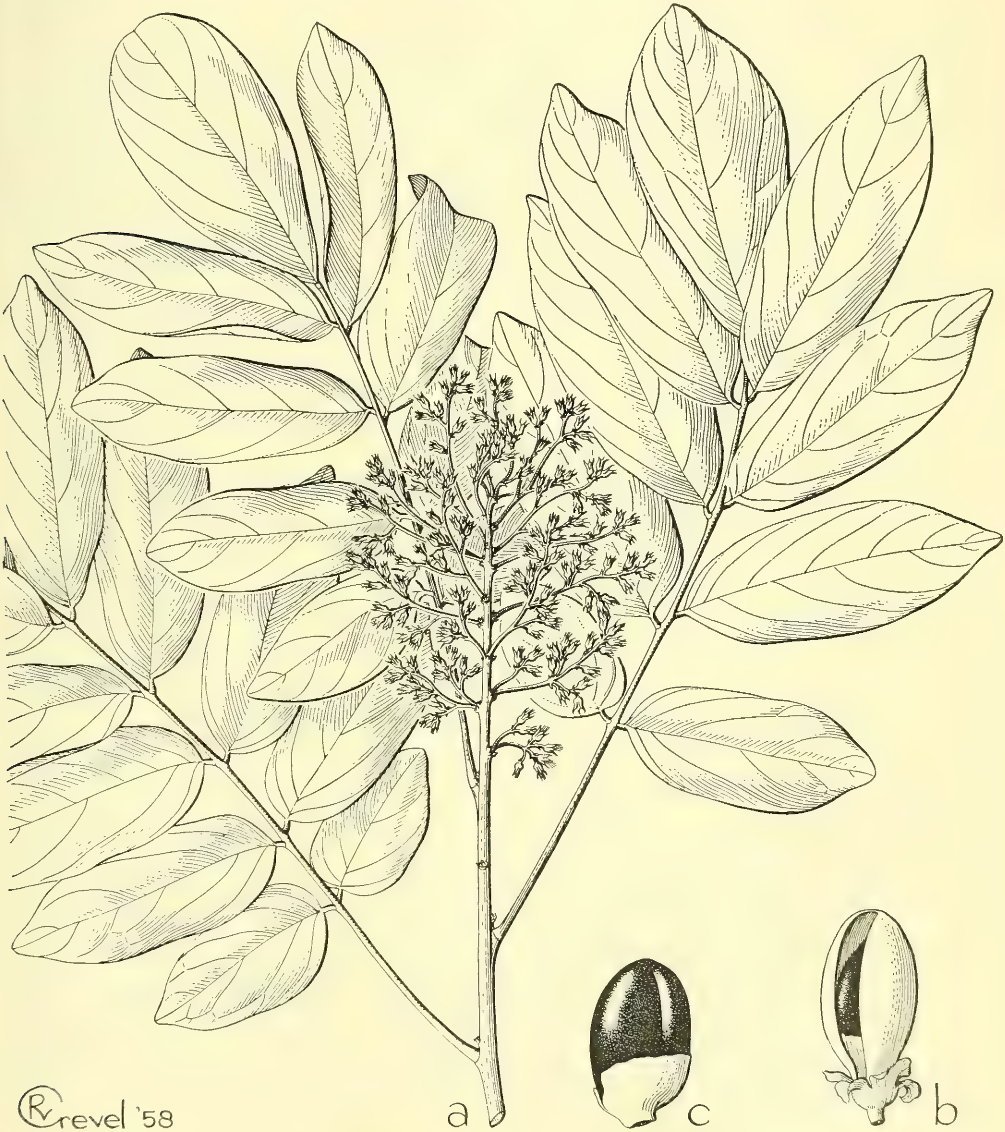


Fig. 7. *Rourea oligophlebia* MERR. *a*. Flowering twig, × 1/2, *b*. fruit, and *c*. seed, nat. size (*a* RAHMAT 6775 and BARTLETT 8161, *b* RAHMAT 4912, *c* CLEMENS 3365).

Morph. In principle the phyllotaxis of the present genus is spiral (2/5), often rather irregular, however, and in some species even not rarely pseudo-opposite.

The flowers are recorded to be fragrant. The calyx is initially creamy-white, turning to pink at the end of the anthesis, and to dull-crimson when the fruit is ripening. Short after anthesis the calyx is contracted in a very peculiar way into a slender cone, with a small tuft of stamens protruding from the apex; this is a valuable character for recognizing the genus. The corolla is creamy to white, turning to pinkish-white; though choripetalous, it falls off as a whole, as the petals are conglutinated slightly above their bases. The filaments are waxy-white, the anthers yellow. The pistils are usually pilose, at least at the base of the sharp centripetal edge of the ovary; the upper half of the style is always glabrous. The ovary is pale yellow, the style white, and the stigma brown.

The fruits turn from bright green via yellow to red; the inner surface remains green. After dehiscence the pericarp is recurving (if it is not shed as a whole, like in *sect. Afrosantaloides*), and the seed is protruding from the pericarp.

The seed. Normally the testa is shining light-brown to black. However, at least part of the testa is fleshy and yellow to red, moreover, it is fragrant. In *subg. Jaundea* this sarcotesta covers the whole seed or the greater part of it. In *subg. Rourea* the sarcotesta is restricted to a small area near the base of the seed, opposite to the hilum. In *subg. Palliatus* the sarcotestal part fully coincides with the one in *subg. Rourea;* during the ripening of the seed, however, a loose arillode is developing from this small sarcotesta, which at the end loosely envelops the whole seed; this arillode is only slit at the side of the hilum.

Taxon. In the circumscription accepted here, the genus *Rourea* comprises 5 genera distinguished by SCHELLENBERG (Pfl. R.), *viz Santaloidella*, *Santaloides*, *Byrsocarpus*, *Jaundea*, and *Rourea*. The first four of these genera made part of his tribe *Byrsocarpeae*, the last named genus was considered to belong to the tribe *Connareae*. In fact all these genera differ only in the degree of development of the sarcotesta. And as to this character they form a gradual series, the only exception being the arillode of *Santaloides*. This arillode develops in a very late ontogenetical stage, however, as an outgrowth of a sarcotesta of quite the same kind as in his genera *Rourea* and *Santaloidella*.

In my opinion the genus *Rourea* in the wide sense should be placed in the tribe *Byrsocarpeae*, and it may be subdivided in the following way:

Subg. **Jaundea** (GILG) LEENH. (comprising the genera *Jaundea* and *Byrsocarpus*): sarcotesta covering the whole seed or a great part of it; hilum basal, large; calyx spreading in fruit. About 24 *spp.*, mainly in Africa, 1 in Madagascar, 1 in Annam and Sumatra (*R. oligophlebia*). Possibly both former genera might be kept apart as sections.

Subg. **Rourea** (comprising the genera *Santaloidella* and *Rourea sensu* SCHELLENB.): sarcotesta covering only a small part of the seed near the base just opposite the hilum; hilum lateral, near the base, small; calyx appressed in fruit. About 30 *spp.*, 1 in W. Africa, all others in Central and South America.

Subg. **Palliatus** LEENH. (*Santaloides sensu* SCHELLENB.): seed entirely enveloped by an arillode which is fixed near the base opposite the hilum; hilum lateral near the base, small; calyx appressed in fruit. About 35 *spp.* in Africa, SE. Asia, *Malaysia*, NE. Australia, and Melanesia.

The last subgenus may further be subdivided into 2 sections:

Sect. **Palliatus** (*Santaloides subg. Dalbergioidea & Mimosoidea sensu* SCHELLENB.): fruit dehiscing by a ventral slit. About 30 *spp.;* distribution as the subgenus with the exception of Africa, *incl.* all but three of the Mal. *spp.*

Sect. **Afrosantaloides** (SCHELLENB.) LEENH. (*Santaloides subg. Afrosantaloides* SCHELLENB. Pfl. R. Heft 103, 1938, 137): fruit dehiscing irregularly around the base. About 7–8 *spp.*, 5 of which are confined to W. Africa, 1 in Madagascar, 1 in the Deccan and the Malay Peninsula (*R. prainiana*), and possibly 1 in Borneo (*R. ovale*).

Nomencl. The proposal to conserve *Rourea* AUBL. against *Kalawael* ADANS. needs some comment and entails its typification.

In 1717 HERMANN, in his 'Museum Zeylanicum', gave some notes on two different plants from Ceylon, both recorded by their vernacular names, *Kalawael* (*l.c.* p. 21 & 24) and *Kiridiwael* (*l.c.* p. 10). As appears from his specimens preserved in the British Museum (the first named also in Herb. Leyden) *Kalawael* = *Derris heptaphylla* (L.) MERR. and *Kiridiwael* = *Rourea minor* (GAERTN.) LEENH.

In 1747 LINNÉ described in his 'Flora Zeylanica', in the class *Decandria*, the genus *Santaloides* L. in which by citation he included both *Kalawael* and *Kiridiwael*. From his description and from the systematic position he gave to his genus it is clear that he based it on *Kiridiwael*, of which he obviously must have seen a HERMANN specimen; none is preserved in the Linnean Herbarium. The mention of '*styli duo*' in his diagnosis must be a mistake, as it does not fit any of the two HERMANN species. It is thus inferred, that *Santaloides* L. 1747 should be typified by *Kiridiwael*, that is *Rourea*, and in this sense it has always been understood. It is most remarkable that LINNÉ did not refer to it in his later works.

In 1763 ADANSON described in his 'Familles des Plantes' (vol. 2, p. 344) the genus *Kalawael* in his family *Pistaciae*. He based himself exclusively on the description of LINNÉ 1747, repeating the mistake alluded to above '*2 stil. 2 stig.*' He provided the generic name *Kalawael* with the references: '*Herm. Zeyl. 24. Santaloides Linn.*', adding, in the index (*l.c.* p. 530) '*Kiridivel*' as another synonym, thereby maintaining exactly the same citation and circumscription as LINNÉ had cited in 1747 for *Santaloides*.

Though ADANSON accepted the name *Kalawael*, a common Ceylonese vernacular for *Derris*, it is clear that the typification of *Kalawael* ADANS. should be in accordance with the taxonomical position he gave to it, and with his diagnosis. And the latter which he derived from LINNÉ should in turn be typified in the same sense as *Santaloides* L., that is by *Kiridiwael* HERM. = *Rourea minor* (GAERTN.) LEENH. The conclusion is, therefore, that *Kalawael* ADANS. 1763 is an earlier taxonomic synonym of *Rourea* AUBL. 1775.

The arguments for proposing to reject *Kalawael* in favour of *Rourea* are primarily that no taxonomist has taken up this name since it was proposed by ADANSON in 1763 and no binary combination has been attached to it, whereas *Rourea* is a well-known large genus. A minor issue is that the generic name *Kalawael* is a common vernacular in Ceylon for *Derris*.

KEY TO THE SPECIES

1. Seed covered by a sarcotesta in the basal half . . . . **1. R. oligophlebia**
1. Seed enveloped by an arillode.
  2. Pericarp tearing loose irregularly ± circumsciss at the base.
    3. Leaves 3–6-jugate . . . . **7. R. prainiana**
    3. Leaves uni- to 3-foliolate. . . . . **8. R. ovale**
  2. Fruit dehiscing with a ventral lengthwise slit.
    4. Leaves mimosoid, leaflets many (up to *c.* 25 pairs) and small (up to $3^1/_2$ by $1^1/_2$ cm).
      5. Lateral leaflets (nearly) equilateral at the base; pubescence fulvous . . . **4. R. mimosoides**
      5. Lateral leaflets distinctly oblique at the base; pubescence reddish-brown . . **5. R. fulgens**
    4. Leaves not mimosoid.
      6. Leaflets bullate, beneath at least pubescent on the midrib and the nerves . . . **2. R. rugosa**
      6. Leaflets not bullate, usually glabrous, if pubescent only on the midrib beneath.
        7. Pistils extremely small ($^1/_2$–1 mm) (or plant dioecious?) . . . . . . **6. R. radlkoferiana**
        7. Pistils at least $1^1/_2$–2 mm . . . . **3. R. minor**

Subgenus Jaundea

(GILG) LEENH., *nov. comb.—Byrsocarpus* SCHUM. & THONN., 1827.—*Jaundea* GILG, 1895.—*Byrsocarpus subg. Jaundea* SCHELLENB. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 43.

Calyx spreading in fruit. Seed entirely or for the greater part covered by a sarcotesta; hilum basal, large.

1. Rourea oligophlebia MERR. Pap. Mich. Ac. Sc. 23 (1938) 178.—**Fig. 7.**

Liana. Twigs thin-tomentose when young. *Leaves* (4–)5–9-jugate; lateral petiolules 2–4 mm long. *Leaflets* ovate (basal pairs), oblong to rarely oblong-ovate (lateral ones) or oblong-obovate (terminal ones), 5–10 by 2–4 cm, thin-chartaceous, glabrous above, minutely pubescent mainly on the nerves and veins beneath; base of lateral leaflets usually oblique, rounded to cuneate, sometimes slightly decurrent, base of terminal ones equilateral, cuneate; apex blunt, usually minutely emarginate and mucronulate; nerves 5–6 pairs, ascending, slightly curved to nearly straight, gradually looping into the marginal vein. *Inflorescences* pseudo-terminal, each consisting of 1(–3) raceme(s), 2–5 cm long, few-flowered, thinly pubescent. *Calyx* 3 mm high, minutely pubescent outside. *Petals* 4 mm long. *Ovary* pilose. *Fruits* ellipsoid, straight, $2^1/_4$–3 by 1–$1^1/_4$ cm, acute. *Seed* up to halfway covered by a sarcotesta.

Distr. Indo-China (Annam) and *Malaysia:* Sumatra (Tapanuli and Asahan, S to the Bila River).

Ecol. Along forest-edges at low altitude. *Fl.* March-May, *fr.* May-July.

Vern. *Andor garunggang*, M.

Note. This very interesting species is the only representative of *subg. Jaundea* outside Africa.

Subgenus Palliatus

LEENH., *nov. nom.—Santaloides* L. *ex* O.K. *emend.* SCHELLENB. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 46.

Calyx appressed in fruit. Seed entirely enveloped by an arillode which is attached near the base opposite the hilum; hilum lateral near the base, small.

1. Section Palliatus

Rourea sect. Dalbergioideae PLANCH. Linnaea 23 (1850) 414.—*Rourea sect. Mimosoideae* PLANCH. Linnaea 23 (1850) 420.—*Santaloides subg. Dalbergioidea* SCHELLENB. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 49.— *Santaloides subg. Mimosoidea* SCHELLENB. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 54.

Fruit dehiscing by a ventral slit.

2. Rourea rugosa PLANCH. Linnaea 23 (1850) 422; Walp. Ann. 2 (1851) 298; MIQ. Fl. Ind. Bat. 1, 2 (1859) 661; HOOK. *f.* Fl. Br. Ind. 2 (1876) 48; KING, J. As. Soc. Beng. 66, ii (1897) 14; RIDL. Fl. Mal. Pen. 1 (1922) 550; *non* F.–VILL. Nov. App. (1880) 56, *quae est Cnestis palala* (LOUR.) MERR. —*Connarus rugosus* WALL. Cat. (1847) *no* 8527, *nom. nud.*—*Santalodes rugosum* O.K. Rev. Gen. 1 (1891) 155; BURK. Dict. (1935) 1952; SCHELLENB. Pfl. R. Heft 103 (1938) 141.

Liana, up to 25 m by $7^1/_2$ cm. Twigs densely fulvous-tomentose. *Leaves* (4–)7 to *c.* 20-jugate; lateral petiolules *c.* $^1/_2$ mm long. *Leaflets* oblong-obovate to lanceolate, rarely ovate (especially the terminal ones), $5^1/_2$–9(–12) by $1^1/_4$–4(–5) cm, (basal pairs elliptic to ovate, 2–3 by $1^1/_2$ cm), thin-coriaceous to stiff-chartaceous, slightly bullate, sparsely tomentose on the midrib above, thinly short-pilose on the nerves beneath; base of lateral leaflets slightly oblique, cordate, of the terminal ones equilateral, broadly cuneate; apex slightly acuminate to caudate, blunt; nerves 6–10 pairs, patent, rather irregular, nearly straight, distinctly looped and joined. *Inflorescences* axillary, consisting of 5 fascicled, narrow panicles (and often some smaller ones), which are 7–15 cm long, rather many-flowered, fulvous-tomentose. *Calyx* 2 mm high, laxly pilose outside. *Corolla* 5 mm long. *Ovary* and basal half of the style laxly pilose. *Fruits* oblong-ovoid, curved, $1^1/_4$–$1^3/_4$ by $^1/_2$–$^3/_4$ cm, acute.

Distr. *Malaysia:* Malay Peninsula.

SCHELLENBERG (1938) erroneously localized the specimen WRAY 1923, from Assam Kumbang, Perak, as being collected in Assam.

Ecol. Primary and secondary forests, up to 850 m. *Fl.* mainly Jan.–June, *fr.* May–Aug.

Uses. A decoction of the roots is used by the Malays as a medicine for stomach-ache; furthermore, it is drunk after childbirth.

Vern. *Akar batah, a. hutam, a. kělěntit* (or *kuluntět*) *kěra, a. klinlek nghmoo, a. sěm(b)ělit, a. s. darah, a. s. puteh,* (*bûnga*) *akar pěrějeb, kělěntit nyamok.*

3. Rourea minor (GAERTN.) LEENH., *nov. comb.* —*Aegiceras minus* GAERTN. Fruct. 1 (1788) 216, t. 46, *excl. syn. Umbraculum maris* RUMPH.; *non* WILLD. Sp. Pl. 1 (1797) 1184, *et auct.*—*Cnestis florida* JACK, Mal. Misc. 2, 7 (1822) 43; Hook. Comp. Bot. Mag. 1 (1835) 151; Walp. Repert. 1 (1842) 561; MERR. J. Arn. Arb. 33 (1952) 220.—*Cnestis monadelpha* ROXB. [Hort. Beng. (1814) 34, *nom. nud.*] *ex* DC. Prod. 2 (1825) 87.—*Connarus javanicus* BL. Bijdr. (1826) 1166; Walp. Repert. 5 (1845–6) 421.—*Connarus microphyllus* HOOK. *f.* & ARN. Bot. Beech. Voy. (1833) 179, *nom. illeg.*—*Connarus roxburghii* HOOK. *f.* & ARN. Bot. Beech. Voy. (1833) 179, *nom. illeg.*—*R. santaloides* W. & A. Prod. (1834) 144; BEDDOME, Fl. Sylv. 3 (1871) t. 11; F.–VILL. Nov. App. (1883) 56; E. & P. Nat. Pfl. Fam. 3, 3 (1888) f. 34 F; TRIM. Fl. Ceyl. 2 (1894) 1; PIERRE, Fl. Coch. 5 (1898) t. 379 B, *incl. var. mekongensis;* BRANDIS, Ind. Trees (1906) f. 92; LECOMTE, Fl. Gén. I.–C. 2 (1908) 47.—*Cnestis erecta* BLANCO, Fl. Filip. (1837) 387; MERR. Philip. Gov. Lab. Publ. *no* 27 (1905) 37.—*?Cnestis glabra* (*non* LAMK) BLANCO, Fl. Filip. (1837) 387; ed. 2 (1845) 271; ed. 3, 2 (1878) 138, t. 140.—*Omphalobium pictum* BLANCO, Fl. Filip. ed. 2 (1845) 271; ed. 3, 2 (1878) 139.—*Cnestis acuminata* WALL. Cat. (1847) *no* 8533, *nom. nud.*—*Omphalobium obliquum* PRESL, Epim. Bot. (1849) 207.—*R. multiflora* PLANCH. Linnaea 23 (1850) 418; Walp. Ann. 2 (1851) 297; MIQ. Fl. Ind. Bat. 1, 2 (1859) 658; F.—VILL. Nov. App. (1880) 56; VIDAL, Sinopsis (1883) t. 39 f. A.—*R. caudata* PLANCH. Linnaea 23 (1850) 419; Walp. Ann. 2 (1851) 297; HOOK. *f.* Fl. Br. Ind. 2 (1876) 48.—*R. heterophylla* PLANCH. Linnaea 23 (1850) 419; Walp. Ann. 2 (1851) 297; MIQ. Fl. Ind. Bat. 1, 2 (1859) 658.—*R. pulchella* PLANCH. Linnaea 23 (1850) 419; Walp. Ann. 2 (1851) 297; MIQ. Fl. Ind. Bat. 1, 2 (1859) 658; HOOK. *f.* Fl. Br. Ind. 2 (1876) 48; KURZ, For. Fl. Burma 1 (1877) 324; KING, J. As. Soc. Beng. 66, ii (1897) 13; RIDL. Fl. Mal. Pen. 1 (1922) 550.—*R. commutata* PLANCH. Linnaea 23 (1850) 420, *nom. illeg.;* KURZ, For. Fl. Burma 1 (1877) 324; F.–VILL. Nov. App. (1880) 56; LECOMTE, Fl. Gén. I.–C. 2 (1908) 48; KANJILAL *et al.* Fl. Assam 2 (1938) 2. —*R. microphylla* PLANCH. Linnaea 23 (1850) 421, *nom. illeg.*; LECOMTE, Fl. Gén. I.–C. 2 (1908) 47. —*R. humilis* BL. Mus. Bot. 1 (1850) 262; Walp. Ann. 2 (1851) 297; MIQ. Fl. Ind. Bat. 1, 2 (1859) 658; KING, J. As. Soc. Beng. 66, ii (1897) 13; BACK. Schoolfl. (1911) 287, *incl.* also *f. pulchella;* KOORD. Exk. Fl. Java 2 (1912) 340; RIDL. Fl. Mal. Pen. 1 (1922) 550; MERR. Pl. Elm. Born. (1929) 95.—*R. javanica* BL. Mus. Bot. 1 (1850) 262, f. 59; Walp. Ann. 2 (1851) 297; SCHNIZL. Iconogr. 4 (1866–70) t. 247 f. 17–20; LECOMTE, Fl. Gén. I.–C. 2 (1908) 48.—*R. simplicifolia* BL. Mus. Bot. 1 (1850) 263; Walp. Ann. 2 (1851) 297; MIQ. Fl. Ind. Bat. 1, 2 (1859) 658.—*Connarus obliquus* PRESL, Walp. Ann. 3 (1851) 844.—*R. florida* MIQ. Sum. (1861) 528.—*R. brachyandra* F.v.M. Fragm. 8 (1872) 6; F. M. BAIL. Queensl. Fl. 2 (1900) 328. —*R. acuminata* HOOK. *f.* Fl. Br. Ind. 2 (1876) 48; KING, J. As. Soc. Beng. 66, ii (1897) 12; RIDL. Fl. Mal. Pen. 1 (1922) 550.—*Connarus monocarpus* (*non* L.) F.-Vill. Nov. App. (1880) 57.—? *Connarus paniculatus* (*non* Roxb.) F.-Vill. Nov. App. (1880) 57.—*R. obliqua* Radlk. Sitz. Ber. Bayer. Akad. Wiss. 16 (1886) 366.—*Santalodes acuminatum* O.K. Rev. Gen. 1 (1891) 155; Schellenb. Pfl. R. Heft 103 (1938) 136.—*Santalodes caudatum* O.K. Rev. Gen. 1 (1891) 155; Schellenb. Pfl. R. Heft 103 (1938) 132.—*Santalodes floridum* O.K. Rev. Gen. 1 (1891) 155; Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 28; Burk. Dict. (1935) 1951; Schellenb. Pfl. R. Heft 103 (1938) 124; Bakh. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 7.—*Santalodes heterophyllum* O.K. Rev. Gen. 1 (1891) 155.—*Santalodes humile* O.K. Rev. Gen. 1 (1891) 155.—*Santalodes monadelphum* O.K. Rev. Gen. 1 (1891) 155; Schellenb. Pfl. R. Heft 103 (1938) 122, f. 21.—*Santalodes multiflorum* O.K. Rev. Gen. 1 (1891) 155.—*Santalodes pulchellum* O.K. Rev. Gen. 1 (1891) 155; Burk. Dict. (1935) 1952; Schellenb. Pfl. R. Heft 103 (1938) 126.—*Santalodes roxburghii* O.K. Rev. Gen. 1 (1891) 155, *nom. illeg.;* Schellenb. Pfl. R. Heft 103 (1938) 125.—*Santalodes simplicifolium* O.K. Rev. Gen. 1 (1891) 155; Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 29; Pfl. R. Heft 103 (1938) 129.—*Sarcotheca paniculata* Ridl. Trans. Linn. Soc. II, 3 (1893) 282; Fl. Mal. Pen. 1 (1922) 324; Knuth, Pfl. R. Heft 95 (1930) 427.—*R. anomala* King, J. As. Soc. Beng. 66, ii (1897) 11; Ridl. Fl. Mal. Pen. 1 (1922) 549.—*R. acropetala* Pierre, Fl. Coch. 5 (1898) t. 379 d; Lecomte, Fl. Gén. I.-C. 2 (1908) 50.—*R. rubella* Pierre, Fl. Coch. 5 (1898) t. 379 f; Lecomte, Fl. Gén. I.-C. 2 (1908) 47.—*R. volubilis* (*non Cnestis volubilis* Blanco) Merr. Philip. Gov. Lab. Publ. *no* 27 (1905) 36, *pro specim.;* Philip. J. Sc. 4 (1909) Bot. 125; Brown, Min. Prod. Philip. For. 1 (1920) 378; Hayata, Ic. Pl. Formos. 10 (1921) 3; Merr. En. Philip. 2 (1923) 240; Ito, Illustr. Formos. Pl. (1927) t. 16; Sasaki, Cat. Gov. Herb. Formosa (1930) 263.—*R. samoensis* Laut. Bot. Jahrb. 41 (1908) 226.—*R. erecta* Merr. Philip. J. Sc. 4 (1909) Bot. 125; Fl. Manil. (1912) 220; En. Philip. 2 (1923) 239.—*Santaloides anomalum* Schellenb. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 50; Craib, Fl. Siam. En. 1 (1928) 360; Schellenb. Pfl. R. Heft 103 (1938) 128.—*Santaloides brachyandrum* Schellenb. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 50; Pfl. R. Heft 103 (1938) 125.—*Santaloides volubile* (*non Cnestis volubilis* Blanco) Schellenb. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 51, *pro specim.*; Merr. Sp. Blanc. (1918) 164.—*Santaloides erectum* Schellenb. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 52; Fedde, Rep. 10 (1911) 247; Merr. Sp. Blanc. (1918) 163; Schellenb. Pfl. R. Heft 103 (1938) 133.—*Santaloides microphyllum* Schellenb. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 53, *nom. illeg.;* Pfl. R. Heft 103 (1938) 130, *incl.* also *var. grandifoliolata.*—*R. unifoliolata* Merr. Philip. J. Sc. 8 (1913) Bot. 372; En. Philip. 2 (1923) 240.—*R. imbricata* Elm. Leafl. Philip. Bot. 7 (1915) 2597; Merr. En. Philip. 2 (1923) 240.—*R. microcarpa* Elm. Leafl. Philip. Bot. 7 (1915) 2599.—*R. subvolubilis* Elm. Leafl. Philip. Bot. 7 (1915) 2600.—*R. luzoniensis* Merr. Philip. J. Sc. 14 (1919) 404; En. Philip. 2 (1923) 240.—*Santaloides papuanum* Schellenb. Bot. Jahrb. 58 (1923) 179; Pfl. R. Heft 103 (1938) 124.—*Santaloides samoense* Schellenb. Bot. Jahrb. 58 (1923) 180; Pfl. R. Heft 103 (1938) 122.—*Santaloides minus* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 28; Pfl. R. Heft 103 (1938) 126.—*Santaloides cordatum* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 29, *p.p.;* Pfl. R. Heft 103 (1938) 128.—*Santaloides beccarii* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 30; Pfl. R. Heft 103 (1938) 137.—*Santaloides luzoniensis* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 30; Pfl. R. Heft 103 (1938) 137.—*Connaropsis varians* Craib, Kew Bull. (1926) 158; Fl. Siam. En. 1 (1926) 207.—*Santaloides rubellum* Schellenb. Kew Bull. (1927) 376; Pfl. R. Heft 103 (1938) 133.—*Santaloides siamense* Schellenb. Kew Bull. (1927) 376; Pfl. R. Heft 103 (1938) 133.—*Sarcotheca varians* Knuth, Pfl. R. Heft 95 (1930) 425.—*Santaloides desmos* Guill. Bull. Mus. Hist. Nat. Paris II, 9 (1937) 285.—*Santaloides vieillardii* Schellenb. Pfl. R. Heft 103 (1938) 125.—*Santaloides acropetalum* Schellenb. *l.c.* 127.—*Santaloides celebicum* Schellenb. *l.c.* 130.—*Santaloides sumatrense* Schellenb. *l.c.* 132.—*Santaloides vitiense* Schellenb. *l.c.* 135.—*Santaloides discolor* Schellenb. *l.c.* 136, *nom. illeg.*, *non* O.K.—*Santaloides elmeri* Schellenb. *l.c.* 289.—**Fig. 8.**

Usually a large liana, rarely a shrub or treelet. Twigs glabrous or the young parts minutely tomentose. *Leaves* unifoliolate to 9-jugate, almost always glabrous; lateral petiolules ($^1/_2$–)2–6 mm long. *Leaflets* suborbicular or ovate to lanceolate, terminal ones sometimes obovate, 1–25 by $^1/_2$–10 cm, thin-chartaceous to coriaceous, smooth and shining on both sides or minutely papillose and dull to slightly glaucous beneath; base equilateral to oblique, acute to cordate; apex short and broad to caudate acuminate, acumen blunt; nerves 4–7(–11) pairs, either neatly pinnate or more or less triplinerved, always distinctly looped and joined near the margin; reticulations inconspicuous to distinctly minutely tessellate. *Inflorescences* mainly in the upper leaf-axils, or pseudo-terminal, consisting of 1–5 axes, central one up to 20 cm long, the other ones distinctly shorter, all loosely paniculate to subracemose, usually rather many-flowered, glabrous. *Calyx* 2–3 mm high, minutely tomentose to glabrous. *Corolla* 4–7$^1/_2$ mm long. *Pistils* pubescent to glabrous (sometimes even varying in the same inflorescence!). *Fruits* oblique-ellipsoid to oblique-ovoid, straight to curved, 1–3 by $^1/_3$–1 cm, blunt to acute.

Distr. Ceylon, SW. Deccan, continental SE. Asia from E. Bengal and Assam to S. China (Hongkong), Hainan, and Kôtôsyo Isl. near Formosa, the Andaman and Nicobar Islands, *Malaysia* (unknown only from the Lesser Sunda Islands east of Bali), NE. Queensland, New Caledonia, the New Hebrides, and the Fiji and Samoa Islands.

Ecol. In primary and secondary forests, bamboo-and teak-forests (Java), usually along forest edges, in more open places and along river-banks, also in swamps, in thickets, and on coastal rocks, from sea-level up to 1800 m. *Fl.* and *fr.* Jan.–Dec.

Uses. The branches are used as ropes. The wood and the roots are apparently poisonous, and a decoction, mixed up with dog's food, is used for killing dogs. A decoction of the wood and the roots is also used in medicine.

Vern. *Palo santo*, Spanish, *akar kĕntjing njamuk*, *a. nasi-nasi*, *ba-blimbing*, *tĕmbassau*, Sum., *akar bala*, *a.* (or *asam*) *nyamok*, *a. sĕmĕlit*, *bĕbatai bukit*, *kachang-kachang*, *pĕngichut*, *pĕtala bumi*, Mal. Pen., *aroy burris*, *a. tjiètjèr*, *tjalintjing*, S, *itil mingip*, *ojot-wuluan*, *upil aking*, J, *kadĕlik*, *liktjilikan*, Md, *akar malam*, *kolabat*, Born.; Philip.: *baraláng*, *paragauúk*, Ibn., *bitog*, Ig., *dakolai*, Mbo., *gapae-gapae*, *uñgali*, Bis., *gikos-gikos*, *guraikan*, *hanmababau*, *kamagsa*, *k. tagílis*, *kamagsang-tindig*, *kamaisa*, *kamumin*, *maputí*, Tag., *hanmababau*, *magtabig*, *mabindato*, *uñgalina mapula*, Bis., *kalayan*, *tioa*, Bag., *magtabig*, Pamp.; *walikok*, New Guinea.

Morph. In some specimens, mainly from the Malay Peninsula (and in the type specimen from Ceylon) the seeds are abnormal: stalked, globular, without arillode, thus shining light-brown with a lighter line lengthwise.

Taxon. In the circumscription as given here the species shows a wide range of variability, and consequently possesses a very large number of synonyms.

Already in 1924 SCHELLENBERG (Bot. Jahrb. 59, 1924, Beibl. *no* 131, p. 28) considered the numerous 'species' of the *Rourea minor* complex as constituting small, closely related and usually replacing microspecies which, together, make the impression of a chain or mosaic of races ('geographische Rassen einer Gesamtart'). The increase of material has entailed increase in difficulty of defining these small species against one another and it has appeared that the already feeble demarcations between them have in most cases fallen away or have been weakened so much that I feel they cannot be

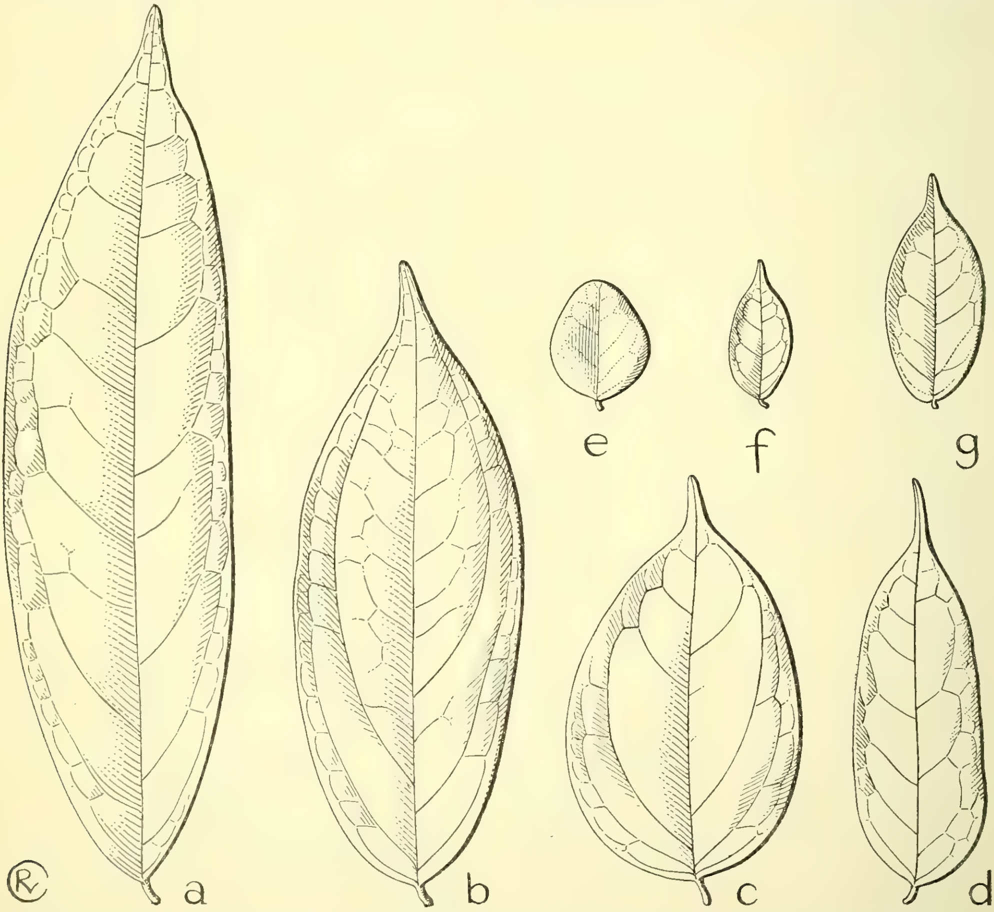


Fig. 8. Variability of leaflets in *Rourea minor* (GAERTN.) LEENH. *a.* '*acropetala*' (POILANE 29530), *b.* '*florida*' (HAVILAND *s.n.*), *c.* '*florida*' (FOX 5121), *d.* '*erecta*' (BS 76866), *e.* '*beccarii*' (BROOKE 10821), *f.* '*microphylla*' (WANG 1838), *g.* '*acuminata*' (SF 32196). All × 2/3.

kept up. This has led to the present wide species concept.

The fact remains that within the complex specific population certain local partial populations can be distinguished as racial variants, by minor characters of the number of leaflets, their shape, texture, and nervation. As both in continental Asia and on the Malaysian and Melanesian islands in each subregion a limited number of two to three clearly distinguishable variants occur they may give the impression of representing 'good species' to the local botanist. In Hainan for example there occur two populations which are there clearly representing distinct taxa, locally known as *R. roxburghii* and *R. microphylla* and would be well acceptable as distinct species to the Hainan botanist, although the differences are mainly vegetative. If the characters of these 'species' are 'followed' in Indo-China these differences become less clear which has induced SCHELLENBERG to create a large-leaved variety of *R. microphylla* (*var. grandifoliolata*). If the populations are further followed up towards the south in the Mal. Peninsula and east in the Philippines they gradually merge and their demarcation completely breaks down.

From the monographer's standpoint, considering a species over its entire area of distribution it appears quite impossible to give any taxonomical subdivision of it. In the variation there are two definitely non-geographical tendencies. The first extreme of these tendencies is characterized by a rather large number of rather small leaflets, which are chartaceous, often dull beneath, distinctly, often caudate-acuminate, neatly penninerved, and minutely tessellate-reticulate; the fruits are often small. The other extreme has unifoliolate to 2-jugate leaves, relatively large, coriaceous leaflets, shining on both sides; usually they are only shortly broad-acuminate, and often more or less triplinerved, the reticulations are inconspicuous to invisible; fruits are usually rather large.

Specimens of the first small-leaved category have been mainly referred to as *R. caudata* (Siam, Indo-China, and Yunnan), *R. rubella* (Indo-China), *R. microphylla* (Tonkin, S. China, and Hainan; very extreme form) fig. 8f, *Santaloides elmeri* (Borneo), *R. acuminata* (Sumatra and the Malay Peninsula) fig. 8g, *Santaloides beccarii* (Borneo) fig. 8e, *R. erecta* (Philippines) fig. 8d, and *Santaloides celebicum* (Celebes).

More or less intermediate are *R. pulchella* (Malay Peninsula), *Santaloides sumatrense* (Sumatra), *R. minor* (Ceylon), and *Santalodes roxburghii* (Indo-China, S. China, and Hainan).

A wide and uninterrupted range of variability is shown by forms described as *R. javanica* (Java) and *Santaloides vitiense* (Fiji).

The main forms representing the second tendency have been referred to as *R. anomala* (Assam to the Malay Peninsula), *R. acropetala* (Indo-China) fig. 8a, *R. florida* (from the Andaman and Nicobar Islands to the Samoa Islands) fig. 8b, c, and *Santaloides cordatum* (Borneo).

For descriptions and more complete details of all these and some other variations I refer to SCHELLENBERG (Pfl. R. Heft 103, 1938) who treated them as species.

R. minor is doubtless most closely related to *R. balanseana* from New Caledonia, of which I have seen only inadequate material but which might also be conspecific.

Nomencl. The name *Aegiceras minus* GAERTN. was based exclusively upon some fruits from Ceylon, which are now preserved in the Rijksherbarium at Leyden (KÖNIG *s.n.* in herb. L carpologica 1163), and which doubtless belong to the present species. On account of the synonym *Umbraculum maris* RUMPH. cited by GAERTNER —which represents a true *Aegiceras*—WILLDENOW, and all subsequent authors, wrongly emendated GAERTNER's diagnosis.

The identity of *Cnestis glabra* (*non* LAMK) BLANCO, as well as some other of BLANCO's species, remains doubtful; the plate 140 as given in the 3rd edition of his Flora exactly represents the present species. *Connarus paniculatus* (*non* ROXB.) F.-VILL. was based upon this plate.

The name *Rourea volubilis* MERR. = *Santaloides volubilis* SCHELLENB. is based on *Cnestis volubilis* BLANCO, Fl. Filip. (1837) 385. As BLANCO described his species as possessing "cinco cagillas" and "germenes al parecer unidos; pero que se separan facilmente", it seems to be quite impossible that it belongs to *Rourea*, and even to the *Connaraceae*. In the 2nd edition (1845, p. 270) BLANCO reduced it to *Cnestis trifolia* LAMK, and F.-VILL. (Nov. App. 1880, 56) reduced it to *Rourea heterophylla* PLANCH.

4. Rourea mimosoides (VAHL) PLANCH. Linnaea 23(1850) 420.—*Connarus mimosoides* VAHL, Symb. 3 (1794) 87; WILLD. Sp. Pl. 3 (1800) 693.—*Cnestis mimosoides* JACK, Mal. Misc. 2, 7 (1822) 44; Hook. Comp. Bot. Mag. 1 (1835) 151; MERR. J. Arn. Arb. 33 (1952) 221.—*Connarus lucidus* HASSK. Tijd. Nat. Gesch. Phys. 10 (1843) 144, *non* JACK (1822); Cat. Hort. Bog. (1844) 248; Walp. Repert. 5 (1845/6) 420.—*Connarus nitidus* HASSK. Flora 27 (1844) 616; Walp. Repert. 5 (1845/6) 420.—*R. parvifolia* PLANCH. Linnaea 23 (1850) 420, *nom. nud.*—*R. parallela* PLANCH. Linnaea 23 (1850) 421; Walp. Ann. 2 (1851) 298; MIQ. Fl. Ind. Bat. 1, 2 (1859) 659; KING, J. As. Soc. Beng. 66, ii (1897) 14, *incl. var. major*; LECOMTE, Fl. Gén. I.-C. 2 (1908) 50; BACK. Schoolfl. (1911) 287.—*R. sororia* PLANCH. Linnaea 23 (1850) 421; Walp. Ann. 2 (1851) 298; MIQ. Fl. Ind. Bat. 1, 2 (1859) 660.—*R. wallichiana* PLANCH. [Linnaea 23 (1850) 421, *nom. nud.*] *ex* BL. Mus. Bot. 1 (1850) 263; MIQ. Fl. Ind. Bat. 1, 2 (1859) 659; HOOK. *f.* Fl. Br. Ind. 2 (1876) 49; KURZ, For. Fl. Burma 1 (1877) 325.—*R. villosa* PLANCH. Linnaea 23 (1850) 422; Walp. Ann. 2 (1851) 298; HOOK. *f.* Fl. Br. Ind. 2 (1876) 48; KURZ, For. Fl. Burma 1 (1877) 325.—*R. lucida* PLANCH. Linnaea 23 (1850) 423; BL. Mus. Bot. 1 (1850) 263; MIQ. Fl. Ind. Bat. 1, 2 (1859) 659; SCHNIZL. Iconogr. 4 (1866/70) t. 247 f. 1-11; GILG in E. & P. Nat. Pfl. Fam. 3, 3 (1894) f. 36; KOORD. Exk. Fl. Java 2 (1912) 340.—*R. nitida* PLANCH.

Linnaea 23 (1850) 423.—*R. concolor* Bl. Mus. Bot. 1 (1850) 264; Walp. Ann. 2 (1851) 299; Miq. Fl. Ind. Bat. 1, 2 (1859) 660; Hook. *f.* Fl. Br. Ind. 2 (1876) 49; King, J. As. Soc. Beng. 66, ii (1897) 15; Ridl. Fl. Mal. Pen. 1 (1922) 551.—*R. phyllanthoides* Bl. Mus. Bot. 1 (1850) 264; Walp. Ann. 2 (1851) 299; Miq. Fl. Ind. Bat. 1, 2 (1859) 660.—*R. polyphylla* Bl. Mus. Bot. 1 (1850) 264; Walp. Ann. 2 (1851) 299; Miq. Fl. Ind. Bat. 1, 2 (1859) 660.—*R. similis* Bl. Mus. Bot. 1 (1850) 264; Walp. Ann. 2 (1851) 298; Miq. Fl. Ind. Bat. 1, 2 (1859) 659; Sum. (1861) 207; Hook. *f.* Fl. Br. Ind. 2 (1876) 49; Koord.-Schum. Syst. Verz. 2 (1910) 22, *incl. var. macrantha* Boerl. & Koord.; Ridl. Fl. Mal. Pen. 1 (1922) 551; Burk. & Henders. Gard. Bull. S.S. 3 (1925) 365; Henders. Gard. Bull. S.S. 4 (1928) 246.—*Santalodes concolor* O.K. Rev. Gen. Pl. 1 (1891) 155; Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 32; Burk. Dict. (1935) 1951; Schellenb. Pfl. R. Heft 103 (1938) 144.—*Santalodes mimosoides* O.K. Rev. Gen. Pl. 1 (1891) 155; Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 30; Craib, Fl. Siam. En. 1 (1928) 360; Burk. Dict. (1935) 1951; Schellenb. Pfl. R. Heft 103 (1938) 142, f. 25, *incl.* also *f. intermedium;* Bakh. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 7.—*Santalodes nitidum* O.K. Rev. Gen. Pl. 1 (1891) 155.—*Santalodes phyllanthoides* O.K., *l.c.*; Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 31; Pfl. R. Heft 103 (1938) 143.—*Santalodes polyphyllum* O.K. Rev. Gen. Pl. 1 (1891) 155.—*Santalodes simile* O.K., *l.c.*; Schellenb. Pfl. R. Heft 103 (1938) 145.—*Santalodes villosum* O.K. Rev. Gen. Pl. 1 (1891) 155; Schellenb. Pfl. R. Heft 103 (1938) 143.—*Santalodes wallichianum* O.K. Rev. Gen. Pl. 1 (1891) 155; Schellenb. Pfl. R. Heft 103 (1938) 145.—*R. quocensis* Pierre, Fl. Coch. 5 (1898) t. 379 c.—*R. intermedia* Ridl. J. Fed. Mal. States Mus. 10 (1920) 88.—*Santaloides havilandii* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 32.—**Fig. 9a–f.**

Large liana, up to 50 m by 10 cm, rarely an erect shrub with drooping branches, sometimes a tree (?). Twigs minutely fulvous-tomentose, more or less glabrescent. *Leaves* 2- to *c.* 25-jugate, at least the petiole, rhachis, and petiolules pubescent; lateral petiolules up to $^1/_2$ mm long. *Leaflets* ovate or elliptic to oblong (terminal ones sometimes obovate), $^1/_2$–3$^1/_2$ by $^1/_2$–1$^1/_2$ cm, chartaceous (to coriaceous), shining above, dull and minutely papillose, sometimes glaucous beneath and glabrous or minutely pilose on the nerves; base slightly cordate or truncate, in lateral leaflets slightly oblique; margins in oblong leaflets usually parallel; apex emarginate or obtuse; nerves 2–10 pairs, looped and joined, inconspicuous. *Inflorescences* axillary, often together pseudo-terminal, each consisting of 1–3 narrow panicles (the upper, greater part usually racemose), central one up to 12 cm long, lateral ones slightly shorter, all rather densely fulvous-tomentose, many-flowered. *Calyx* 1$^1/_2$–2 (–3) mm high, variously hairy. *Corolla* 3$^1/_2$–5(–6$^1/_2$)

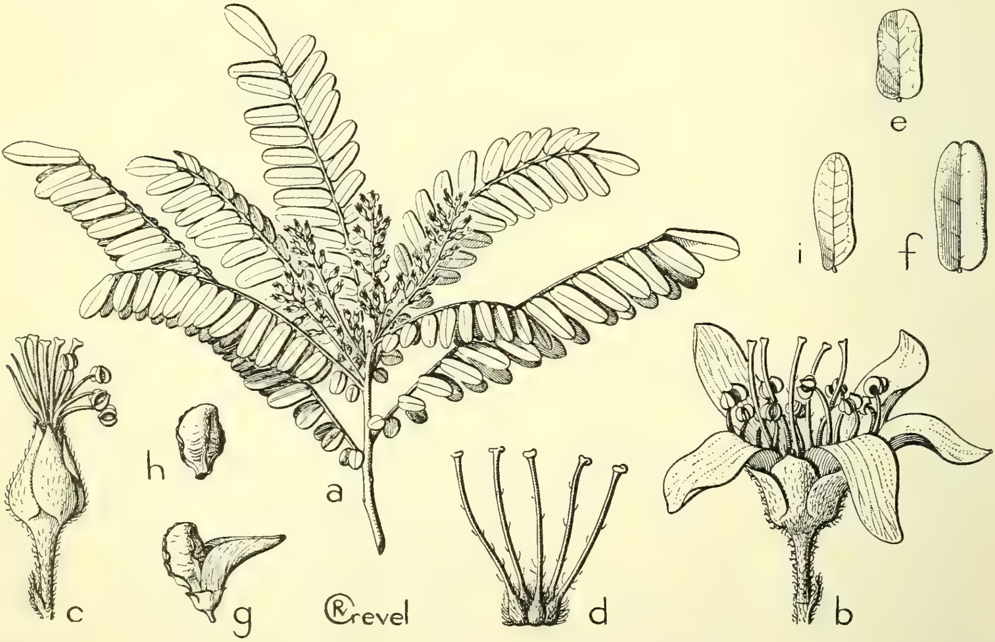


Fig. 9. *Rourea mimosoides* (Vahl) Planch. *a.* Flowering twig (*f. obtusifolia*), × $^1/_2$, *b.* flower, × 5, *c. ditto* just after anthesis, × 5, *d.* long-styled pistils, × 5, *e.* leaflet of *f. obtusifolia*, nat. size, *f.* leaflet of *f. mimosoides*, nat. size.—*R. fulgens* Planch. *g.* Opened fruit, *h.* seed, *i.* leaflet, all nat. size (*a*, *c*, Sf 39593, *b*, *d* Lobb 341, *e* Kostermans 4563, *f* Kep 36047, *g–i* Kep 76340).

mm long. Indument on *pistils* variable. *Fruits* narrowly ellipsoid, curved, 1–1½ by ½ cm.

Distr. Andaman and Nicobar Islands, Lower Burma, Siam, Cambodia, and *Malaysia:* Sumatra, Malay Peninsula, W. Java, and Borneo.

Ecol. In primary and secondary forests, in bamboo forests and shrubberies, along roads and river-banks, sometimes near the beach, 0–750 m (Mt Kinabalu 1500 m). *Fl.* and *fr.* Jan.–Dec.

Uses. A decoction of the roots is used as a medicine against dysentery, and possibly also against leprosy. The stems can be used for binding fences.

Vern. *Tjuma lagi*, Sum., *akar kachang halus daun, a. sĕmĕlit, hujan panas, pĕrget, pĕtai-pĕtai, pinang keroh, rajah kayu, sĕmbĕlit darah, s. puteh*, Mal. Pen., *areuj tjalingtjingan, tĕmbĕlék*, S, *kanggum*, Born.

Notes. The leaflets are slightly sensitive.

The nearest relative of the present species is *R. harmandiana* PIERRE from Cochinchina, differing by its very oblique leaflets, which are cuneate at the base.

Rather variable, especially in its vegetative parts. As these variations are grading, however, and moreover concern characters of slight importance, it appeared to be impossible to distinguish between these variants as several distinct species as has been done up till the present. The only distinction, which seems to be of some value, is between the following two forms:

f. **mimosoides** (*Connarus mimosoides* VAHL; *Connarus lucidus* HASSK.; *Connarus nitidus* HASSK.; *R. parallela* PLANCH.; *R. sororia* PLANCH.; *R. quocensis* PIERRE).—Fig. 9f.—Leaflets usually oblong with parallel margins, relatively large (1½–3½ cm long), margins distinctly recurved, midrib deeply sunken above, apex emarginate. Inflorescences usually composed of 3 axes.

Distr. As the species, Sumatra excepted.

f. **obtusifolia** LEENH. *nov. f.* (*R. wallichiana* PLANCH.; *R. concolor* BL.; *R. polyphylla* BL.; *R. similis* BL.).—Fig. 9a, e.—Leaflets ovate to elliptic, small (rarely more than 1½ cm long), margins and midrib usually flat, apex obtuse. Inflorescences usually consisting of 1 axis only. (Based on *R. similis* BL.)

Distr. As the species, with the exception of the Andaman and Nicobar Islands, of Cambodia, and of Java.

5. Rourea fulgens PLANCH. Linnaea 23 (1850) 423; Walp. Ann. 2 (1851) 298; MIQ. Fl. Ind. Bat. 1, 2 (1859) 661; HOOK. *f.* Fl. Br. Ind. 2 (1876) 49; KING, J. As. Soc. Beng. 66, ii (1897) 15; RIDL. Fl. Mal. Pen. 1 (1922) 551; HEYNE, Nutt. Pl. ed. 2 (1927) 699; HENDERS. Gard. Bull. S.S. 4 (1928) 246.—*Connarus fulgens* WALL. Cat. (1847) *no* 8524, *nom. nud.*—*Santalodes fulgens* O.K. Rev. Gen. Pl. 1 (1891) 155; BURK. Dict. (1935) 1951; SCHELLENB. Pfl. R. Heft 103 (1938) 144; BAKH. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 7. —**Fig. 9g–i.**

Large climbing shrub or liana. Twigs densely ferruginous-tomentose, gradually glabrescent. *Leaves* 6- to *c.* 25-jugate, petiole, rhachis, and petiolules pubescent like the twigs. *Leaflets* subsessile, lateral ones oblique, oblong to lanceolate (lower pairs ovate, *c.* ¾ by ½ cm), terminal ones equilateral, oblong-elliptic to oblong-obovate, all *c.* 1½–2½ by ⅓–¾ cm, thin-chartaceous, thinly ferruginous-pilose, mainly beneath, lower surface minutely papillose; base in lateral leaflets very oblique, truncate to faintly cordate, in terminal ones equilateral, narrowed, slightly cordate; apex blunt to rounded; nerves 6–7 pairs, nearly transverse, straight, distinctly looped and joined. *Inflorescences* axillary, partly pseudo-terminal, each composed of (1–)3 axes, the central one of which is much stronger developed than the lateral ones, and up to 8 cm long; all narrowly paniculate, rather densely ferruginous-pubescent. *Calyx* 2½ mm high, outside with a few long hairs. *Corolla* 5 mm long. *Pistils* glabrous except a few bristles near the base. *Fruits* ovoid to ellipsoid, curved, 1½–1¾ by *c.* ½ cm.

Distr. Lower Burma (Tenasserim) and *Malaysia:* Banka and the SW. part of the Malay Peninsula (Selangor, Negri Sembilan, Johore, and Singapore).

Erroneously mentioned from Java by SCHELLENBERG, 1938, *l.c.*, on account of a specimen in the herbarium of PLOEM (L); this specimen has certainly been mislocalized.

Ecol. Collected at low altitudes. *Fl.* Dec.–April, *fr.* Sept.–Dec.

Uses. A decoction of the roots is said to be used as a medicine against stomach-ache.

Vern. *Akar soanai*, Banka, *sĕmilat putih*, Mal. Pen.

Note. Doubtless most closely related to *R. mimosoides* from which it differs by its reddish-brown pubescence and the very oblique bases of its lateral leaflets.

6. Rourea radlkoferiana K. SCHUM. in Schum. & Laut. Fl. Schutzgeb. (1900) 342.—*Santaloides radlkoferianum* SCHELLENB. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 53; Bot. Jahrb. 58 (1923) 180; Pfl. R. Heft 103 (1938) 130, f. 22.—*R. simulans* MERR. & PERRY, J. Arn. Arb. 23 (1942) 391.

Large climbing shrub. Twigs minutely fulvous-pubescent. *Leaves* 3–8-jugate, glabrous or minutely pubescent; lateral petiolules 1½–2 mm long. *Leaflets* lanceolate, lateral ones with nearly parallel margins, terminal ones often broadened towards the centre, 1½–7½ by ¾–3 cm, thin-chartaceous, glabrous or beneath pubescent on the midrib and with a few scattered hairs on the nerves; base rounded (rarely narrowed), slightly oblique in lateral leaflets; apex gradually acuminate, acumen short to rather long, blunt; nerves 6–10 pairs, nearly transverse, straight, distinctly looped and joined. *Inflorescences* axillary, in fascicles of 4–5 panicles, the central one slightly longer, up to 7 cm long, rather many-flowered, glabrous to rather densely ferruginous-pilose. *Calyx* 2–3 mm high, thinly tomentose outside. *Corolla* 3½–5 mm long. *Pistils* extremely small,

$^1/_2$–1 mm high, possibly sterile! *Fruits* (*sec.* SCHELLENBERG) strongly curved, $1^1/_2$ cm long.

Distr. *Malaysia:* E. New Guinea (Augusta and April Fluss and Lower Fly River).

Ecol. Rain-forest borders, river-banks. *Fl.* Sept., Nov.

Note. I have referred *R. simulans* to the present species, though the only specimen known (BRASS 8288) differs slightly from the type specimen of *R. radlkoferiana*, mainly by being distinctly more hairy. It is remarkable that both specimens possess very small pistils, which even might be sterile. This is the main reason that I have kept this species separate from *R. minor*, which it very closely approaches in vegetative characters, specially its 'race' described as *R. acuminata*.

2. Section Afrosantaloides

(SCHELLENB.) LEENH., *nov. comb.—Santaloides subg. Afrosantaloides* SCHELLENB. Pfl. R. Heft 103 (1938) 137.

Fruit dehiscing irregularly around the base.

7. Rourea prainiana TALBOT, For. Fl. Bombay 1 (1909) 368, f. 213.—*Roureopsis scortechinii* KING, J. As. Soc. Beng. 66, ii (1897) 16 *pro specim. fruct., typo excl.*; BURK. & HENDERS. Gard. Bull. S.S. 3 (1925) 365.—*Santaloides prainianum* SCHELLENB. Pfl. R. Heft 103 (1938) 127.

Scandent shrub or small tree. Twigs nearly glabrous. *Leaves* 3–6-jugate, glabrous, leaflets often alternating; lateral petiolules 2–3 mm long. *Leaflets* oblong-ovate (terminal ones more elliptic), 5–8 by $1^1/_2$–3 cm, stiff-chartaceous, slightly glaucous-waxy beneath; the base in lateral leaflets slightly oblique, broadly cuneate, somewhat decurrent, in terminal ones equilateral and more acute; apex gradually caudate-acuminate, blunt; nerves 4–6 pairs, patent (at least the basal ones), straight to curved, distinctly looped and joined (sometimes with the exception of the basal ones), not very conspicuous. *Inflorescences* axillary, glabrous, in fascicles of 4–5 axes, which are all nearly of the same length (up to *c.* 10 cm), laxly paniculate in the lower part, pseudo-racemose with long-stalked flowers in the upper. *Calyx* 3 mm high, thinly pubescent outside. *Corolla* 8 mm long. *Pistils* glabrous. *Fruits* elliptic-ovoid, acute, straight, $2^1/_2$–3 by 1 cm.

Distr. W. Deccan and *Malaysia:* Malay Peninsula (Perak: G. Hijau).

Ecol. Mountains, 1500–1750 m. *Fl.* Sept., *fr.* Feb. and Sept.

Incertae sedis

8. Rourea ovale(SCHELLENB.) LEENH., *nov. comb.* —*Santaloides ovale* SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 29; Pfl. R. Heft 103 (1938) 127.

Twigs glabrous except the tips, glaucous-waxy. *Leaves* uni-(to tri-)foliolate, glabrous. *Leaflets* elliptic (to ovate, specially the lateral ones), 9–10 by 4–5 cm (lateral ones *c.* 4 by 2 cm), chartaceous, white waxy beneath; base rounded, rarely broadly cuneate, subpeltate; apex gradually to ± abruptly acuminate, acumen usually rather long (up to $1^1/_2$ cm), slender, and blunt; nerves 5–6 pairs, patent, straight to slightly curved, distinctly looped and joined at some distance from the margin. *Inflorescences* axillary, in fascicles of 4–5, the central one up to *c.* 8 cm long, only slightly longer than the other ones, all narrowly paniculate to racemose, rather few-flowered, glabrous; pedicels rather long. *Calyx* 2 mm high, thinly pubescent outside, mainly along the margin and at the apex. *Pistils* with some long hairs. *Calyx* spreading in fruit, 1 cm diam. Immature *fruits* ovoid-ellipsoid, faintly curved, 2 by $^3/_4$ cm, blunt to blunt-acuminate, probably basally dehiscent. *Seed* enveloped by the arillode.

Distr. *Malaysia:* Borneo (Sarawak: Mattang).

Ecol. *Fl.* Sept., *fr.* Dec.

Note. The taxonomical position of this species is not yet clear. The spreading calyx under the fruit is unusual in *subg. Palliatus*; the arillode is, however, normally developed. As far as can be judged from the young fruits, the dehiscence points to *sect. Afrosantaloides*. If this would appear not to be true, the species will have to be compared again with *R. minor*.

Excluded

Rourea diversifolia MIQ. Sum. (1861) 528.—*Santalodes diversifolium* O.K. Rev. Gen. Pl. 1 (1891) 155 = *Connaropsis diversifolia* (MIQ.) KURZ (*Oxalid.*).

5. ELLIPANTHUS

HOOK. *f.* in B. & H. Gen. Pl. 1 (1862) 434; SCHELLENB. Pfl. R. Heft 103 (1938) 181.—*Hemandradenia* STAPF, Kew Bull. (1908) 288; SCHELLENB. Pfl. R. Heft 103 (1938) 64.—*Pseudellipanthus* SCHELLENB. in Mez, Bot. Arch. 1 (1922) 314; Pfl. R. Heft 103 (1938) 189.—**Fig. 10.**

Shrubs or small trees. *Leaves* unifoliolate. *Inflorescences* axillary, paniculate to glomerulous, small. *Bracts* early caducous, lanceolate, small. *Flowers* 4–5 merous, protandrous, bisexual or unisexual, in the latter case plants apparently dioecious.

Sepals valvate in bud, outside densely pubescent. *Petals* free, cochlear-imbricate in bud, (greenish- or creamy-) white. *Stamens* twice as much as petals, connate at base, episepalous ones well developed, epipetalous ones staminodial, much smaller; the tube outside glabrous, inside pilose. *Pistil* 1, pilose, somewhat laterally inserted; ovary oblique, flattened ovoid; style slender; stigma disk-shaped to bilobed, rather large. *Fruits* densely tomentose, yellowish to brownish when ripe, slightly to strongly dorsally geniculate, the basal part constricted into a short to long stipe, the fertile part more or less (flattened-)ovoid, fertile part opening lengthwise by a slit; pericarp woody; calyx persistent, not accrescent. *Seed* 1, ellipsoid, blunt at both ends, shining black, the basal part covered with a yellowish to orange arilloid; endosperm about 1 mm thick, hard.

Distr. About 10 *spp.*, 3 in Africa, 2 in Madagascar, the other ones in Ceylon, continental SE. Asia (Deccan to Hainan), the Andamans, and the western half of *Malaysia*.

Ecol. Shrubs or small, rarely medium-sized trees in rain-forests at low to medium altitudes.

Notes. The distinction made by SCHELLENBERG between *Ellipanthus* with bisexual, 5-merous flowers and *Pseudellipanthus* with dioecious, 4-merous flowers (only in Borneo) would be acceptable for defining supraspecific taxa if these characters would be constant. It has appeared, however, that, if a sufficient number of flowers of one inflorescence is examined, the number of floral parts is variable within it, though either 4- or 5-merous flowers are predominant in one specimen. The flowers of '*Pseudellipanthus*' are always unisexual, those of '*Ellipanthus*', however, may probably be also occasionally unisexual, specially in *E. tomentosus var. gibbosus* in the Malay Peninsula, though as the flowers of the latter are protandrous, it is sometimes difficult to establish whether the stamens have been, or the pistil will be, fertile.

The *arilloid* is doubtless of sarcotestal nature, as it is in the other genera. In the greater part of the material it is no more than a small fleshy part of the testa near the base, and so represents a true sarcotesta. In *E. tomentosus ssp. kingii* it is composed of some long lobes, which at least partly cover the normal dry testa, and therefore may better be called an arillode.

KEY TO THE SPECIES

1. Flowers predominantly 5-merous, nearly always bisexual . . . . **1. E. tomentosus**
1. Flowers predominantly 4-merous, dioecious . . . . **2. E. beccarii**

1. Ellipanthus tomentosus KURZ, J. As. Soc. Beng. 41, ii (1872) 305; BRANDIS, Ind. Trees (1906) 213, f. 94; CRAIB, Fl. Siam. En. 1 (1928) 366; SCHELLENB. Pfl. R. Heft 103 (1938) 186, f. 34^{1-4}.—*E. helferi* HOOK. *f.* Fl. Br. Ind. 2 (1876) 55; VIDAL, Sinops. Atl. (1883) t. 39 f. B; RIDL. J. Fed. Mal. St. Mus. 10 (1920) 88; SCHELLENB. Pfl. R. Heft 103 (1938) 184.—*E. griffithii* HOOK. *f.* Fl. Br. Ind. 2 (1876) 56; KING, J. As. Soc. Beng. 66, ii (1897) 10; RIDL. Fl. Mal. Pen. 1 (1922) 548; BURK. Dict. (1935) 918; SCHELLENB. Pfl. R. Heft 103 (1938) 184.—*E. calophyllus* (*non* KURZ) F.-VILL. Nov. App. (1883) 351.—*E. luzoniensis* VIDAL, Rev. Pl. Vasc. Filip. (1886) 104; MERR. En. Philip. 2 (1923) 241; SCHELLENB. Pfl. R. Heft 103 (1938) 188, f. 34^{5-6}.— *E. monophyllus* O.K. *var. griffithii* O.K. Rev. Gen. Pl. 1 (1891) 155, *nom. illeg.*—*E. curtisii* KING, J. As. Soc. Beng. 66, ii (1897) 9; RIDL. Fl. Mal. Pen. 1 (1922) 548.—*E. gibbosus* KING, J. As. Soc. Beng. 66, ii (1897) 10; RIDL. Fl. Mal. Pen. 1 (1922) 549; SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 27; CRAIB, Fl. Siam. En. 1 (1928) 365; SCHELLENB. Pfl. R. Heft 103 (1938) 184.—*E. kingii* BOERL. & KOORD. Ic. Bog. (1897) t. 18; K. & V. Bijdr. Booms. 5 (1900) 61; BACK. Schoolfl. (1911) 289; KOORD.-SCHUM. Syst. Verz. 1 (1911–13) fam. 127, 24; KOORD. Exk. Fl. Java 2 (1912) 341; SCHELLENB. Pfl. R. Heft 103 (1938) 188, f. 35^{7-8}; BAKH. *f.* in Back. Bekn. Fl. Java (em. ed) 7A (1948) fam. 154, 8.—*E. cinereus* PIERRE, Fl. Coch. 5 (1898) t. 378 f. C; LECOMTE, Fl. Gén. I.-C. 2 (1908) 55, f. 7g.—*E. subrufus* PIERRE, Fl. Coch. 5 (1898) t. 378 f. D; LECOMTE, Fl. Gén. I.-C. 2 (1908) 56.—*E. mindanaensis* MERR. Philip. J. Sc. 4 (1909) Bot. 124; *non* J. As. Soc. Str. Br. *no* 76 (1917) 84, *nec* En. Born. (1921) 291, *nec* Pl. Elm. Born. (1929) 96 (all = *E. beccarii*); En. Philip. 2 (1923) 241; SCHELLENB. Pfl. R. Heft 103 (1938) 185, *excl. specim. Born.*, which belong to *E. beccarii.*—*Connarus urdanetensis* ELM. Leafl. Philip. Bot. 7 (1915) 2594.—*E. burebidensis* ELM. Leafl. Philip. Bot. 7 (1915) 2596.—*E. vidalii* ELM. Leafl. Philip. Bot. 7 (1915) 2596.—? *E. neglectus* GAMBLE, Kew Bull. (1917) 26; SCHELLENB. Pfl. R. Heft 103 (1938) 186.—*E. longifolius* MERR. Philip. J. Sc. 17 (1921) Bot. 262; En. Philip. 2 (1923) 241; SCHELLENB. Pfl. R. Heft 103 (1938) 185.—*E. urdanetensis* MERR. En. Philip. 2 (1923) 241.—*E. sarawakensis* SCHELLENB. Pfl. R. Heft 103 (1938) 185.—**Fig. 10.**

Shrubs or small to medium-sized trees, up to 25–30 m by 50–60 cm. *Branchlets* fulvous-tomentose, at least when young. *Petioles* ½–3½ cm long, slender, articulated near the leaf-base, tomentose, glabrescent. *Leaves* elliptic to lanceolate, some-

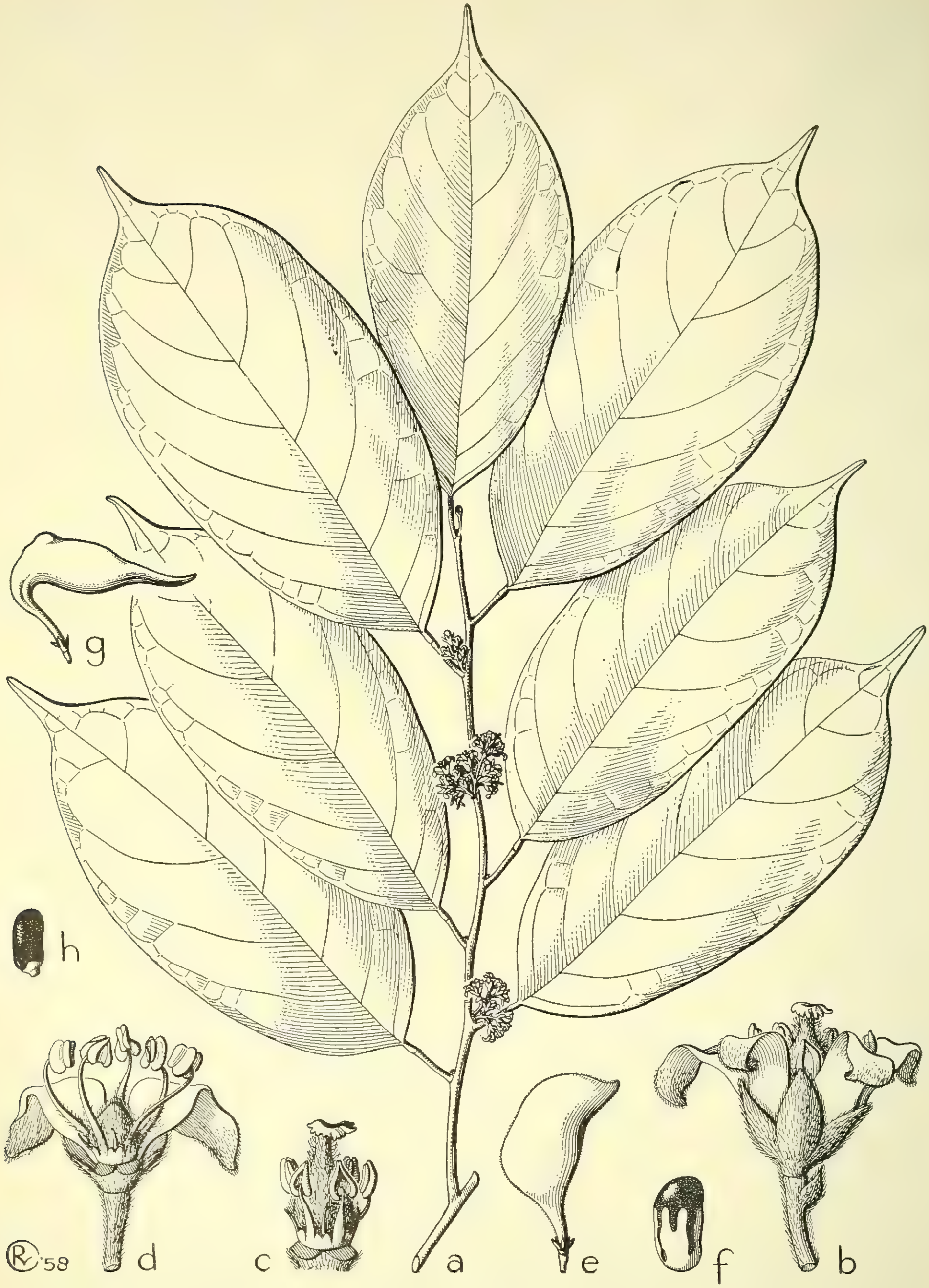


Fig. 10. *Ellipanthus tomentosus* KURZ. *a.* Flowering twig (*var. gibbosus*), × 1/2, *b.* bisexual flower (*var. luzoniensis*), × 5, *c.* stamens, staminodes, and pistil (*ditto*), × 5, *d.* ♂ flower (*ditto*), × 5, *e.* fruit (*ditto*), × 3/4, *f.* seed (*ssp. kingii*), × 3/4, *g.* fruit (*var. gibbosus*), × 3/4, *h.* seed (*var. gibbosus*), × 3/4 (*a* RIDLEY 14678, *b–c* BS 26844, *d* ELMER 6889, *e* FB 25299, *f* KOORDERS 5294, *g–h* SF 32329).

times obovate, 7–22(–33) by 3–9 cm, papyraceous to coriaceous, tomentose on the midrib above, beneath glabrous to thinly tomentose on the whole surface; base acute, rounded, or subcordate, sometimes slightly peltate; apex tapering to rather abruptly, blunt- to acute-acuminate; nerves 5–10 (–12) pairs, patent to nearly transverse, distinctly looped and joined or not. *Inflorescences* axillary or ramiflorous, paniculate to glomerulous, up to *c.* 2½ cm long, many- to few-flowered, always densely pilose. *Flowers* bisexual (always?), protandrous, (4–)5(–6)-merous. *Sepals* ovate to deltoid, blunt or acute, 1½–2 mm long, inside tomentose to glabrous. *Petals* ovate to linear, blunt, 2–4½ by 1¼–2½ mm, outside pilose, inside minutely tomentose usually with the exception of the base. *Stamens* glabrous or inside pubescent, at least the tube, staminodes glabrous; anthers pale yellow. *Pistil* pale orange, stigma usually 2-lobed, white. *Infructescences* not accrescent, usually with few fruits. *Fruits* ½–3 cm stipitate, slightly to *c.* 135° geniculate on top of the stipe, the fertile part blunt-triangular to oblique-ovoid, often much flattened, 2–4 by ¾–1¼ cm, blunt with a style-remnant or short-beaked, the ventral suture straight and smooth or sinuous and tuberculate either in the middle or near the base. *Seed* 12–20 by 6–10 mm, often flattened; arilloid minute and cupular to covering ⅔ of the seed and deeply lobed, always adaxially split up to below the hilum.

Distr. Deccan (?), Lower Burma, Siam, Cambodia, Cochinchina, Laos, and *Malaysia:* Sumatra, Malay Peninsula, Java, Borneo, the Philippines, and Celebes.

Note. The flowers of *E. tomentosus* are said to possess a strong sweet scent, like *Coffea* or like *Cananga odorata.*

KEY TO THE SUBSPECIES

1. Inflorescences axillary on the young twigs, glomerulous or distinctly paniculate, few-flowered. Arilloid covering less than half the seed, usually very small only. *ssp.* **tomentosus**
1. Ramiflorous, loosely glomerulous, all paniculate branches of about the same length, many-flowered. Arillode covering the seed for about ⅔ part, 5-lobed till near the base. *ssp.* **kingii**

ssp. **tomentosus.**—All synonyms with the exception of *E. kingii.*

With the exception of the characters mentioned in the key, as variable as the species as a whole.

Distr. As the species, Java excepted.

Note. On account of the exceptional variability of this subspecies I have tried to distinguish at least some of the more common and morphologically and geographically more or less well circumscribed varieties; some more populations, which may be of taxonomical value, but are at present still quite insufficiently known, are mentioned only.

var. **tomentosus.**—*E. griffithii* HOOK. *f.*—*E. curtisii* KING.—*E. cinereus* PIERRE.

Tree, up to 30 m high, sometimes a shrub. Branchlets slender, remaining tomentose for a long time. Petioles ½–¾ cm long. Leaves 8–18 by 3–6 cm, stiff, usually thin-coriaceous, tomentose beneath, specially on the nerves; base neither acute, nor peltate; apex tapering acuminate; nerves faintly curved, looped and joined near the margin. Inflorescences glomerulous, few-flowered. Fruits short-stipitate (5–7½ by 3 to 10 by 2 mm), less than 90° geniculate, fertile part *c.* 2 by ¾–1¼ cm, ventral suture smooth. Seed for 1–5 mm covered by the faintly lobed sarcotesta.

Distr. Lower Burma, Siam, Cochinchina, Cambodia, Laos, and *Malaysia:* Sumatra (*incl.* also Simalur), and the Malay Peninsula.

Ecol. Rain-forests and deciduous jungle, up to *c.* 700 m. *Fl.* nearly the whole year, *fr.* March–June.

Uses. Wood hard and durable.

Vern. *Kĕrantai mèrah*, Mal. Pen.

var. **gibbosus** (KING) LEENH., *nov. stat.*—*E. helferi* HOOK. *f.*—*E. gibbosus* KING.—**Fig. 10a, g–h.**

Shrub or small tree, up to *c.* 10 m high. Branchlets 2–4 mm thick, soon glabrescent. Petioles ¾–1½ cm long, soon glabrescent. Leaves 9–22 by 4–8 cm, papyraceous, subglabrous; base faintly acuminate, subpeltate; apex tapering acuminate; nerves curved, not distinctly joined. Inflorescences glomerulous, few-flowered. Flowers probably sometimes unisexual. Fruits long-stipitate (1¼–2 cm by 1½–2 mm), about 90° or somewhat more geniculate, fertile part flattened, *c.* 2½–3 by 1 cm, ending in a slightly curved beak, ventral suture at least at the corner strongly tuberculate. Seed for 3–5 mm covered by a faintly lobed to rounded sarcotesta.

Distr. Andamans, Lower Burma, Peninsular Siam, and *Malaysia:* Malay Peninsula.

Ecol. Rain-forests, up to *c.* 800 m. *Fl.* April–Sept., *fr.* March-Oct.

Notes. Besides the typical form as described above, there are some apparently very closely related, though in some points differing forms which have not been given infraspecific epithets. Specimens from Pahang and Johore are nearly all characterized by their slightly smaller, fully glabrous leaves with distinctly interarching nerves. These specimens are vegetatively nearly indistinguishable from '*E. sarawakensis*' (Borneo), which differs from them by its fruits, these being shortly stipitate, *c.* 45° geniculate, the fertile part blunt-triangular, ventral suture smooth; about ⅓ of the flowers are, according to the fruits, 4-merous, and in this character, as well as in the fruit-form it comes near to *E. beccarii.*

A few specimens from the Malay Peninsula (KEP 23787, SF. 24263 & 30732) are distinguished by very large leaves, which are distinctly peltate at the base, and by large, slender fruits, the fertile part of which is about 4 cm long. These specimens are nearly indistinguishable from '*E. mindanaensis*' (Mindanao) which, however, is again different by its caudate-acuminate leaves.

var. **luzoniensis** (VIDAL) LEENH., *nov. stat.*—*E. helferi* (*non* HOOK. *f.*) VIDAL.—*E. calophyllus* (*non* KURZ) F.-VILL.—*E. luzoniensis* VIDAL.—*Connarus urdanetensis* ELM.—*E. burebidensis* ELM.—*E. vidalii* ELM.—*E. longifolius* MERR.—*E. urdanetensis* MERR.—*E. sarawakensis* SCHELLENB.—**Fig. 10b–e.**

Shrub or tree, up to 25 m by 50 cm. Branchlets $2^1/_2$–5 mm thick, early glabrescent, then shining black. Petioles 1–$3^1/_2$ cm long, glabrous. Leaves usually elliptic to oblong, 7–15(–21) by 3–9 cm, pergamentaceous to chartaceous, subglabrous; base usually acute to cuneate, rarely rounded or subpeltate; apex gradually to rather abruptly cuneate-acuminate; nerves 5–7 pairs, usually rather patent, faintly curved and inconspicuously looped and joined. Inflorescences more distinctly paniculate than in the other varieties, as the main axis is distinctly stronger developed (2–$3^1/_2$ cm long). Fruits short- to long-stipitate, basal part not very slender, fertile part *c.* $2^1/_2$–4 by $1^1/_4$ cm, not strongly flattened. Seeds for 4–7 mm covered by a faintly lobed sarcotesta.

Distr. *Malaysia:* Borneo (Sarawak), Philippines (Palawan excepted), and Central Celebes.

Ecol. Rain-forests, up to *c.* 1100 m. *Fl.* mainly July–Jan., *fr.* Dec.–May.

Vern. *Alomañgói, atarúkan, banato,* Tag., *dañgalis,* Bag., *pañgalámag,* Mbo., *guisik,* Yak., *saling-uák,* Bis., *wojo,* Celebes.

Notes. As a whole this variety is rather uniform, the fruits excepted. Some extremes are represented on the one side by *E. burebidensis, vidalii,* and *urdanetensis,* all characterized by rather large, relatively broad and more pubescent leaves, on the other side by *E. longifolius,* the leaves of which are lanceolate, 19–33 by 4–8 cm, coriaceous, and nearly glabrous. These extremes are connected with the group of average specimens by some intermediates.

ssp. **kingii** (BOERL. & KOORD.) LEENH., *nov. stat.* —*E. kingii* BOERL. & KOORD.—**Fig. 10f.**

Trees, up to *c.* 25 m by 60 cm. Branchlets *c.* 2 mm thick, pubescent. Petioles 1–$1^1/_2$ cm, tomentose. Leaves elliptic to obovate, 7–14 by 3–7 cm, chartaceous, more or less densely tomentose, at least beneath; base rounded, not peltate; apex shortly blunt-acuminate; nerves (7–)9–12 pairs, curved, distinctly looped and joined close to the margin. Inflorescences ramiflorous, loosely glomerulous, the main branches of about the same length, paniculate. Sepals ovate. Fruits variable. The deeply 5-lobed arillode covering $^2/_3$–$^3/_4$ part of the seed.

Distr. *Malaysia:* Java (Mts Salak and Malang in W. and Mt Wilis in E. Java), apparently very rare.

Ecol. Rain-forests at 1000-1500 m. *Fl.* April-June, *fr.* Sept.–Oct.

KOORDERS mentioned the presence of nectar at the base of the staminal tube (which is sometimes thickened).

Notes. According to KOORDERS very conspicuous by its smooth, copper-red bark.

The fruits of the few specimens from E. Java are different from those of the only fruiting specimen from W. Java. The latter are 90° or more geniculate, long- and slender-stipitate, and the fertile part is strongly flattened, the ventral suture distinctly tuberculated; in the former the fruits are short- and thick-stipitate, up to 90° geniculate, not flattened, and only very faintly tuberculated along the ventral suture.

2. Ellipanthus beccarii PIERRE, Fl. Coch. 5 (1898) t. 378 (text only).—*E. mindanaensis* (*non* MERR.) MERR. J. As. Soc. Str. Br. *no* 76 (1917) 84; En. Born. (1921) 291; Pl. Elm. Born. (1929) 96; SCHELLENB. Pfl. R. Heft 103 (1938) 185, *pro specim. Born.*—*Pseudellipanthus beccarii* SCHELLENB. in Mez, Bot. Arch. 1 (1922) 314; Pfl. R. Heft 103 (1938) 191, f. 35 B.—*Pseudellipanthus peltatus* SCHELLENB. in Mez, Bot. Arch. 1 (1922) 314; Pfl. R. Heft 103 (1938) 191, f. 35 A.—*Dichapetalum tetramerum* RIDL. Kew Bull. (1938) 234.

Shrub or small tree, up to *c.* 8 m by 10 cm. Branchlets ferruginous-tomentose when young, glabrescent. Petioles $^1/_2$–$1^1/_4$ cm. *Leaves* elliptic or elliptic-ovate to lanceolate, $7^1/_2$–18 by $3^1/_2$–$5^1/_2$ cm, herbaceous to thin-coriaceous, glabrous above (sometimes the midrib and the bases of the nerves excepted), more or less densely ferruginous-pubescent beneath; base rounded, peltate or not; apex acuminate; nerves 8–11(–14) pairs, faintly curved, distinctly looped and joined. *Inflorescences* axillary, glomerulous, $^1/_2$–1 cm, few-flowered, densely pilose. *Flowers* unisexual (dioecious), 4(–5)-merous. *Sepals* narrowly deltoid to linear, 2–$2^1/_2$ mm long, inside subglabrous. *Petals* elliptic, blunt, *c.* 4 by $1^1/_2$ mm, outside pilose, inside in the upper half densely tomentose. *Stamens* in the basal half pilose, in ♂ flowers $3^1/_2$ mm long, the tube $^3/_4$ mm, in ♀ flowers 1–2 mm, the tube $^1/_2$ mm; the staminodes glabrous, not rarely absent. *Pistil* in ♂ flowers moderately reduced to fully absent. *Infructescences* with a few fruits only. *Fruits* shortly stipitate ($^1/_4$–$^3/_4$ cm), about 90° geniculate, the fertile part blunt-triangular, *c.* $1^1/_2$ by 1 cm, smooth. *Seed* with a minute cupular sarcotesta.

Distr. *Malaysia:* Borneo.

Ecol. Rain-forests, up to *c.* 900 m. *Fl.* May-Jan., *fr.* Aug., Nov.

Vern. *Kadarai* or *karadai, kedelai seluang.*

Notes. Two varieties are well distinguishable:

var. **beccarii** (*incl.* also *Dichapetalum tetramerum* RIDL.), characterized by the non-peltate leaf-base (surroundings of Kuching).

var. **peltatus** (SCHELLENB.) LEENH., *nov. stat.* (*E. mindanaensis auct. non* MERR. *pro specim. Born.*) —*Pseudellipanthus peltatus* SCHELLENB.. Characterized by a peltate leaf-base (N. and E. Borneo).

Excluded

Ellipanthus scortechinii KING, J. As. Soc. Beng. 66, ii (1897) 8 = *Dichapetalum gelonioides* (ROXB.) ENGL. (*Dichap.*).

6. CONNARUS

LINNÉ, Sp. Pl. 2 (1753) 675; Gen. Pl. ed. 5 (1754) 305; SCHELLENB. Pfl. R. Heft 103 (1938) 216.—*Tapomana* ADANS. Fam. Pl. 2 (1763) 343, *nom. illeg.*—*Omphalobium* GAERTN. Fruct. 1 (1788) 217, t. 46 f. 3.—*Erythrostigma* HASSK. Flora 25 (1842) Beibl. 45.—*Anisostemon* TURCZ. Bull. Soc. Nat. Mosc. 20 (1847) 152.—*Tricholobus* BL. Mus. Bot. 1 (1850) 236..—**Fig. 11–15.**

Lianas, shrubs, or small trees. *Leaves* imparipinnate, sometimes trifoliolate, rarely unifoliolate. *Leaflets* always more or less conspicuously, pellucid-glandular punctate. *Inflorescences* terminal and often in the upper leaf-axils, paniculate. *Flowers* bisexual, fragrant, 5-merous, sepals, petals, and stamens more or less distinctly punctate by glands appearing as dark dots in the herbarium. *Sepals* slightly confluent at the base, usually thick and fleshy. *Petals* free, imbricate in bud, at least glandular-ciliate along the margin just below the middle and there slightly cohering just before anthesis (though less than in *Rourea*), nearly always hairy at the apex; hairs partly capitate-glandular. *Stamens* 10, connate at the base, epipetalous ones always shortest and often sterile to staminodial; filaments usually sparsely glandular-pubescent, connective on the apex with a tuft of gland-topped hairs. *Pistil* 1, heterodistylous, ovary globular, style slender, stigma capitate, ovary and basal half of the style densely pilose, upper half of the style glandular-pubescent. *Calyx* in fruit persistent, not accrescent. *Fruits* pod-like, opening lengthwise along the ventral, and sometimes also along the dorsal suture, often somewhat compressed, the base often narrowed into a stipe, the dorsal suture usually rather straight, the ventral one often bulging just above the stipe, and strongly sinuate, the style-remnant usually more or less shifted to the dorsal side, often developed as an acutely triangular beak; pericarp dry, chartaceous to woody. *Seed* 1, more or less bean-shaped, testa shining black, basal part partly enveloped by a fleshy, yellow arillode, which is 2-lobed, wavy along the margin, and inserted just below the hilum; no endosperm.

Distr. According to SCHELLENBERG, *l.c.*, about 100 species but in my opinion much less, pantropical, though especially richly developed in S. America and in SE. Asia and *Malaysia*, in Australia representep by 1 and in Melanesia by 2 species.

Ecol. In and along forests, often also in more open places, in park- and even grass-lands, at low and medium altitudes.

Uses. The timber of some arboreous American species seems to be valued. Most of the Malaysian species are lianas and are only used for ropes. A decoction of several parts of different species is used as a medicine, possibly on account of the occurrence of saponin.

Morph. The leaflets of many species are apparently in vivo slightly conduplicate.

The bracts are in a few species (in Malaysia: *C. ferrugineus*, *villosus*, *culionensis*, and *odoratus*) subulate to cylindrical; their apex is often thickened to tripartite, suggesting reduced pinnate leaves.

The calyx is usually brown-pubescent, the corolla is white to pinkish, often with red spots, probably representing the internal glands, the filaments are pinkish, the anthers and style yellow.

The reduction of the inner stamens is in degree. They are always much shorter than the outer ones, and usually less pubescent; they may be fully fertile, the anthers either being as large as those of the outer ones or smaller. According to BURCK (Ann. Jard. Bot. Btzg 6, 1887, 251) in the latter case the pollen-grains may be smaller and so possibly sterile; it is not clear, however, if this refers only to anthers which remain closed. In many cases the inner stamens look quite normal, but the anthers apparently never open; in some species they are fully staminodial, thread-like and capitate, and then sometimes some of them may be wanting.

The fruits are usually yellow when immature, becoming orange to red; the inner side of the pericarp is light-coloured, the seed, which apparently is not exposed when the fruits are ripe, is shining black with a yellow arillode.

Taxon. In the present revision I have refrained from giving a subdivision of the genus into subgenera and sections. The one given by SCHELLENBERG, *l.c.*, is in my opinion not reflecting the natural relationships, at least as far as Malaysian species are concerned; in some cases species from distant sections appeared to be either conspecific or very closely allied. I studied only a small part of the genus which cannot easily be subdivided in clearly demarcated groups.

For identification of specimens the fruits are most important; the leaves are rather characteristic and constant in a few species only; the characters of the flowers are still less important except the presence or absence of indument on the petals.

KEY TO THE SPECIES

1. Hairs branched, usually stellate.
2. Petals outside pubescent . . . . **8. C. culionensis** *var.* **stellatus**
2. Petals outside glabrous.
3. Leaves 1–4-jugate; nerves ascending, usually distinctly looped and joined near the margin; veins laxly reticulate. Fruits densely pubescent . . . . **7. C. villosus**
3. Leaves (1–)4–8-jugate; nerves not distinctly ascending, vaguely joined; veins transverse to the midrib, parallel, dense. Fruits glabrous . . . . **9. C. odoratus**
1. Hairs simple or plant glabrous.
4. Petals outside glabrous or with a few scattered capitate-glandular hairs mainly along the margin and at the apex.
5. Pericarp thin, fruits relatively small (1½–3¾ by 1–2 cm) . . . . . . **11. C. semidecandrus**
5. Pericarp thick, woody; fruits relatively large (3½–7 by 2–4 cm).
6. Twigs (as well as petiole, rhachis, and petiolules) densely ferruginous-pubescent. Leaves (1–)3–5-jugate. Bracts nearly always subulate, ¾–1 cm long. Fruits remaining pubescent for a long time.
7. Sepals 2–2½ mm long, inside glabrous. Leaflets thin-coriaceous, usually smooth and nearly glabrous, with (8–)10–18 pairs of nerves. . . . . **2. C. euphlebius**
7. Sepals 4–4½ mm long, inside densely tomentose. Leaflets stiff-coriaceous, usually bullate and pubescent, with 5–8 pairs of nerves . . . . **6. C. ferrugineus**
6. Twigs glabrous or minutely tomentose at the tips only. Leaves 1–2-jugate. Bracts nearly always deltoid, minute. Fruits soon glabrous.
8. Leaflets pubescent beneath on midrib and nerves . . . . **1. C. agamae**
8. Leaflets fully glabrous.
9. Veins rather dense and conspicuous. Leaflets stiff-coriaceous . . . . **3. C. planchonianus**
9. Veins neither very dense, nor conspicuous. Leaflets chartaceous to thin-coriaceous.
10. Fruit-beak lateral, distinct. Petals 6–7 mm long. Leaflets usually decurrent at the base, often more or less triplinerved . . . . **4. C. grandis**
10. Fruit-beak nearly terminal, inconspicuous. Petals 2–2½ mm long. Leaflets not decurrent at the base, not triplinerved . . . . **19. C. salomoniensis**
4. Petals distinctly pubescent outside.
11. Twigs densely pubescent, gradually glabrescent.
12. Fruits large (5–6 by 3–4 by 2 cm), thick-walled. Sepals inside pubescent. Leaflets elliptic to oblong . . . . **5. C. subinaequifolius**
12. Fruits small (2½ by 1½ cm), thin-walled. Sepals inside glabrous. Leaflets (oblong to) lanceolate. **8. C. culionensis** *var.* **culionensis**
11. Twigs glabrous or minutely pubescent at the tips only.
13. Bracts subulate, *c.* 1 cm long . . . . **C. peekelii,** *cf.* p. 541
13. Bracts deltoid, minute.
14. Endocarp glabrous. Inflorescences glabrous, the ultimate branches excepted.
15. Fruits not stipitate. Ultimate branches of the inflorescences narrowly paniculate. Sepals 1½ mm long. Petals 5–6 mm . . . . **16. C. lucens**
15. Fruits stipitate. Ultimate branches of the inflorescences subspicate. Sepals more than 2 mm long. Petals *c.* 9 mm . . . . **17. C. winkleri**
14. Endocarp sparsely to densely pubescent. Inflorescences distinctly pubescent.
16. Leaflets *caudate*-acuminate, when dry blackish-verrucose on both surfaces. Fruits obovoid, slightly flattened, 2½ by 1¾ cm, beak lateral . . . . **14. C. whitfordii**
16. Leaflets usually not *caudate*-acuminate (if so, then fruit different), if verrucose, then warts not black.
17. Fruits curved to falcate, broad and flattened. Ultimate branches of the inflorescences subspicate . . . . **18. C. schumannianus**
17. Fruits either straight (stipe excepted) or curved-spindle-shaped. Ultimate branches of the inflorescences paniculate.
18. Fruits 1¾ cm long, endocarp sparsely glandular-pubescent. Sepals inside thinly tomentose. Petals 4–5 mm long . . . . **13. C. lamii**
18. Fruits 2 cm long or more, endocarp densely pubescent. Sepals inside (sub)glabrous. Petals 5–10 mm long.
19. Fruits slenderly semi-obovoid, 3½ cm long, beak lateral (near the apex). Sepals blunt. **10. C. paniculatus**

19. Fruit-shape otherwise, beak about terminal. Sepals acute.
 20. Fruits 2–2$\frac{1}{2}$ cm long, oblique-ellipsoid. Lower side of the leaflets minutely verrucose; reticulations not conspicuous . . . . **12. C. cochinchinensis**
 20. Fruits 3–5 cm long, usually spindle-shaped. Leaflets not verrucose; reticulations conspicuous, tessellate . . . . **15. C. monocarpus** *ssp.* **malayensis**

1. Connarus agamae MERR. Philip. J. Sc. 13 (1918) Bot. 68; SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 37; MERR. Pl. Elm. Born. (1929) 94; SCHELLENB. Pfl. R. Heft 103 (1938) 254.—**Fig. 11a.**

Tree, up to 17 m by 20 cm, sometimes shrub or climber. Twigs thinly pubescent, glabrescent, sparsely lenticellate. *Leaves* 1–2-jugate (at the base of the inflorescence sometimes unifoliolate); petiolules $\frac{1}{4}$–$\frac{1}{2}$ cm long. *Leaflets* oblong, slightly oblique, 11–20 by 4–10 cm (terminal ones slightly ovate, equilateral, up to 26 by 12 cm), thin-chartaceous, glabrous above, more or less densely minutely ferruginous-pilose mainly on the midrib and nerves beneath; base rounded to acute, slightly cordate and subpeltate; apex blunt; nerves 8–15 pairs, straight to slightly curved, strongly looped close to the margin, but not joined; veins and reticulations inconspicuous above, veins mainly transverse to the nerves, not dense. *Inflorescences c.* 15–35 cm long, rather broad, densely minutely ferruginous-pubescent, many-flowered. Bracts minute. *Sepals* ovate, acute, 2$\frac{1}{2}$ by 1$\frac{1}{2}$ mm, not keeled, on both sides thinly pilose, brown. *Petals* linear, blunt, 6$\frac{1}{2}$ mm long, on both sides with a few glandular hairs, densely punctate. *Stamens* all fertile, for $\frac{2}{3}$ mm connate, all filaments capitate-glandular pubescent. *Fruits* obovate, 5 by 3$\frac{1}{2}$ by 2 cm, with a 1–1$\frac{1}{2}$ cm long, slender stipe; beak acute, small, at about $\frac{4}{5}$ of the height; pericarp glabrous, shining, slightly wrinkled, woody, *c.* 2 mm thick, inside densely fulvous-tomentose.

Distr. *Malaysia:* NE. Borneo.

Apparently restricted to the E. part of Br. N. Borneo; the specimens, collected by HALLIER in W. Borneo, cited by SCHELLENBERG, 1938, obviously belong to *C. euphlebius.*

Ecol. In forests at low altitude, up to 300 m. *Fl.* Oct.–Jan., May, *fr.* May–July.

Vern. *Akar kulibat, bĕluguh, buah kaban, karopkupan, kulabit, lĕkabang.*

Note. Nearest related to *C. euphlebius.*

2. Connarus euphlebius MERR. J. Str. Br. R. As. Soc. *no* 85 (1922) 200; SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 38; MERR. Pl. Elm. Born. (1929) 94; HENDERS. Gard. Bull. S.S. 7 (1933) 99; SCHELLENB. Pfl. R. Heft 103 (1938) 257, *incl.* also *f. microcarpa.*—**Fig. 12.**

Liana, up to 25 m high, or scandent shrub. Branches densely ferruginous-pubescent, as are the petiole, rhachis, and petiolules. *Leaves* 1–4-jugate; petiolules $\frac{1}{4}$–$\frac{1}{2}$ cm long. *Leaflets* lanceolate (lower ones) to lanceolate-ovate or oblanceolate (upper pairs), 7$\frac{1}{2}$–27 by 2$\frac{1}{2}$–9 cm, stiff-chartaceous to subcoriaceous, pubescent, at least on the nerves beneath; base rounded to cuneate, usually subpeltate; apex slightly, shortly, and bluntly acuminate; nerves (8–)10–18 pairs, straight

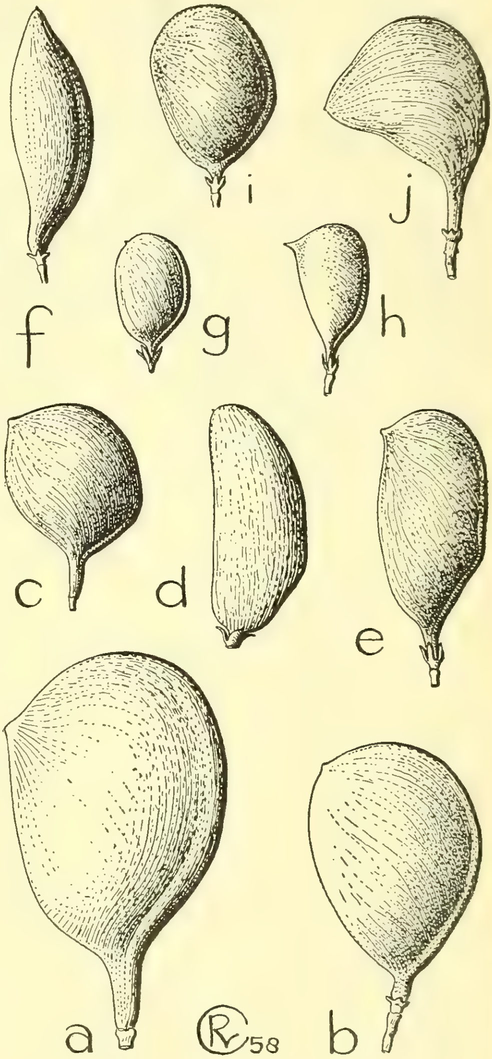


Fig. 11. Different fruit forms in *Connarus*. *a. C. agamae* MERR. (ELMER 20341), *b. C. salomoniensis* SCHELLENB. (NGF 7949), *c. C. winkleri* SCHELLENB. (WINKLER 2567), *d. C. semidecandrus* JACK (*'furfuraceus'*; RAHMAT 4614), *e. C. paniculatus* ROXB. (SF 25895), *f. C. monocarpus* L. *ssp. malayensis* LEENH. (MEIJER 4427), *g. C. semidecandrus* JACK *f.* β (SF 25920), *h. ditto, f.* α (BROOKE 9860), *i. C. odoratus* HOOK. *f.* (ELMER 21617), *j. C. schumannianus* GILG (BRASS 27586). All × $\frac{3}{4}$.

to slightly curved, dense and parallel, nearly always distinctly looped and joined close to the margin; veins transverse to the nerves, usually rather dense. *Inflorescences* up to 45 by 30 cm, densely ferruginous-tomentose, many-flowered. Bracts cylindrical, incurved, up to 1½ cm long. *Sepals* elliptic, acute to blunt, 2–2½ by 1–1¼ mm, not to distinctly keeled, outside densely pubescent, inside glabrous. *Petals* lanceolate, blunt to slightly emarginate at the apex, 5½–7 mm long, outside glabrous except sometimes a few glandular hairs at the apex, inside glabrous or in the upper part sparsely capitate-glandular pubescent, punctate. *Stamens* ½ mm connate, epipetalous ones usually fertile, filaments glabrous or glandular-pubescent. *Fruits* obovoid, rather flattened, 3½–5 by 2–4 cm, not or only shortly (up to ¾ cm) stipitate; beak usually distinct, acute, at about ⅔ of the height; pericarp obliquely wrinkled, outside densely minutely ferruginous-tomentose, glabrescent, woody, *c.* 1 mm thick, inside densely ferruginous-pubescent.

Distr. *Malaysia:* P. Tioman (E of Malaya), Borneo, and the Moluccas.

Ecol. In forests at rather low altitude, up to 600 m. *Fl.* Feb.–July, Oct., *fr.* Oct.–Nov. (March, July).

Vern. *Aka bĕlian*, Borneo.

Note. Nearest related to *C. agamae.*

KEY TO THE INFRASPECIFIC TAXA

1. Leaflets glabrous above. Stamens all fertile. *ssp.* **euphlebius**
  2. Leaves 3–4-jugate, leaflets not bullate. *var.* **euphlebius**
  2. Leaves 1–3-jugate, leaflets bullate. *var.* **bullatus**
1. Leaflets minutely tomentose on the midrib above. Epipetalous stamens staminodial *ssp.* **moluccanus**

ssp. **euphlebius.**

Leaflets glabrous above; base subpeltate; nerves 10–18 pairs, dense, near the margin distinctly joined. Sepals not keeled, outside densely appressed-pubescent. Petals inside in the upper part sparsely glandular-pubescent. Stamens all fertile, all filaments glandular-pubescent.

Distr. P. Tioman (E of Malaya) and Borneo.

var. **euphlebius.**

Pubescence short, tomentose. Leaves 3–4-jugate; leaflets not bullate. Fruit-beak distinct.

Distr. As the subspecies.

var. **bullatus** LEENH. Blumea Suppl. 4 (1958) *in the press.*

Pubescence more shaggy, velvety. Leaves 1–3-jugate; leaflets bullate. Fruit-beak rather inconspicuous.

Distr. Borneo (E. coast: Sangkulirang Isl., once collected).

ssp. **moluccanus** LEENH. Blumea Suppl. 4 (1958) *in the press.*

Leaflets above minutely tomentose on the midrib and sometimes also on the nerves, glabrescent; base not peltate; nerves *c.* 8 pairs, not very close, only part of them distinctly joined; venation less dense than in *ssp. euphlebius.* The ultimate branches of the inflorescence usually densely spicate; bracts rather small. Sepals distinctly keeled, outside densely woolly pubescent. Petals fully glabrous. Epipetalous stamens sterile, all filaments glabrous.

Distr. Moluccas (Sula Islands: Taliabu, once collected).

Note. This may prove to be a good species; as long as fruits are unknown I prefer the present solution, however.

3. Connarus planchonianus SCHELLENB. Kew Bull. (1927) 375; CRAIB, Fl. Siam. En. 1 (1928) 364; BURK. Dict. 1 (1935) 650; SCHELLENB. Pfl. R. Heft 103 (1938) 262, f. 45 B.—*C. grandis* (*non* JACK) HOOK. *f.* Fl. Br. Ind. 2 (1876) 53; KURZ, For. Fl. Burma 1 (1877) 328; KING, J. As. Soc. Beng. 66, ii (1897) 7; RIDL. Fl. Mal. Pen. 1 (1922) 547.—*C. wallichii* (*non* PLANCH.) SCHELLENB. Candollea 2 (1925) 94, 97.

Usually a rather large liana, up to 30 m by 15 cm, sometimes described as a shrubby creeper, an erect shrub (2 m high), or even a tall tree. Branches minutely tomentose when young, soon glabrous. *Leaves* 1–2-jugate, glabrous; petiolules ¾ cm long. *Leaflets* oblong to lanceolate, 10–30 by 3½–12 cm, stiff-coriaceous, sometimes minutely warty beneath; base broadly cuneate to rounded, subpeltate; apex blunt to very shortly, blunt-acuminate; midrib very prominent beneath, nerves 8–14 pairs, gradually, usually slightly curved, rather inconspicuously joined close to the margin; veins transverse to the midrib, rather dense and conspicuous. *Inflorescences* up to 40 cm long, very broad, rather densely ferruginous-tomentose, the main branches also widely branched, flower-bearing axes densely spicate. Bracts scale-like and minute to filiform curved and up to ¾ cm long. *Sepals* elliptic to lanceolate, blunt to acute, 3 by 1–1½ mm, not keeled, densely minutely tomentose outside, inside minutely pubescent. *Petals* lanceolate-spathulate, blunt, 5–6 mm long, glabrous, punctate. *Stamens* connate for 1 mm, the epipetalous ones probably not always fully fertile; filaments, mainly those of the episepalous stamens, scattered glandular-pubescent. *Fruits* flattened ellipsoid to obovoid, 4–6 by 2½–3 cm, stipe 1–1½ cm long, beak rather inconspicuous, inserted at or near the apex; pericarp coarsely obliquely wrinkled, glabrous outside, woody, *c.* 1 mm thick, inside sparsely shortly pubescent.

Distr. *Malaysia:* Sumatra (E. coast: Bila River near Rantauparapat, once collected) and Malay Peninsula, north to Tenasserim.

Ecol. In open to dense, primary and secondary forests, at up to 300 m. *Fl.* (May–)Aug.–Nov., *fr.* March–April and Sept.

Vern. *Kaju lipat*, Sum., *akar larak*, *a. tulang daeng padang*, *angor satasin*, *bunga mĕroyan*, *b. pamo-pamo rimba*, Mal. Pen.

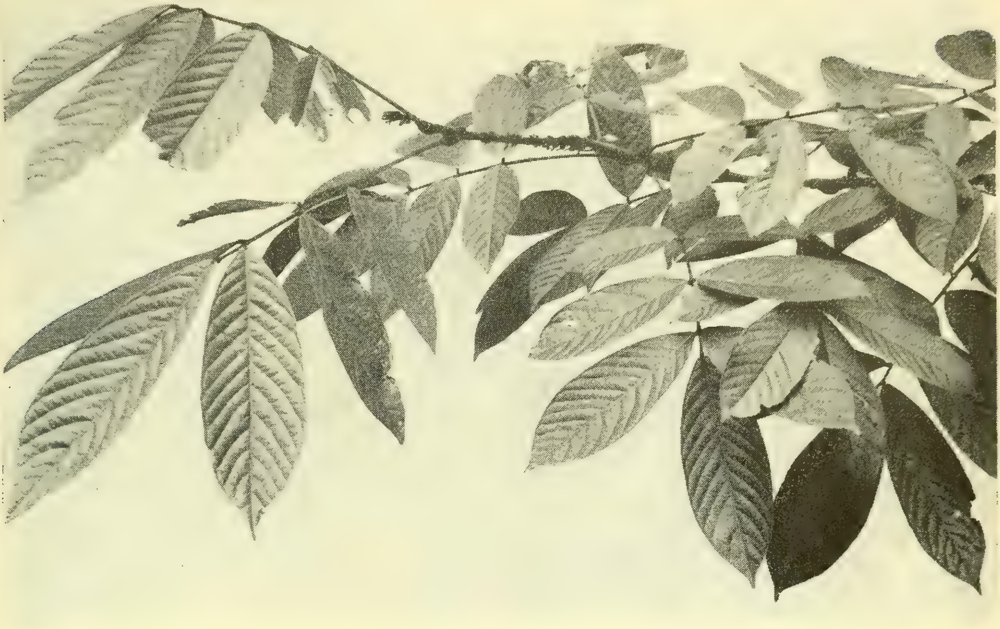


Fig. 12. *Connarus euphlebius* Merr. (Cult. Hort. Bog. XVII-F-12, Oct. 1957).

Note. Doubtless nearest related to *C. kingii* Schellenb. from the Andamans which differs in the following points: leaflets thinner, nerves less numerous, veins less dense and less conspicuous, fruits broader; the flowers of the two species are identical. Schellenberg recorded *C. kingii* also from Lower Burma; I saw only one of the two specimens cited by him, and this doubtless represented *C. planchonianus*.

4. Connarus grandis Jack, Mal. Misc. 2, *no* 7 (1822) 40; Hook. Comp. 1 (1835) 150; Walp. Rep. 1 (1842) 561; Bl. Mus. Bot. 1 (1850) 267, *incl.* also *var. kiladja* and *lunulatus*; Walp. Ann. 2 (1851) 301; Miq. Fl. Ind. Bat. 1, 2 (1859) 663; Koord. Exk. Fl. Java 2 (1912) 339; Schellenb. Candollea 2 (1925) 94, 97; Heyne, Nutt. Pl. (1927) 699; Burk. Dict. 1 (1935) 649; Schellenb. Pfl. R. Heft 103 (1938) 254, f. 45 A; Bakh. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 4; *non* Hook. *f.* Fl. Br. Ind. 2 (1876) 53; *nec* Kurz, For. Fl. Burma 1 (1877) 328; *nec* King, J. As. Soc. Beng. 66, ii (1897) 7; *nec* Ridl. Fl. Mal. Pen. 1 (1922) 547 (all of which = *C. planchonianus*).—*Anisostemon trifoliatus* Turcz. Bull. Soc. Nat. Mosc. 20 (1847) 152; Walp. Ann. 1 (1848) 199.—*C. polyanthus* Planch. Linnaea 23 (1850) 428; Walp. Ann. 2 (1851) 300; Miq. Fl. Ind. Bat. 1, 2 (1859) 665.—*C. trifoliatus;* Rolfe, J. Bot. 23 (1885) 212, *sphalm. trifoliolatus*; Merr. Philip. J. Sc. 4 (1909) Bot. 119; En. Philip. 2 (1923) 238; Schellenb. Pfl. R. Heft 103 (1938) 263.—*C. rolfei* Vidal, Phan. Cuming. (1885) 23, 106, *nom. illeg.*—*C. ellipticus* King, J. As. Soc. Beng. 66, ii (1897) 7, *excl. basionym*; Ridl. Fl. Mal. Pen. 1 (1922) 547; Merr. Pl. Elm. Born. (1929) 95.—*C. diversifolius* Scheffer *ex* Back. Schoolfl. (1911) 289, *excl. basionym?*—*C. lunulatus* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 37.—**Fig. 13g.**

Large liana (up to 30 m by $7^1/_2$ cm), rarely a shrub or small tree (up to 7 m by 18 cm). Branches glabrous, sometimes distinctly lenticellate. *Leaves* 1–2-jugate, sometimes without a terminal leaflet; petiolules $^1/_2$–$^3/_4$ cm. *Leaflets* oblong-ovate to lanceolate-oblong, sometimes slightly oblique, $5^1/_2$–27 by $3^1/_2$–$12^1/_2$ cm, thin-chartaceous to thin-coriaceous, glabrous; base acute to broadly rounded, sometimes even cordate, rarely subpeltate, often slightly decurrent; apex tapering blunt-acuminate; nerves 5–10 pairs, the basal pair originating from the very base of the leaflet, all slightly curving to near the apex, not distinctly joined; veins rather inconspicuous, mainly transverse to the midrib. *Inflorescences* up to *c.* 35 by 30 cm, more or less densely fulvous-tomentose, rather many-flowered. Bracts minute. *Sepals* ovate to elliptic, acute, $2^1/_2$–$3^1/_2$ by 1–$1^1/_2$ mm, not keeled, outside rather densely, inside more sparsely, minutely appressed-pubescent, the apex with a few bristle-like capitate-glandular hairs. *Petals* linear, blunt, white, pink, or cream-coloured, often distinctly red punctate, 6–7 mm long, outside sometimes with a few scattered glandular hairs near the base and the apex minutely tomentose, inside glabrous. *Stamens* for ¹/₂ mm connate, in Philippine specimens usually all fertile, in W. Malaysian ones epipetalous stamens usually sterile to staminodial and sometimes even partly absent; filaments, at least of the long stamens, with scattered glandular hairs. *Fruits* coarse, obovoid, 5–7 by 3¹/₂–4 by 2 cm, without or with a short stipe (up to ¹/₂ cm); beak acute, often hooked, inserted at 60–90% of the height; pericarp rather smooth, glabrous, woody, *c.* 2 mm thick, inside densely ferruginous-pubescent.

Distr. *Malaysia:* Sumatra (*incl.* also Simalur and Banka), Malay Peninsula, W. Java (mainly Depok and Mt Salak), Borneo, and the Philippines, possibly also on Talaud Isl.

The Moluccan specimens cited by SCHELLENBERG (1938) I have referred to *C. semidecandrus.*

Ecol. In primary, secondary, and mossy forests, usually along the edges, in more open places, and along river-banks, also on a marshy soil, up to 1400 m. *Fl.* (March–)May–Aug.(–Dec.), *fr.* (Jan.–) June–Aug.(–Dec.).

Uses. According to HEYNE a decoction of the bark of this or some related species is used as a medicine for asthma and other chest-complaints.

Vern. *Akar mambu, mĕribungan akar, tjapé,* Sum., *olor mahara lutung,* Simalur, *tĕlĕlang,* Banka, *akar chinchin,* Mal. Pen., *aroy ki tjaăng, bangkongan, ki hanjĕr, ki ladja,* S, *dulipat, likabang,* Born.

Notes. Though SCHELLENBERG classified *C. grandis* JACK and *C. trifoliatus* ROLFE in different sections, *Xyloconnarus* and *Pseudoxyloconnarus* respectively, they differ so little that they do not even deserve the rank of subspecies. On the whole, the Philippine specimens are characterized by constantly 3-foliolate leaves, by distinctly better developed epipetalous stamens, and by usually slightly smaller, more flattened fruits the beak of which is more hooked and inserted at only about 60 % of the height. Especially in Borneo intermediates occur between both extremes.

A fruiting specimen from Central Celebes (KJELLBERG 2546) comes very close to the present species as well as to *C. agamae.* It mainly differs from both by its fruits: semi-ellipsoid, *c.* 5 by 2¹/₂ cm, rather flattened, narrowed though not distinctly stipitate at the base, the straight dorsal side ending in a conical, 1 cm long, acute rostrum; pericarp glabrous, rugose, 3 mm thick, hard and woody, inside sparsely pubescent. As I am not convinced that these fruits are normal, and as flowers are still unknown, I have referred this specimen provisionally to *C. grandis.*

5. Connarus subinaequifolius ELM. Leafl. Philip. Bot. 1 (1908) 297, *sphalm. subinequifolius*; MERR. Philip. J. Sc. 4 (1909) Bot. 124; En. Philip. 2 (1923) 238; SCHELLENB. Pfl. R. Heft 103 (1938) 259.—*C. bracteatus* MERR. Philip. J. Sc. 4 (1909) Bot. 120; En. Philip. 2 (1923) 237.—*C. castaneus* MERR. Philip. J. Sc. 14 (1919) Bot. 403; En. Philip. 2 (1923) 237; SCHELLENB. Pfl. R. Heft 103 (1938) 358.—**Fig. 13f.**

Scandent shrub. Branches densely ferruginous-pubescent when young, more or less glabrescent. *Leaves* 2–3-jugate; petiolules ¹/₂–³/₄ cm. *Leaflets* elliptic to oblong, 6–18 by 2–7 cm, thinly coriaceous, above glabrous or minutely pubescent on the midrib, beneath either densely red sericeous-pubescent, or midrib and nerves minutely ferruginous-tomentose and glabrescent; base acute to rounded, sometimes subpeltate; apex shortly blunt- to acute-acuminate; nerves 5–8 pairs, gradually curved, more or less distinctly looped and joined near the margin; veins either transverse to the midrib, parallel and rather dense, or reticulate. *Inflorescences* up to 40 cm long, densely ferruginous-tomentose, the ultimate branches racemose and with many flowers. Bracts nearly filiform, curved, *c.* 1 cm long. *Sepals* lanceolate to obovate, acute, 3¹/₂–4 by 1¹/₂–2 mm, on both sides rather densely pubescent. *Petals* lanceolate, blunt, 6–7 mm long, outside rather densely tomentose, inside thinly glandular-pubescent, densely punctate. Epipetalous *stamens* glabrous or with few glandular hairs, episepalous ones slightly glandular-pubescent, probably all fertile. *Fruits* obovate, 5–6 by 3–4 by 2 cm, stipe usually very short (up to ³/₄ cm), beak inconspicuous, inserted at about ³/₄ of the height; pericarp densely red velvety-pubescent, sometimes rather early glabrescent, woody, *c.* 1 mm thick, inside sparsely short-pubescent.

Distr. *Malaysia:* Philippines (Batan Isl., Luzon, Polillo, Dinagat Isl. near Mindanao).

var. **subinaequifolius.**—*C. subinaequifolius* ELM.—*C. bracteatus* MERR.

Leaflets relatively narrow, subglabrescent; veins transverse to the midrib, dense. Fruit early glabrescent.

Distr. Luzon and Dinagat Isl.

Ecol. In forests up to 850 m. *Fl.* April–May, *fr.* March–May.

Note. The only specimen known from Dinagat Island (Bs 83928) is slightly different by the following characters: leaflets more coriaceous, fully glabrous; nerves 3–4 pairs, ascending, not distinctly joined; sepals inside glabrous (fruits of this form are unknown).

var. **sericeus** LEENH., *nov. var.*—*C. castaneus* MERR.

Leaflets relatively broad, densely sericeous-pubescent beneath; veins coarsely reticulate. Fruits remaining pubescent for a long time.

Distr. Luzon, Batan Isl., and Polillo.

Ecol. Forests at low altitude. *Fr.* Nov.–Dec.

6. Connarus ferrugineus JACK, Mal. Misc. 2, *no* 7 (1822) 37; Hook. Comp. 1 (1835) 149; Walp. Rep. 1 (1842) 561; MIQ. Fl. Ind. Bat. 1, 2 (1859) 666; HOOK. *f.* Fl. Br. Ind. 2 (1876) 51; GILG in E. & P. Nat. Pfl. Fam. 3, 3 (1888) f. 34 B–C; KING, J. As. Soc. Beng. 66, ii (1897) 3; BURK. J. Str. Br. R. As. Soc. *no* 73 (1916) 249; RIDL. Fl. Mal. Pen. 1 (1922) 545; HENDERS. Gard. Bull. S.S. 4 (1928) 246;

Burk. Dict. 1 (1935) 649; Schellenb. Pfl. R. Heft 103 (1938) 258, *incl.* also *f. macrocarpa* and *f. microcarpa.*

Liana, up to 25 m by 10 cm, sometimes an erect shrub (up to 5 m high), or a small tree. Branches densely ferruginous-tomentose, more or less glabrescent. *Leaves* 3–5-jugate, petiole, rhachis, and petiolules densely tomentose when young, rather early glabrescent; petiolules 2–3 mm. *Leaflets* oblong-obovate to oblanceolate, 3½–20 by 1½–8 cm (becoming longer and relatively narrower upwards), stiff chartaceous to coriaceous, often bullate, when young appressed-sericeous-pubescent above, glabrescent, beneath rather shaggy ferruginous-pilose on midrib and nerves; base rounded, slightly peltate; apex up to 1 cm long blunt-acuminate; nerves 5–8 pairs, gradually curved, looped and joined near the margin, veins mainly transverse to the nerves. *Inflorescences c.* 20–30 cm long, rather narrow, sparingly branched, few-flowered; flowers clustered, densely brown-tomentose. Bracts cylindrical, curved, thickened at the apex, 1–2 cm. *Sepals* oblong, slightly complicate, blunt, 4–4½ by 1½ mm, slightly keeled, densely brown-tomentose on both surfaces. *Petals* linear-spathulate, blunt, 7–8 mm long, rather stiff, glabrous, punctate. *Stamens* connate for 1 mm, all fertile; filaments with a few scattered glandular hairs. *Fruits* ellipsoid, straight, 3½–7 by 2–3 cm, not or up to 1 cm long stipitate, beak minute, near the apex; pericarp outside densely, minutely crimson-tomentose, glabrescent and wrinkled, woody, *c.* 1½ mm thick, inside ± ferruginous-tomentose.

Distr. *Malaysia:* Malay Peninsula (mainly along the W. coast).

King erroneously recorded this species for Sumatra. According to Henderson it occurs also in Lower Siam, but no specimens have either been mentioned in literature, or have been found by me in herbaria.

Ecol. In primary forests and bamboo thickets, mainly in more open places, along the forest borders, river-banks, and on the rocky seashore up to *c.* 200 m. *Fl.* Dec.–Feb. (June, Sept.), *fr.* (April) June-Aug. (Oct.).

Uses. The fruits are used by the Malays for poisoning dogs.

Vern. *Akar mèrah, a. pulau hantu,* (*a. pulis antau*), *a. sakalat, a. sĕmdĕrap, a. tĕnggêk kĕrau, bunga akar sĕtĕbal, bunga burutta, poko pulis hutan, sĕmbĕlit jantan, sĕmĕlit papan.*

Note. This species seems to be most closely related to *C. subinaequifolius* from the Philippines.

7. Connarus villosus Jack, Mal. Misc. 2, *no* 7 (1822) 38; Hook. Comp. 1 (1835) 149; Walp. Rep. 1 (1842) 561; Miq. Fl. Ind. Bat. 1, 2 (1859) 666; *non* Ridl. Fl. Mal. Pen. 1 (1922) 547, and all subsequent authors (= *C. odoratus* Hook. *f.*). —*Tricholobus fulvus* Bl. Mus. Bot. 1 (1850) 237; Walp. Ann. 2 (1851) 304; Miq. Fl. Ind. Bat. 1, 2 (1859) 666; Sum. (1861) 530.—*C. tricholobus* Schellenb. Mitt. Bot. Mus. Un. Zürich *no* 50 (1910) 75; Pfl. R. Heft 103 (1938) 229.—*C. plumoso-stellatus* Merr. Philip. J. Sc. 13 (1918) Bot. 72; Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 33; Pfl. R. Heft 103 (1938) 230.—**Fig. 13a–e.**

Liana or scandent shrub. Branches densely stellate-plumose, as are the leaves and inflorescences, more or less glabrescent. *Leaves* 1–4-jugate, petiolules ¼–½ cm. *Leaflets* obovate to lanceolate, 4–17 by 1½–5 cm, thin-coriaceous, glabrous above, densely ferruginous-pubescent beneath, rather early glabrescent; base acute to slightly rounded, subpeltate; apex tapering acute-acuminate; midrib strongly prominent beneath, nerves 4–8 pairs, ascending, curved, usually distinctly looped and joined near the margin, inconspicuous above, veins laxly reticulate. *Inflorescences* 10–30 cm long, few-flowered. Bracts very conspicuous, subulate, circinnate, *c.* ½ cm long, often without a flower, giving the inflorescence a very characteristic crispy appearance. *Sepals* lanceolate, acute, complicate, 3½–5 by 1 mm, outside densely pubescent, inside glabrous. *Petals* linear, blunt, 5½–8 mm long, glabrous except the glandular-ciliate margins, punctate. *Stamens* ½ mm connate, all fertile, epipetalous ones glabrous, episepalous ones with many glandular hairs in the upper half of the filaments. *Fruits* ellipsoid, 3–4¼ by 1¾–2¼ cm, not stipitate; beak minute, either inserted at ¾ of the height or nearly at the apex; pericarp rather thin, outside densely orange-brown pubescent, inside glabrous.

Distr. *Malaysia:* Sumatra (Indragiri and Palembang) and Borneo (Sarawak: around Kuching up to Matang and Paloh).

Ecol. In primary, dipterocarp and karengas forests, at low altitude. *Fl.* May, Aug., *fr.* Sept.–Jan. (April).

Vern. *Badju-badju, tankei laju,* Sum., *guid malam,* Born.

Notes. In Sumatran specimens the hairs are less strongly branched and therefore the pubescence is less crispy than in Bornean ones; this difference is specially conspicuous on the fruits. Furthermore the beak of the fruit in Bornean specimens is rather distinct and inserted at *c.* ¾ of the height, in Sumatran specimens it is minute and inserted near the apex.

Though I have not examined the type specimen (cited by Schellenberg as being in the Herb. Delessert, G, but which could not be found), I am satisfied that Ridley and Schellenberg have wrongly interpreted Jack's species. Jack's description of his Sumatran plant fits nicely with several later collections from that island, but differs in many points from *C. villosus* in the sense of Schellenberg (of which Jack's specimen was the only one from Sumatra) and which I have classified as *C. odoratus.*

The present species is closely allied to the Philippine *C. culionensis*, furthermore it is related to *C. ferrugineus* and to *C. odoratus.*

8. Connarus culionensis Merr. Philip. J. Sc. 4 (1909) Bot. 120; En. Philip. 2 (1923) 237; Schellenb. Pfl. R. Heft 103 (1938) 267.—*C. stellatus* Merr. Philip. J. Sc. 4 (1909) Bot. 119; En. Philip. 2 (1923) 238; Philip. J. Sc. 29 (1926) 371; Schel-

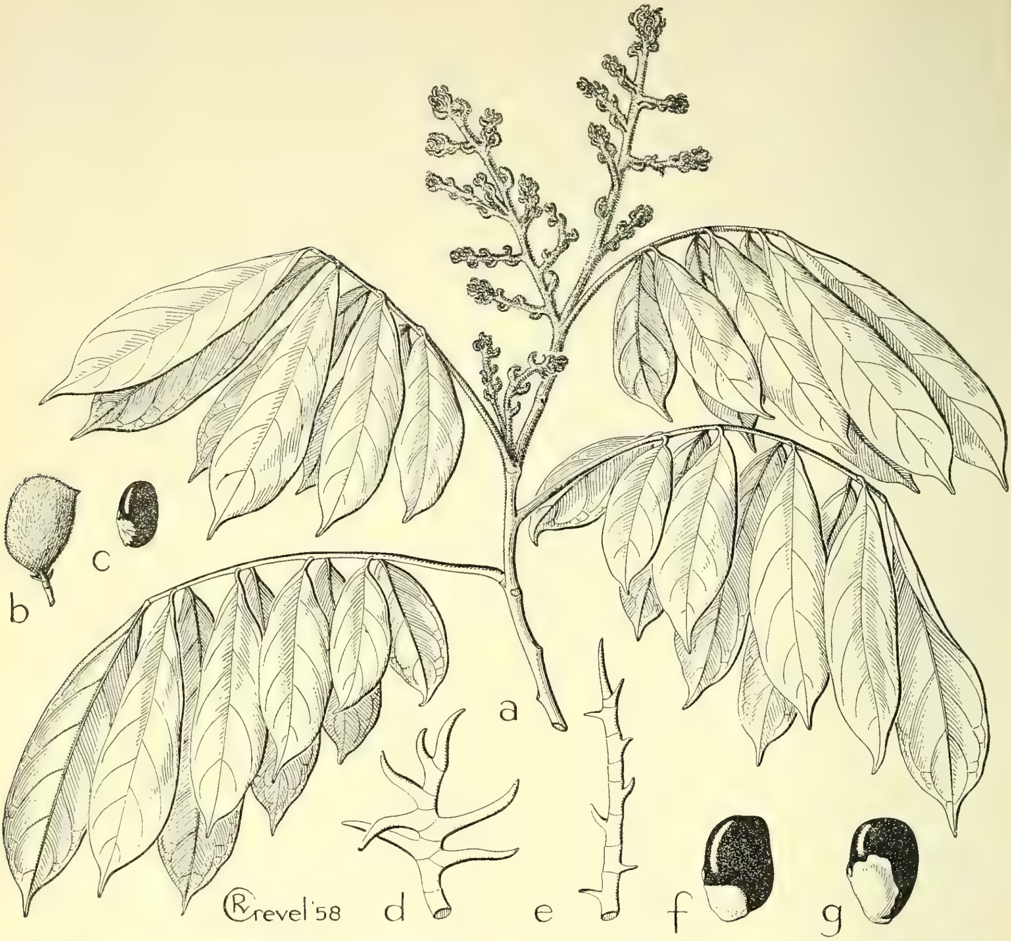


Fig. 13. *Connarus villosus* JACK. *a.* Flowering twig, × ½, *b.* fruit, × ½, *c.* seed, × ½, *d–e.* branched hairs, × 200.—*C. subinaequifolius* ELM. *f.* Seed, × ½.—*C. grandis* JACK. *g.* Seed, × ½ **(*a, d* PRAETORIUS *s.n.* H.L.B. 909. 116–168, *b–c* BIANCHI 47, *e* AMIRUDDIN 29, *f* Bs 47269).**

LENB. Pfl. R. Heft 103 (1938) 229.—*? C. erianthus* ELM. Leafl. Philip. Bot. 5 (1913) 1762, *nom. illeg.*, *non* BENTH. *ex* BAKER, 1871; MERR. En. Philip. 2 (1923) 237.—*? C. lanatus* SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 41.

Liana or more or less scandent to erect shrub. Branches densely ferruginous-tomentose, more or less glabrescent. *Leaves* 2–5-jugate, the petiole, rhachis, and petiolules densely rusty tomentose when young; petiolules ¼–½ cm. *Leaflets* lanceolate (the terminal ones oblanceolate) to oblong, 4–15 by 1–5½ cm, thin-chartaceous to subcoriaceous, when young ferruginous-tomentose on both sides, especially beneath; base usually subpeltate, of the lateral leaflets rounded to slightly cordate rarely cuneate, of the terminal ones cuneate; apex gradually, sometimes very shortly blunt-acuminate; nerves 5–6(–9) pairs, ascending, curved (rarely nearly straight), looped and more or less distinctly joined near the margin. *Inflorescences* 20–35 cm long, densely ferruginous-tomentose, the branches transverse, up to 15 cm long, many-flowered. Bracts minute and scale-like to subulate, up to 1 cm long, and recurved. *Sepals* oblong-ovate, 3½ by 1½ mm, complicate, keeled, outside densely brown-tomentose, inside glabrous. *Petals* linear to elliptic, blunt, 5½–8 mm long, rather densely (rarely outside sparsely) appressed-pubescent on both sides, inside with many glandular hairs, brownish to white, punctate. *Stamens* for *c.* ¾ mm connate, epipetalous ones probably not always fertile, all filaments slightly glandular-pubescent, especially the episepalous ones in the upper part. *Fruits* oblique-ellipsoid, compressed, *c.* 2½ by 1½ cm, stipe very short, beak minute, nearly terminal, pericarp thin, outside obliquely minutely wrinkled, ferruginous-tomentose, glabrescent, inside subglabrous.

Distr. *Malaysia:* North Borneo (Banguey Isl.) and S. Philippines (Balabac, Palawan, Calamianes, and Sulu Islands).

Ecol. On dry, open slopes, in dry thickets, and in forests, at low altitude.

Notes. The type of *C. lanatus* (= *C. erianthus*) differs in a few characters from the present species; in some points it seems to be intermediate between *C. culionensis* and *C. ferrugineus.*

C. ferrugineus, villosus, and *culionensis* are mutually closely related and, moreover, replace each other geographically; they differ in too many points, however, for treating them as subspecies.

var. **culionensis.**—All synonyms except *C. stellatus.*

Hairs not distinctly stellate. Leaflets lanceolate, up to $4^{1}/_{2}$ cm wide, the base never cuneate in the lateral ones. Petals outside, especially in the upper half, densely pubescent. Stamens all fertile.

Distr. Palawan and Calamianes.

var. **stellatus** (MERR.) LEENH., *nov. stat.*—*C. stellatus* MERR.

Hairs distinctly stellate. Leaflets sometimes oblong, up to $5^{1}/_{2}$ cm wide; base of the lateral ones sometimes cuneate. Petals outside sparsely pubescent. Epipetalous stamens probably sterile. Fruit unknown.

Distr. As the species.

9. Connarus odoratus HOOK. *f.* Trans. Linn. Soc. 23 (1860) 172; MERR. Pl. Elm. Born. (1929) 95. —*Tricholobus ferrugineus* BL. Mus. Bot. 1 (1850) 237; Walp. Ann. 2 (1851) 304; MIQ. Fl. Ind. Bat. 1, 2 (1859) 667, *non C. ferrugineus* JACK, 1822.—*C. hebephyllus* KING, J. As. Soc. Beng. 66, ii (1897) 5.— *C. villosus* (*non* JACK) RIDL. Fl. Mal. Pen. 1 (1922) 547; SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 33; Pfl. R. Heft 103 (1938) 228.—**Fig. 11i.**

Liana or scandent shrub, up to 35 m by 15–20 cm, possibly sometimes a small tree. Branches densely ferruginous-tomentose by dendroid hairs when young, glabrescent, lenticellate. *Leaves* (1–)4–8-jugate, petiole, rhachis, and petiolules densely tomentose when young; petiolules $^{1}/_{2}$ cm. *Leaflets* lanceolate, 3–16 by $1^{1}/_{2}$–5 cm (gradually increasing in size from the basal pair to the terminal leaflet), thin-chartaceous, when young tomentose on midrib and nerves beneath, soon glabrescent; base rounded to cuneate, becoming less oblique and more acute from the basal pair to the terminal leaflet, sometimes subpeltate; apex tapering long and slender acuminate; nerves 6–10 pairs, oblique, curved, rather indistinctly looped and joined near the margin, inconspicuous above, veins fine, dense, transverse to the midrib. *Inflorescences* up to *c.* 20 cm long, widely branched, densely ferruginous-tomentose, flowers mainly crowded towards the ends of the branches. Bracts subulate, circinnate and *c.* 1 cm long to deltoid and minute. *Sepals* oblong-ovate, acute, $3^{1}/_{2}$ by 1 mm, complicate, outside densely pubescent, inside glabrous. *Petals* linear-spathulate, 6 mm long, glabrous, punctate. *Stamens* for $^{1}/_{2}$ mm connate, all fertile, filaments with a few scattered glandular hairs. *Fruits* oblique-ellipsoid, not compressed, 3–$3^{3}/_{4}$ by 2–$2^{1}/_{2}$ cm, stalk *c.* $^{1}/_{4}$ cm long, beak minute, inserted at 85% of the height to nearly terminal, pericarp thin, outside glabrous, minutely wrinkled and verruculose, inside more or less densely dendroid-pubescent.

Distr. *Malaysia:* Malay Peninsula and Borneo.

Ecol. In forests and thickets, at up to 450 m. *Fl.* May, Oct., Dec., *fr.* Aug.–Nov. (Feb., May).

Note. *C. odoratus* is distinctly related to *C. ferrugineus, villosus,* and *culionensis,* as well as to *C. paniculatus* and *semidecandrus.*

10. Connarus paniculatus ROXB. [Hort. Beng. (1814) 49, *nom. nud.*] Fl. Ind. 3 (1832) 139; HOOK. *f.* Fl. Br. Ind. 2 (1876) 52; KURZ, For. Fl. Burma 1 (1877) 327; BRANDIS, Ind. Trees (1906) 212; SCHELLENB. Pfl. R. Heft 103 (1938) 260; KANJILAL *et al.* Fl. Assam 2 (1938) 2; *non* F.–VILL. Nov. App. (1880) 57, = *? Rourea minor.*—*C. wightii* HOOK. *f.* Fl. Br. Ind. 2 (1876) 51; BRANDIS, Ind. Trees (1906) 212; GAMBLE, Fl. Madras 2 (1918) 272; SCHELLENB. Pfl. R. Heft 103 (1938) 227.—*C. bariensis* PIERRE, Fl. Coch. 5 (1898) t. 377; SCHELLENB. Pfl. R. Heft 103 (1938) 261.—*C. harmandianus* PIERRE, Fl. Coch. 5 (1898) t. 377 b; LECOMTE, Fl. Gén. I.–C. 2 (1908) 51.—*C. rufulus* PIERRE, Fl. Coch. 5 (1898) t. 378 b; LECOMTE, Fl. Gén. I.–C. 2 (1908) 52; SCHELLENB. Pfl. R. Heft 103 (1938) 267.—*C. hainanensis* MERR. Lingn. Sc. J. 13 (1934) 58; CHUN, Sunyatsenia 4 (1940) 244. —*C. yunnanensis* SCHELLENB. Pfl. R. Heft 103 (1938) 228.—**Fig. 11e.**

Liana (acc. to ROXBURGH a large tree). Branchlets minutely ferruginous-tomentose at the tip, early glabrescent. *Leaves* 2–3-jugate, glabrous; petiolules $^{1}/_{2}$ cm. *Leaflets* oblong to lanceolate, 10–16 by $3^{1}/_{2}$–6 cm, stiff-chartaceous to thin-coriaceous; base subpeltate, rounded or sometimes slightly cordate; apex blunt to shortly and broadly blunt-acuminate, acumen not rarely slightly emarginate; nerves 5–8 pairs, patent to ascending, slightly to distinctly curved, not joined, inconspicuous above; veins parallel, not very dense, nearly invisible. *Inflorescences* (in Malayan specimens unknown) broadly paniculate, 10–40 cm long, shortly and densely ferruginous-tomentose, glabrescent. Bracts scaly, minute. *Sepals* elliptic to obovate, $2^{1}/_{2}$–$3^{1}/_{2}$ by 1–$1^{1}/_{2}$ mm, blunt, distinctly keeled, outside densely ferruginous-pubescent, inside subglabrous. *Petals* narrowly spathulate, *c.* $7^{1}/_{2}$ mm long, blunt, outside shortly and densely pubescent, inside sparsely tomentose. *Stamens* connate for $^{1}/_{2}$–$1^{1}/_{4}$ mm, all fertile, filaments glandular-pubescent. *Fruits* semi-obovoid, convex, $3^{1}/_{2}$ by $1^{3}/_{4}$ by $1^{1}/_{4}$ cm, base narrowed into a short, slender stipe (*c.* 4 mm long), beak inconspicuous, inserted at *c.* 90% of the height to near the apex, pericarp thin, outside striate, granulate, glabrescent, inside rather densely shortly pubescent.

Distr. W. Deccan, Bengal, Assam, S. China, Indo-China, Hainan, and *Malaysia:* Malay Peninsula (Johore).

Ecol. In forests at low altitude. *Fr.* May, July, Oct.

Vern. *Akar chin-chin.*

Note. This species doubtless comprises several distinct races, which Schellenberg treated as species even classified in 3 different sections. The differences between them are minute and mainly concern the vegetative parts (shape and size of leaflets, number of nerves, more or less prominent nervation and reticulations); in fertile characters these races differ slightly in length and degree of hairiness of the petals, shape and size of fruit, and the pericarp which may be subglabrous inside. The material at hand was insufficient for characterizing these subspecies. The Malayan specimens also represent a distinct race, and therefore I have based my description as far as possible (inflorescences and flowers were unknown) on Malayan material only.

C. paniculatus is apparently both related to *C. odoratus* and to *C. latifolius* Wall. (Bengal and Burma, possibly conspecific with *C. semidecandrus*), and *C. semidecandrus*.

Sterile and flowering Malayan specimens are to all probability nearly indistinguishable from *C. monocarpus*, which radically differs in fruit.

11. Connarus semidecandrus Jack, Mal. Misc. 2, *no* 7 (1822) 39; Hook. Comp. 1 (1835) 150; Walp. Rep. 1 (1842) 561; Bl. Mus. Bot. 1 (1850) 269, *incl.* also *var. latifoliolatus;* Miq. Fl. Ind. Bat. 1, 2 (1859) 664; Sum. (1861) 529; Hook. *f.* Fl. Br. Ind. 2 (1876) 52; Kurz, For. Fl. Burma 1 (1877) 326; Ridl. Trans. Linn. Soc. Bot. 3 (1893) 291; King, J. As. Soc. Beng. 66, ii (1897) 4; Brandis, Ind. Trees (1906) 213; Back. Schoolfl. (1911) 289; Ridl. Fl. Mal. Pen. 1 (1922) 546, f. 53; Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 39; Burk. Dict. 1 (1935) 650; Schellenb. Pfl. R. Heft 103 (1938) 280; Bakh. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 4; Merr. J. Arn. Arb. 33 (1952) 221.—*Clompanus funicularis* Rumph. Herb. Amb. 5 (1747) 70, t. 37 f. 2; Merr. Int. Rumph. (1917) 248.—*Omphalobium gaudichaudii* DC. Prod. 2 (1825) 85.—*? Erythrostigma diversifolia* Hassk. Flora 25 (1842) Beibl. 45; Flora 27 (1844) 622; Cat. Hort. Bog. (1844) 247.—*? C. wallichii* Planch. Linnaea 23 (1850) 426; Walp. Ann. 2 (1851) 300; Miq. Fl. Ind. Bat. 1, 2 (1859) 665; *non* Schellenb. Candollea 2 (1925) 94 & 97 (= *C. planchonianus*).—*C. neurocalyx* Planch. Linnaea 23 (1850) 428; Walp. Ann. 2 (1851) 300; Miq. Fl. Ind. Bat. 1, 2 (1859) 665; Vidal, Sinopsis (1883) Atlas t. 39 f. E; Merr. Philip. J. Sc. 4 (1909) Bot. 121; Fl. Man. (1912) 220; En. Philip. 2 (1923) 238; Schellenb. Pfl. R. Heft 103 (1938) 276.—*C. obtusifolius* Planch. Linnaea 23 (1850) 428; Walp. Ann. 2 (1851) 301; Miq. Fl. Ind. Bat. 1, 2 (1859) 665; Merr. Philip. J. Sc. 4 (1909) Bot. 121.—*C. gaudichaudii* Planch. Linnaea 23 (1850) 429; Bl. Mus. Bot. 1 (1850) 266; Miq. Fl. Ind. Bat. 1, 2 (1859) 662; Kanehira, Fl. Micr. (1933) 129, f. 44; Schellenb. Pfl. R. Heft 103 (1938) 277.—*C. nitidus* Wall. *ex* Planch. Linnaea 23 (1850) 436, *nom. nud.*, *non* Hassk. 1844.—*C. furfuraceus* Bl. Mus. Bot. 1 (1850) 268; Walp. Ann. 2 (1851) 301; Miq. Fl. Ind. Bat. 1, 2 (1859) 664; Schellenb. Pfl. R. Heft 103 (1938) 278.—*C. mutabilis* Bl. Mus. Bot. 1 (1850) 269, *incl.* also *var. barbatus*, *elongatus*, and *splendens;* Walp. Ann. 2 (1851) 301; Miq. Fl. Ind. Bat. 1, 2 (1859) 664; Schellenb. Pfl. R. Heft 103 (1938) 281; Bakh. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 4.—*? Erythrostigma ellipticum* Zoll. Nat. Tijd. Ned. Ind. 14 (1857) 174.—*C. pyrrhocarpus* Miq. Sum. (1861) 530.—*C. gibbosus* Wall. [Cat. (1847) *no* 8541 A & B, *nom. nud.*; *ex* Planch. Linnaea 23 (1850) 436, *nom. nud.*] *ex* Hook. *f.* Fl. Br. Ind. 2 (1876) 52; Kurz, J. As. Soc. Beng. 45, ii (1877) 215; For. Fl. Burma 1 (1877) 327; Ridl. Trans. Linn. Soc. Bot. 3 (1893) 290; Brandis, Ind. Trees (1906) 212; Burk. Dict. 1 (1935) 649; Schellenb. Pfl. R. Heft 103 (1938) 276.—*C. griffithii* Hook. *f.* Fl. Br. Ind. 2 (1876) 52; Kurz, For. Fl. Burma 1 (1877) 326; Ridl. Fl. Mal. Pen. 1 (1922) 546; Craib, Fl. Siam. En. 1 (1928) 363; Schellenb. Pfl. R. Heft 103 (1938) 278.—*C. bankensis* Burck, Ann. Jard. Bot. Btzg 6 (1887) 251, *nom. nud.—? C. ellipticus* King, J. As. Soc. Beng. 66, ii (1897) 7, *excl. specim.;* Schellenb. Candollea 2 (1925) 97 & 98; Pfl. R. Heft 103 (1938) 274.—*C. quocensis* Pierre, Fl. Coch. 5 (1898) t. 377 A; Lecomte, Fl. Gén. I.-C. 2 (1908) 52.—*C. amplifolius* Pierre, Fl. Coch. 5 (1898) t. 377 D; Lecomte, Fl. Gén. I.-C. 2 (1908) 53; Schellenb. Pfl. R. Heft 103 (1938) 275.—*C. balsahanensis* Elm. Leafl. Philip. Bot. 5 (1913) 1764; Merr. En. Philip. 2 (1923) 237; Schellenb. Pfl. R. Heft 103 (1938) 275.—*C. borneensis* Merr. Philip. J. Sc. 13 (1918) Bot. 69; Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 39; Pfl. R. Heft 103 (1938) 275.—*Santaloides cordatum* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 29, *p.p. typ. excl.*—*C. jackianus* Schellenb. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 40; Pfl. R. Heft 103 (1938) 282; *non* Wall. *ex* Planch. Linnaea 23 (1850) 437, *nom. nud.* = *Sapind.*—*C. gracilis* Bakh. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 3, *nom. illeg.*; Blumea 6 (1950) 365.—*C. nigropunctus* Gagnep. Bull. Soc. Bot. Fr. 99 (1952) 30. —**Fig. 11d, g–h.**

Large liana or scandent or creeping shrub, sometimes even a small tree; stem up to 10 cm thick. Branches glabrous or the young parts densely ferruginously pubescent, later on verrucose-lenticellate. *Leaves* 1–3(–5)-jugate, glabrous or minutely pubescent in all parts; petiolules $^{1}/_{4}$–$^{3}/_{4}$ cm. *Leaflets* elliptic to lanceolate, 4–25 by 2–9 cm, papyraceous, chartaceous, or thin-coriaceous, not rarely slightly verrucose beneath, glabrous or on the lower side minutely pubescent, mainly on midrib and nerves; base cuneate to rounded, usually subpeltate; apex blunt to acuminate, acumen blunt or emarginate; nerves 4–12 pairs, straight to curved, either distinctly looped and joined or not, veins usually rather fine and dense, transverse to the midrib, sometimes, however, more coarse and reticulate, pseudo-secondary ones sometimes strongly developed. *Panicles* terminal and in the upper leaf-axils, broad, up to 35 cm long, minutely ferruginous- or fulvous-tomentose, many-flowered. Bracts minute. *Sepals* ovate or elliptic to oblong, blunt to acute, sometimes emarginate, 1³/₄–4 mm long, not or slightly keeled or prominently 3-nerved, outside rather densely appressed-pubescent or tomentose, inside nearly always glabrous. *Petals* lanceolate(-spathulate) to linear, 2¹/₂–7 mm long, blunt, outside glabrous except margins and apex, inside usually sparsely to rather densely glandular-pubescent. *Stamens* connate for ¹/₄–1¹/₂ mm, epipetalous ones fertile to minute and staminodial, at least the episepalous ones mainly in the upper part with some to many glandular hairs. *Fruits* oblique-pyriform to semi-ellipsoid, compressed (rarely bulging), 1¹/₂–3³/₄ by 1–2 cm, obliquely ¹/₄–1¹/₂ cm long stipitate, the beak distinct to inconspicuous, inserted near or at the apex, pericarp minutely ferruginous-pubescent, glabrescent, thin, inside glabrous to densely pubescent.

Distr. S. Indo-China, Siam, Burma, ? Andamans, *Malaysia* (the eastern half of Java and the Lesser Sunda Isl. excepted), also in Micronesia (Palau) and Melanesia (Solomon Isl.).

Ecol. In primary and secondary forests, especially in slightly more open parts, along forest edges and river-banks, in clearings, along the beach, also in thickets and alang-alang fields, both on dry and swampy soils, on granite and limestone, from sea-level up to 1100 m. *Fl.* mainly Jan.–May, *fr.* mainly April–July.

Uses. As the present species has obviously often been confused with some others, it is especially difficult to get trustworthy information about its uses. Even the field-labels give seemingly contradictionary information: one collector mentions the fruits as reputed for being poisonous, according to an other collector they are after boiling eaten as jam. According to RUMPHIUS in the Moluccas the young leaves are boiled and eaten as a legume. The wood is said to be tough.

Vern. *Akar kalat*, *a. tanduk*, *karubu*, *silatut*, *tangis kĕrĕ*, Sum., *akar aanda*, *a. puteh*, *a. suanai* (*putie*), Banka, *iop iip*, Siam, *akar kuaia*, *a. lĕpan*, *a. mĕmbur*, *a. mumbô*, *a. nyamok* (or *myamok*), *a. pulang dahing* (or *a. tulang daeng*), *a. tukor*, *bunga akar tupi-tupi*, *stanggih burrong*, *tanga burung*, Mal. Pen., *simbo krah*, Born., *camagsa*, *kamot*, *sandalino*, *tañgisan*, Philip., *kunit wawakas imbolay*, Cel., *kali-ja fua*, *ketahu*, Mol. (Sula Islands).

Notes. A very polymorphous species, as a whole best characterized by its fruits in combination with glabrous petals, locally sometimes also recognizable by vegetative characters. From *C. grandis* it can with certainty only be distinguished by its fruits and that is the reason that the synonyms *Erythrostigma diversifolia*, *Connarus wallichii*, and *Erythrostigma ellipticum* of which the fruits are unknown, are cited as dubious.

It was difficult to clear up the delimitation and, hence, the synonymy of the present species, especially in continental Asia. *C. latifolius* WALL. Bengal and Burma), which is intermediate between *C. semidecandrus* and *C. paniculatus*, may also be sunk into the former.

The species as accepted here contains a number of local races and forms for which it is difficult to give a reliable subdivision. The more important ones are the following:

α. The typical form is characterized by sterile (usually staminodial) epipetalous stamens, only slightly punctate sepals and slightly or not at all punctate petals, nerves which are usually distinctly looped and joined near the margin, and shortly stipitate, distinctly beaked fruits. Fig. 11h. This is the more common form, which is distributed in Burma and throughout W. Malaysia (not in the Philippines).

β. Different from α by its distinctly punctate sepals and petals, by the nerves, which are at least for the greater part not looped and joined, and by the less flattened fruits, which are very shortly stipitate and inconspicuously beaked. Fig. 11g. This form occurs in Indo-China, Siam, Sumatra, and the Malay Peninsula. In the Malaysian and the Siamese specimens of this form all the stamens are fertile, in the specimens from Indo-China the epipetalous ones are staminodial. In literature this form is best known as '*C. griffithii*', though the type of that name belongs to α. It has been described under several names from Indo-China. '*C. furfuraceus*' apparently represents an extreme form of β from Central Sumatra. Fig. 11d. It is mainly characterized by its long, cylindrical fruits (2¹/₂–3³/₄ by 1–1³/₄ cm), which are nearly straight.

γ. Closely related to β and described as *C. neurocalyx*. In its flowers (the stamens are always all fertile) and fruits it nearly fully agrees with '*C. griffithii auct.*'; the main difference is that in '*C. griffithii auct.*' the leaflets are minutely pubescent, mainly on midrib and nerves beneath, and the veins are very inconspicuous, in '*C. neurocalyx*' the leaves are fully glabrous, and the venation is distinct. '*C. neurocalyx*' is known from the Philippines, Celebes, and in a few specimens, which are intermediate between it and α, from Borneo.

'*C. neurocalyx*' itself apparently consists of two forms, the typical one with large fruits (2¹/₂–3 by 1¹/₂–2 cm) and a second one with smaller fruits (1¹/₂–2¹/₂ by 1–1¹/₂ cm); the former is known from east central Luzon (Prov. Pangasinan, Zambalas, Pampanga, and Bataan), the other one from Palawan, west central Luzon (Prov. Bataan, Bulacan, Rizal, Laguna, and Batangas), and Celebes.

'*C. balsahanensis*' represents part of the specimens from Palawan; they differ from the rest of '*C. neurocalyx*' by their rather big leaflets (19–25 by 6–8¹/₂ cm) with more nerves (10–12 pairs). They are small-fruited.

δ. This has been distinguished under the name *C. gaudichaudii*. In its vegetative parts it is not very different from γ. The flowers differ from those of '*C. neurocalyx*' and '*C. griffithii auct.*' only by the acute sepals which are blunt in both other forms. The main difference is shown by the fruits which are long-stipitate (³/₄–1¹/₂ cm as against up to ¹/₂ cm in the other forms) and distinctly beaked.

It is known from the Moluccas (Sula Islands, Buru, and Ambon), New Guinea (*incl.* the Aru Islands), the Solomon Islands (Radewu, New Georgia, and Choiseul), and Palau.

12. Connarus cochinchinensis (BAILL.) PIERRE, Fl. Coch. 5 (1898) t. 378 A; LECOMTE, Fl. Gén. I.–C. 2 (1908) 54, f. 7 a; CRAIB, Fl. Siam. En. 1 (1928) 362; SCHELLENB. Pfl. R. Heft 103 (1938) 265.—*Tricholobus cochinchinensis* BAILL. Adansonia 9 (1869) 150.—*C. attopoeuensis* PIERRE, Fl. Coch. 5 (1898) t. 377 C.

Liana or treelet. Branches thinly pubescent when young, lenticellate. *Leaves* (1–)2–3-jugate, glabrous; petiolules $\frac{1}{4}$–$\frac{1}{2}$ cm. *Leaflets* ovate or elliptic to oblong, $2\frac{1}{2}$–13 by ($1\frac{1}{2}$–)3–$7\frac{1}{2}$ cm, thin-coriaceous, minutely verrucose beneath; base rounded (to slightly cordate); apex slightly to distinctly tapering-acuminate, acumen short and broad (blunt or emarginate) to slender; nerves 5–7 pairs, oblique, nearly straight, curving towards the margin, not joined, inconspicuous, veins inconspicuous, mainly transverse, lax. *Inflorescences* dense, up to *c.* 10 by 4–5 cm, sparsely appressedly stiff-pilose. Bracts minute. *Sepals* lanceolate, acute, 3–4 by $\frac{3}{4}$–1 mm, convex, keeled, rather densely appressedly stiff-pilose outside, inside glabrous. *Petals* linear-spathulate, acute, 5–8 mm long, outside appressedly shaggy pilose, inside sparsely shortly pubescent, punctate. *Stamens* for 1 mm connate, epipetalous ones probably not always fertile, mainly the episepalous ones rather densely glandular-pubescent, especially in the upper part. *Fruits* oblique-ellipsoid, bulging, 2–$2\frac{1}{2}$ by $1\frac{1}{4}$–$1\frac{1}{2}$ cm, stalk $\frac{1}{2}$ cm long, beak apical; pericarp thin, outside glabrous, minutely oblique-wrinkled, inside densely pubescent.

Distr. SE. and S. Indo-China and Siam, in *Malaysia:* in the northern part of the Malay Peninsula.

Ecol. Shrub-jungle and forests, at low altitude. *Fl.* Jan.–Aug., *fr.* July, Sept., Dec.

Note. Apparently specially allied to *C. semidecandrus* ('*C. quocensis* PIERRE') and to *C. paniculatus.*

13. Connarus lamii LEENH. Blumea Suppl. 4 (1958) *in the press.*

Branches glabrous, minutely lenticellate. *Leaves* unifoliolate to 2-jugate, subglabrous; petiolules 4 mm long. *Leaflets* oblong-ovate (rarely ovate), 12–17 by 5–9 cm (terminal ones up to 20 by 9 cm), stiff-chartaceous, glabrous except for some scattered, short hairs on the lower side near the base; base rounded to cordate, usually distinctly subpeltate; apex tapering acuminate, acumen short, broad, and blunt; nerves 6–8 pairs, patent, curved, not distinctly joined, inconspicuous above; veins transverse to the midrib, dense, parallel, slender, nearly invisible above. *Inflorescences* interrupted-paniculate, 20–30 cm long, branches shortly and densely ferruginous-tomentose, rather many-flowered. Bracts minute. *Sepals* oblong-elliptic, *c.* 3 by 1 mm, acute, keeled towards the base, shortly sparsely tomentose on both sides. *Petals* oblong-obovate, 4–5 mm long, outside sparsely appressed-pubescent, inside densely glandular-tomentose. *Stamens* connate for $\frac{1}{3}$–$\frac{1}{2}$ mm, all fertile, filaments with some scattered glandular hairs. *Fruits* (not attached to the specimen) nearly semi-discoid, rather compressed, $1\frac{3}{4}$ by $1\frac{1}{2}$ by 1 cm, stipe slender, 3 mm long, beak acute, at $\frac{2}{3}$–$\frac{3}{4}$ of the height, pericarp thin, outside glabrous, striate and slightly granular, inside scattered shortly glandular-pubescent.

Distr. *Malaysia:* W. New Guinea (Mamberamo, once collected).

Ecol. Altitude 6 m. *Fl.* Oct.

Note. Probably specially related with *C. semidecandrus* ('*C. gaudichaudii*').

14. Connarus whitfordii MERR. Philip. J. Sc. 4 (1909) Bot. 123; En. Philip. 2 (1923) 238; SCHELLENB. Pfl. R. Heft 103 (1938) 266.—*C. mindanaensis* MERR. Philip. J. Sc. 4 (1909) Bot. 122; C. B. ROB. Philip. J. Sc. 6 (1911) Bot. 205; MERR. En. Philip. 2 (1923) 237; SCHELLENB. Pfl. R. Heft 103 (1938) 257.—*C. caudatus* MERR. Philip. J. Sc. 17 (1921) 261; En. Philip. 2 (1923) 237.—*C. oliganthus* ELM. Leafl. Philip. Bot. 10 (1939) 3718, *nom. illeg.*—**Fig. 14.**

Liana, up to 8 m by 2 cm, sometimes scandent shrub or treelet. Branches sparsely ferruginous-tomentose to glabrous. *Leaves* (1–)2–3-jugate, the petiole, rhachis, and petiolules with a few scattered hairs; petiolules 3–4 mm long. *Leaflets* ovate or elliptic to oblong, $2\frac{1}{2}$–11(–17) by $1\frac{1}{4}$–$5\frac{1}{2}$ cm, chartaceous, blackish-verrucose on both sides when dry, especially beneath (probably representing the internal glands), glabrous; base broadly cuneate to rounded; apex tapering caudate-acuminate, blunt; nerves (3–)4–5 pairs, ascending, strongly curved, not rarely distinctly looped and joined; veins laxly transverse-reticulate to transverse and rather dense. *Inflorescences c.* 20–40 cm long, densely ferruginous-tomentose, laxly to densely branched, branches up to 20 cm long, many-flowered. Bracts minute. *Sepals* elliptic, blunt, $2\frac{1}{2}$–3 by $1\frac{1}{4}$ mm, keeled, densely tomentose outside, inside glabrous. *Petals* lanceolate, blunt, $4\frac{1}{2}$–6 mm long, outside densely, inside in the upper half thinly tomentose, densely punctate. *Stamens* for $\frac{1}{2}$ mm connate, all fertile, episepalous filaments with a few glandular hairs. *Fruits* obovoid, slightly compressed, $2\frac{1}{2}$ by $1\frac{3}{4}$ cm, stipe $\frac{1}{4}$ cm, beak minute, lateral, usually inserted at about $\frac{2}{3}$ of the height, pericarp thin, outside diagonally striate, glabrous, inside sparsely to rather densely shortly pubescent.

Distr. *Malaysia:* E. Philippines (Luzon, Bucas Grande Isl., Polillo, Samar, Leyte, Biliran, and Mindanao).

Ecol. In and along primary and secondary forests, up to *c.* 750 m. *Fl.* Jan.–April (July, Sept.), *fr.* Oct.–Jan. (April, June).

Uses. Fluted stem used for tying.

Vern. *Kauang*, Mbo., *sapinib*, *uul*, C. Bis., *uñgali*, S. L. Bis.

Notes. I am not quite certain about the conspecificity of *C. mindanaensis*, which differs in a few vegetative characters (leaves more often 3-foliolate, nervation somewhat different); its flowers are too young for analysis, and fruits are lacking. In literature both species have already been confused. For instance SCHELLENBERG, *l.c.* 1938, cited a few specimens under both species (and part of the other specimens, cited by him under *C. mindanaensis*, belong to *C. winkleri*), and the greater part of the specimens, cited by MERRILL, *l.c.* 1923, under *C. mindanaensis*, certainly represent *C. whitfordii.*

The identification of specimens of this species is very difficult. Flowering material differs distinctly from *C. semidecandrus* by the densely pubescent

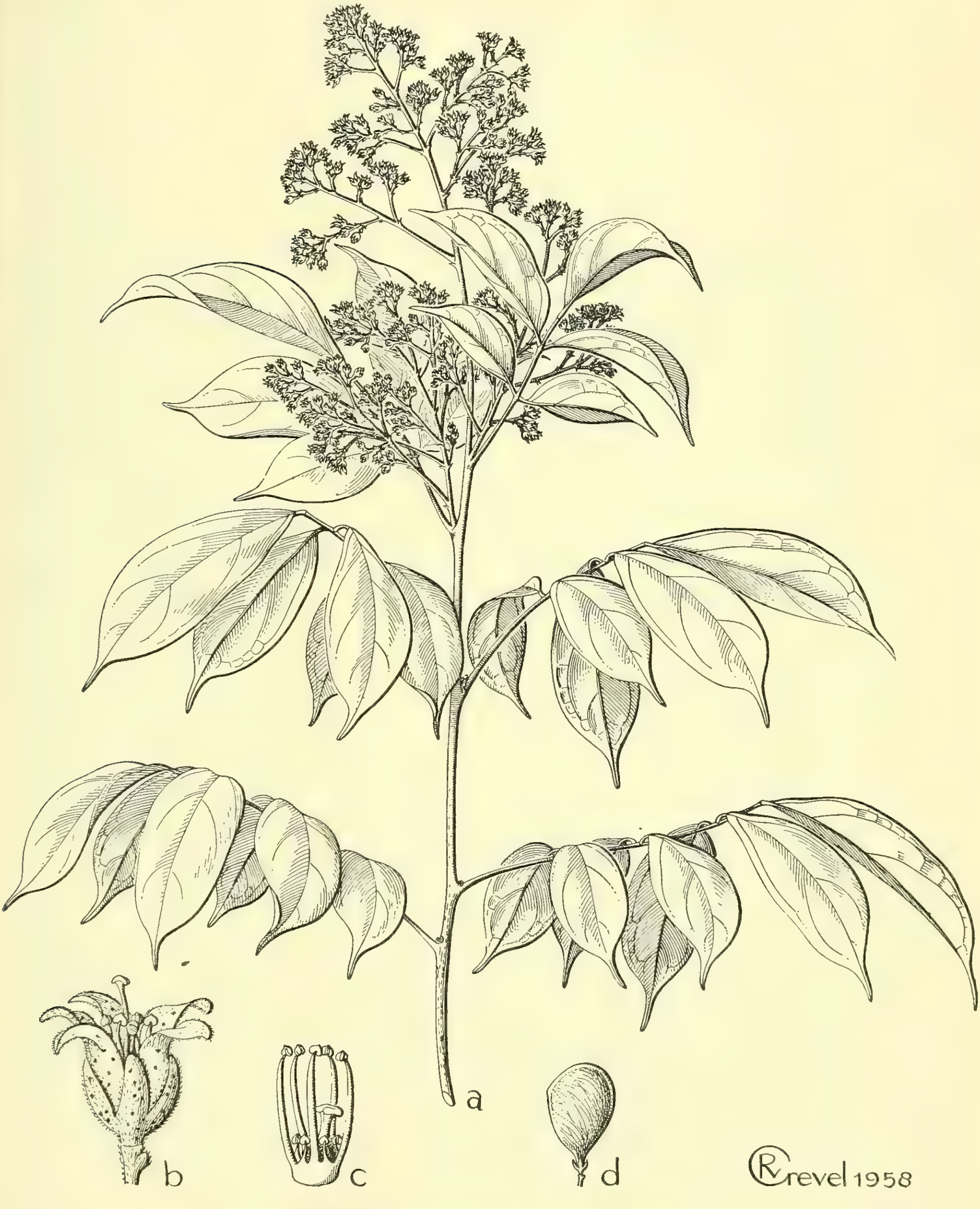


Fig. 14. *Connarus whitfordii* MERR. *a.* Flowering twig, × 1/2, *b.* long-styled flower, × 5, *c.* stamens and pistil of short-styled flower, × 5, *d.* fruit, × 3/4 (*a* PNH 2628, *b* PNH 21536, *c–d* PNH 14354).

petals, but is nearly indistinguishable from *C. monocarpus*. The fruits, on the other hand, are distinctly different from those of *C. monocarpus*, but indistinguishable from those of *C. semidecandrus*. Fruiting specimens, in which some petals are left at the base of the fruits, allow trustworthy identification. The caudate-acuminate leaflets are characteristic, but not conclusive.

15. Connarus monocarpus LINNÉ, Sp. Pl. (1753) 675; SCHELLENB. Pfl. R. Heft 103 (1938) 284, f. 47; *non* F.-VILL. Nov. App. (1880) 57 = *Rourea minor*.

ssp. **malayensis** LEENH., *nov. subsp.* (typified by *C. falcatus* BL.)—*Cnestis pentaphylla* SPANOGHE, Linnaea 15 (1841) 189; Walp. Rep. 1 (1842) 561. —*C. oligophyllus* WALL. *ex* PLANCH. Linnaea 23 (1850) 427; Walp. Ann. 2 (1851) 300; MIQ. Fl. Ind. Bat. 1, 2 (1859) 665; HOOK. *f.* Fl. Br. Ind. 2 (1876) 53; KING, J. As. Soc. Beng. 66, ii (1897) 5; RIDL. Fl. Mal. Pen. 1 (1922) 546, *incl. var. maingayi;* CRAIB, Fl. Siam. En. 1 (1928) 364; BURK. Dict. 1 (1935) 649; SCHELLENB. Pfl. R. Heft 103 (1938) 231, f. 43 A.—*C. falcatus* BL. Mus. Bot. 1 (1850) 266; Walp. Ann. 2 (1851) 301; MIQ. Fl. Ind. Bat. 1, 2 (1859) 663; BURCK, Ann. Jard. Bot. Btzg 6 (1887) 252; BACK. Schoolfl. (1911) 288; KOORD. Exk. Fl. Java 2 (1912) 339; SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 33; Pfl. R. Heft 103 (1938) 235, f. 43 B; BAKH. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 3.—*C. hasseltii* BL. Mus. Bot. 1 (1850) 266; Walp. Ann. 2 (1851) 301; MIQ. Fl. Ind. Bat.1, 2 (1859) 662; BACK. Schoolfl. (1911) 288; KOORD. Exk. Fl. Java 2 (1912) 339; SCHELLENB. Pfl. R. Heft 103 (1938) 234; BAKH. *f.* in Back. Bekn. Fl. Java (em. ed.) 7A (1948) fam. 154, 3.—*C. spanoghei* BL. Mus. Bot. 1 (1850) 267, *nom. illeg.;* MIQ. Fl. Ind. Bat. 1, 2 (1859) 663.—*C. maingayi* HOOK. *f.* Fl. Br. Ind. 2 (1876) 53; KING, J. As. Soc. Beng. 66, ii (1897) 3; SCHELLENB. Candollea 2 (1925) 100.—*C. hallieri* MERR. Philip. J. Sc. 4 (1909) Bot. 122; En. Philip. 2 (1923) 237; SCHELLENB. Pfl. R. Heft 103 (1938) 233.—*C. fragrans* ELM. Leafl. Philip. Bot. 4 (1912) 1507; SCHELLENB. Pfl. R. Heft 103 (1938) 233, *excl. syn. C. oliganthus* ELM.—*C. carnosus* ELM. Leafl. Philip. Bot. 4 (1912) 1508; SCHELLENB. Pfl. R. Heft 103 (1938) 235.—*C. palawanensis* ELM. Leafl. Philip. Bot. 5 (1913) 1763; MERR. En. Philip. 2 (1923) 238; SCHELLENB. Pfl. R. Heft 103 (1938) 274.—*C. densiflorus* MERR. Philip. J. Sc. 13 (1918) Bot. 70; SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 39; MERR. Pl. Elm. Born. (1929) 95.—*C. celebicus* SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 34; Pfl. R. Heft 103 (1938) 233. —*C. pentaphyllus* SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 34; Pfl. R. Heft 103 (1938) 234. —*C. strictinervis* SCHELLENB. Candollea 2 (1925) 100; Pfl. R. Heft 103 (1938) 265.—**Fig. 11f.**

Liana, up to 25(–40) m by 15 cm, sometimes a shrub or small tree. Branches glabrous, often lenticellate. *Leaves* (1–)2–4-jugate, glabrous; petiolules 1/2 cm. *Leaflets* ovate-elliptic to lanceolate, 4–14 by 2 1/2–7 cm, chartaceous to coriaceous; base cuneate or rounded to subcordate, sometimes subpeltate, in lateral ones sometimes slightly oblique; apex shortly to caudate acuminate; nerves rather inconspicuous, 3–8 pairs, patent or ascending, curved, more or less distinctly looped and joined; veins mainly transverse to the midrib, rather dense; reticulations tessellate. *Inflorescences* up to *c.* 15 cm long, shortly and densely tomentose, widely and laxly branched and with rather many flowers. Bracts minute. *Sepals* ovate, acute, 2–3 by 1 1/4–1 1/2 mm, usually distinctly keeled, outside densely pubescent, inside glabrous. *Petals* lanceolate to linear, 6–10 mm long, blunt, on both sides rather densely minutely tomentose, punctate. *Stamens* 1–1 1/2 mm connate, either all fertile or the epipetalous ones sterile, all filaments with few scattered glandular hairs. *Fruits* obliquely (sometimes even rather strongly curved) spindle-shaped to oblique-ellipsoid, in the latter case distinctly shortly stipitate, *c.* 3–5 by 1–2 cm, bright-yellow to orange, beak usually acute, apical, pericarp thin, coriaceous, outside rather smooth, minutely lengthwise striate, inside densely pubescent.

Distr. *Malaysia:* throughout, the Moluccas and New Guinea excepted, reported from the Nicobars by KURZ.

A second subspecies *monocarpus* in Ceylon and the W. Deccan.

Ecol. In dense as well as open, primary and secondary forests, in clearings, along forest-edges and river-banks, and on rocks near the sea-shore, both on dry and on swampy soil, even in marshes, often reported from limestone, up to 600 m. *Fl.* Jan.-May, *fr.* mainly Sept.–April.

Uses. Stems and branches are used for tying purposes. A decoction of the bark is drunk for stomach-ache; the pounded root should be used for poulticing for itch.

Vern. *Feu feuw*, Sum., *akar kunjal*, Banka, *akar tulang daeng*, *kahyu sadin*, *lĕlĕmak*, *mĕrĕnsa*, *satik*, Mal. Pen., *chamba än*, *gadel laut*, *kitjarang aroy*, S., *buah sunsung*, *tangi balu*, *tuba raung*, Born.; Philippines: *bago-bago*, P. Bis., *oñgali*, S. L. Bis.; *kunet wawakas im bolai*, Cel.

Notes. This subspecies is best characterized by its rather stiff leaflets with slender, ascending nerves and rather inconspicuous venation, and by its usually spindle-shaped fruits. Apart from the most common form, which is distributed throughout western Malaysia, two other forms are more or less distinguishable:

α. Leaflets relatively broad, thick-coriaceous. Malay Peninsula ('*C. maingayi*').

β. Mainly characterized by its oblique-ellipsoid, slenderly stipitate fruits with rather thick, woody pericarp. Typical specimens are only known from Timor ('*C. pentaphyllus*'). What has been referred to as '*C. celebicus*' is a series of intergrades between this form and the common W. Malaysian one.

Ssp. monocarpus from Ceylon and the W. Deccan differs from *ssp. malayensis* mainly by the following characters: fruits inside glabrous; sepals relatively long (3–3 1/2 mm, in *malayensis* rarely more than 2 mm); venation more reticulate, less dense, not conspicuously tessellate; young parts ferruginous-tomentose.

An authentic specimen of HERMANN from Ceylon, exactly fitting the description is preserved in the Leyden Herbarium.

C. monocarpus seems to be allied with *C. africanus* LAMK from W. Africa, and in Malaysia with *C. winkleri* and *C. lucens*.

16. Connarus lucens SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 36; Pfl. R. Heft 103 (1938) 253.—**Fig. 15.**

Branches glabrous. *Leaves* (2–)3–4-jugate, glabrous; petiolules $^1/_2$ cm. *Leaflets* oblong-ovate to oblong-lanceolate, 7–15 by $2^1/_2$–5 cm, stiff-chartaceous; base rounded; apex tapering blunt-acuminate; nerves 6–8 pairs, patent, curved, indistinctly joined near the margin, rather inconspicuous; veins transverse to the midrib, rather lax, nearly invisible above. *Inflorescences* up to *c.* 25 cm long, widely branched, thinly tomentose, the branches itself narrowly paniculate. Bracts minute. *Sepals* $1^1/_2$ by $^3/_4$ mm, ovate, acute, outside rather densely, inside more thinly tomentose. *Petals* linear, 5–6 mm long, outside rather densely tomentose, except at the base, inside thinly pubescent, punctate. *Stamens* for $^1/_2$ mm connate, epipetalous ones probably sterile, all filaments rather densely glandular-pubescent. *Fruits* trapezoid to oblique-ellipsoid, 4 by 2 cm, moderately flattened, not stipitate, beak minute, acute, apical; pericarp $1^1/_2$–2 mm thick, woody, outside minutely wrinkled, glabrous, inside glabrous.

Distr. *Malaysia:* Borneo (Sarawak: Sarebas region).

Ecol. *Fl.* July, *fr.* April, July.

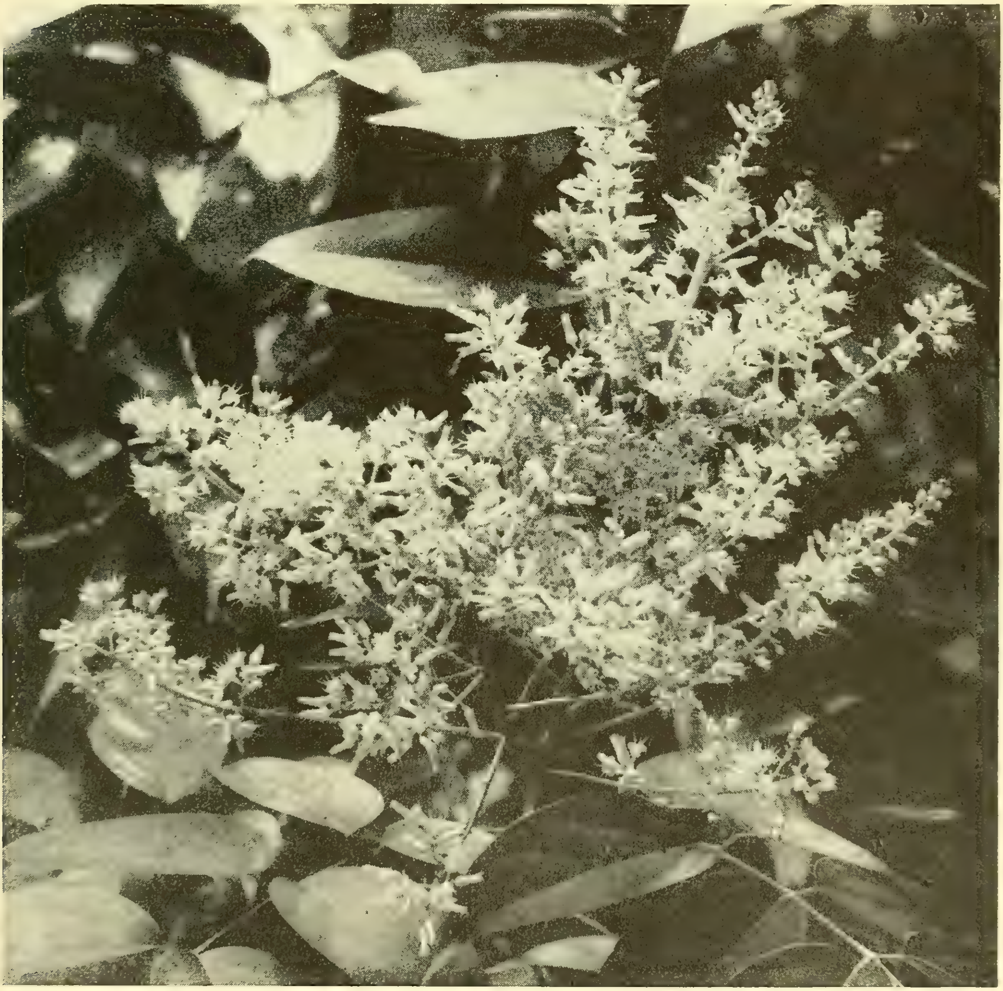


Fig. 15. *Connarus lucens* SCHELLENB. Inflorescence in anthesis. Cult. Hort. Bog. (XVII. F. 30), Nov. 1957. This plant is the source of the type specimen.

Note. Probably nearest related to *C. monocarpus* (*'pentaphyllus'*) and possibly also to *C. winkleri.*

17. Connarus winkleri SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 38; Pfl. R. Heft 103 (1938) 256, f. 45 D.—**Fig. 11c.**

Liana, 25 m high, sometimes creeping shrub or small tree. Branches glabrous. *Leaves* 2–3-jugate, glabrous; petiolules 1/2 cm. *Leaflets* ovate to elliptic or oblong, 7–17 by 3–7 cm, thin-chartaceous to thin-coriaceous; base broadly cuneate to rounded, rarely acute, in lateral ones often slightly oblique; apex acuminate; nerves 6–8 pairs, patent, rather strongly curved, usually distinctly looped and joined, veins (transverse-) reticulate. *Inflorescences* up to *c.* 25 cm long, rather laxly branched, branches rather long, ascending, subspicate, glabrous the tips excepted. Bracts minute. *Sepals* ovate, blunt or acute, 2¼–3½ by 1–1½ mm, faintly keeled, on both sides variously pubescent. *Petals* ovate-lanceolate, 8½–9½ mm long, blunt, tomentose on both sides, punctate. *Stamens* for 1½ mm connate, apparently all fertile, long filaments more or less densely glandular-pubescent, short ones either sparsely so or glabrous. *Fruits* ellipsoid, more or less bulging, 2–3½ by 1½–2½ cm, stipe ¼–1 cm long, beak minute, acute, at or near the apex; pericarp thin-coriaceous to woody, outside laxly obliquely veined, on both surfaces glabrous.

Distr. *Malaysia:* N. & E. Borneo, SE. Philippines (Leyte, Mindanao, Basilan).

Ecol. In forests at low altitude.

Note. As far as can be judged from the diagnosis and a photograph of the type specimen, *C. pachyphyllus* MERR. (Philip. J. Sc. 13, 1918, Bot. 71) may also be closely related to the present species. Apparently it mainly differs by the following characters: leaves 3-foliolate, leaflets thick-coriaceous, petiolules rather long, nerves about 9 pairs.

ssp. **winkleri.**

Branches black. Leaflets thin-chartaceous; apex shortly acuminate, blunt; reticulations lax. Inflorescences lax. Fruits relatively large, much swollen, stipe ½–1 cm long, pericarp thin-coriaceous, outside coarsely veined.

Distr. Borneo.

ssp. **philippinensis** LEENH. Blumea Suppl. 4 (1958) *in the press.*

Branches light-grey. Leaflets thin-chartaceous to coriaceous; apex caudate-acuminate, acute or blunt; reticulations dense. Inflorescences more dense and many-flowered. Fruits up to 2½ by 2¼ cm, less swollen, stipe *c.* ¼ cm long, pericarp *c.* 1 mm thick, woody, outside minutely wrinkled.

Distr. Philippines.

Vern. *Amoñgali, uñgañgo,* Basilan.

Note. The position of this latter subspecies remains somewhat dubious. SCHELLENBERG cited two specimens, which I refer to this subspecies, under *C. mindanaensis,* to which it doubtless shows some resemblance. It shows also resemblance to *C. monocarpus* (*'pentaphyllus'*).

18. Connarus schumannianus GILG in K. Sch. & Laut. Fl. Schutzgeb. (1900) 341; SCHELLENB. Pfl. R. Heft 103 (1938) 253.—**Fig. 11j.**

Scandent shrub to large liana, sometimes a small tree. Branches subglabrous. *Leaves* uni- or 3-foliolate (to 2-jugate), glabrous; petiolules ½–¾ cm. *Leaflets* oblong to elliptic, 8–17 by 4–8 cm, chartaceous; base rounded, subpeltate; apex rounded or blunt-acuminate; nerves 5–7 pairs, patent, slightly curved, not distinctly joined; veins laxly reticulate, mainly transverse. *Inflorescences* up to 40 cm long, thinly and minutely pubescent, branches rather short, poorly branched, ultimate branchlets subspicate with the flowers crowded near their apex. Bracts minute. *Sepals* oblong-lanceolate, blunt to acute, 2½–3 by 1 mm, outside densely tomentose, inside sparsely pubescent. *Petals* linear-spathulate, 7 mm long, outside in the basal half sparsely tomentose, inside glandular-pubescent, densely punctate. *Stamens* for ¾ mm connate, epipetalous ones probably sterile, glabrous, long filaments sometimes glandular-pubescent towards the tip. *Fruits* curved to falcate, flattened, 2½–3½ by 2–2¾ cm, gradually narrowed at base into an up to 1 cm long stipe, beak acute, terminal; pericarp thin, outside minutely striate, verruculose, on both surfaces sparsely pubescent.

Distr. *Malaysia:* E. New Guinea (Sepik River, Cape Vogel Peninsula) and Louisiades (Misima & Rossel Isl.).

Ecol. In and along rain-forests, sometimes on limestone, from sea-level up to 80 m. *Fl.* April, July, Oct., *fr.* April, July–Oct.

Note. In its leaves resembling *C. salomoniensis,* best characterized by its more or less falcate fruits.

19. Connarus salomoniensis SCHELLENB. Pfl. R. Heft 103 (1938) 260.—**Fig. 11b.**

Large liana or small tree (up to 12 m). Branches glabrous. *Leaves* (1–)2-jugate, glabrous; petiolules 3–6 mm. *Leaflets* ovate to elliptic-oblong, 8–22 by 4–11 cm, thin-coriaceous to chartaceous; base rounded, sometimes subpeltate; apex acute; nerves 6–8 pairs, patent, slightly curved, not distinctly joined; veins transverse, spaced. *Inflorescences c.* 20–25 cm long, the uppermost parts minutely ferruginous-tomentose, broadly paniculate, many-flowered. Bracts deltoid, minute. *Sepals* oblong, 2¼ by 1 mm, blunt, outside rather densely minutely tomentose, inside sparsely pubescent. *Petals* obovate, 2½ by 1½ mm, slightly ciliate at the apex, further glabrous, sparsely punctate. *Stamens* for ½ mm connate, epipetalous ones staminodial, glabrous except for some glandular hairs on top of the reduced anther, long filaments with some glandular hairs in the apical half. *Fruits* semi-ellipsoid, nearly straight, slightly flattened, 3½–5 by 2–3 cm, stipe up to ½ cm long, beak minute, inserted slightly below the apex; pericarp woody, 1–1½ mm thick, outside smooth, faintly lenghtwise striate, glabrous, inside sparsely pubescent to glabrous.

Distr. Solomon Islands (Bougainville, New Georgia, and Malaita) and *Malaysia:* New Guinea (Gulf Distr.) and New Britain.

Ecol. In rain-forests up to 800 m and along the coast on mud flats subject to tidal inundation. *Fl.* Jan., *fr.* Jan., March, July-Aug.

Uses. In the Solomon Islands the seeds are chewed as a substitute for betel nuts.

Notes. The present species is doubtless related to *C. schumannianus* from New Guinea and to *C. pickeringii* A. GRAY from Fiji. From the former species it is distinctly different in its flowers and fruits, but hardly so in the leaves. *C. pickeringii* mainly differs by the woolly pubescence of its young parts, inflorescences, and flowers, by longer flowers (*c.* 7 mm), and smaller more or less tomentose fruits (*c.* 3 by 2 cm).

It is not impossible that *C. salomoniensis* will prove to be conspecific with and has to be reduced to *C. peekelii* described from New Ireland. I saw some loose fruits of one of the syntypes from the Wroclaw Herbarium and they agree very well with those of *C. salomoniensis.* According to the description *C. peekelii* differs, however, by its long, cylindrical bracts and long petals pubescent outside. For this reason I have provisionally incorporated it under the dubious species.

Dubious species

Of the following species I did either see no material or the material was insufficient.

Connarus pachyphyllus MERR. Philip. J. Sc. 13 (1918) Bot. 71; SCHELLENB. Bot. Jahrb. 59 (1924) Beibl. *no* 131, p. 40; Pfl. R. Heft 103 (1938) 282.

See notes under *C. winkleri.*

Distr. *Malaysia:* Borneo (Sarawak).

Vern. *Bua tumut.*

Connarus peekelii SCHELLENB. Bot. Jahrb. 58 (1923) 180; Pfl. R. Heft 103 (1938) 262.

See notes under *C. salomoniensis.*

Distr. *Malaysia:* New Ireland.

Connarus subfoveolatus MERR. Philip. J. Sc. 13 (1918) Bot. 15; En. Philip. 2 (1923) 238; SCHELLENB. Pfl. R. Heft 103 (1938) 278.

Scandent shrub, *c.* 6 m high. Branches lenticellate, sparingly pubescent when young. *Leaves* trifoliolate, glabrous; petiolules 3–5 mm long. *Leaflets* ovate to elliptic, 9–13 by $4^1/_2$–7 cm, stiff-chartaceous; base rounded, slightly peltate; apex rather abruptly acuminate, acumen 8–12 mm long, blunt; midrib grooved above, nerves 3–4 pairs, strongly ascending, curved, looped and more or less distinctly joined; veins and veinlets together minutely tessellate-reticulate. *Inflorescences* up to 12 cm long, rather lax, densely minutely ferruginous-tomentose. *Sepals* oblong, blunt, 2 mm long, pubescent. *Petals* lanceolate, blunt, 3–$3^1/_2$ mm long, glabrous, densely punctate. *Stamens* slightly connate, epipetalous ones staminodial, all filaments glabrous. *Fruits* unknown.

Distr. *Malaysia:* Philippines (Luzon).

Ecol. In damp forests at medium alt. *Fl.* May.

Note. Possibly a good species, probably related to *C. semidecandrus.*

Excluded

Connarus foetens BLANCO, Fl. Filip. (1837) 525 = *Murraya paniculata* (L.) JACK (*Rut.*).

Connarus lucidus JACK, Mal. Misc. 2, *no* 7 (1822) 41; Hook. Comp. 1 (1835) 150; Walp. Rep. 1 (1842) 561; MIQ. Fl. Ind. Bat. 1, 2 (1859) 666; (*non?*) Sum. (1861) 530; SCHELLENB. Pfl. R. Heft 103 (1938) 112; MERR. J. Arn. Arb. 33 (1952) 221.

If this species really belongs to the *Connaraceae* it might be synonymous with *Roureopsis emarginata* (see there and SCHELLENBERG, *l.c.*). In my opinion it is also possible that it belongs to some other family, for instance *Leguminosae.*

Connarus santaloides (*non* VAHL) BLANCO, Fl. Filip. ed. 2 (1845) 366; ed. 3, 2 (1878) 314, t. 155 = *Murraya paniculata* (L.) JACK (*Rut.*).

Excluded

Eurycoma JACK, Mal. Misc. 2, *no* 7 (1822) 44, originally described in the *Connaraceae*, is generally referred to the *Simaroubaceae.*

Nothocnestis MIQ. Sum. (1861) 530, originally described in the *Connaraceae*, has been reduced to *Kurrimia* = *Bhesa* (*Celastr.*).

ERYTHROXYLACEAE (J. P. D. W. Payens, Leyden)

1. ERYTHROXYLUM

P. BROWNE, Hist. Jamaica 1 (1756) 278; LINNÉ, Syst. Nat. ed. 10, 2 (1759) 1035 (*Erythroxylon*); O. E. SCHULZ, Pfl. R. Heft 29 (1907); E. & P. Pfl. Fam. ed. 2, 19a (1931) 130.—**Fig. 1–4.**

Shrubs or trees. Youngest branchlets compressed, older branches terete; base of the lateral twigs often provided with small distichous 'bracts' (*ramenta*) sometimes also occurring between the leaves. *Leaves* simple, alternate (distichous), entire, involute in bud, the margins leaving a more or less permanent trace as 2 longitudinal lines on the upper leaf surface ('areolate'). Stipules mostly entirely connate, rarely bifid, intrapetiolar, often bicarinate, sometimes emarginate or 2-toothed at the apex, long-persistent or early caducous, inserted ± semi-amplexicaulous and leaving a distinct, mostly oblique scar. *Flowers* axillary, solitary or in clusters, often dimorphous, or even 3–4-morphous, 5-merous, actinomorphic, bisexual. Pedicels more or less thickened, often only under the calyx, provided with 2 bracteoles at the base. *Calyx* persistent, campanulate, (in Mal.) ± halfway divided into 5 lobes imbricate in bud. *Petals* 5, free, caducous, alternating with the calyx lobes, quincuncial in bud, nearly always provided with an emarginate or 3-lobed ligule inserted on the apex of the claw of the petal. *Stamens* 10, in two whorls of 5, persistent; filaments towards the base connate into a staminal tube often with a toothed margin; anthers ellipsoid, basifixed, cordate at the base, 2-celled, opening lengthwise. latrorse. *Ovary* (1–)3-celled, each cell with 1 ovule, normally only 1 cell fertile, but the other empty cells sometimes distinctly enlarged in fruit; styles 3, erect, free or partly connate or stigmas ± sessile; stigmas flattened (often oblique) or (in extra-Mal. *spp.*) clavate, blunt or rarely acute. Ovules pendulous, anatropous, with a ventral raphe. *Fruit* a drupe. *Seed* with or without endosperm; embryo oblong, erect; cotyledons flat to plano-convex; no plumule, but a distinct radicle.

Distr. The *Erythroxylaceae* comprise three exclusively tropical genera. *Aneulophus* BENTH. is monotypic and restricted to West Africa. *Nectaropetalum* BENTH. (*Peglera* BOLUS) has a few species in SE. Africa (*cf.* STAPF, Kew Bull. 1909, 188).

Erythroxylum occurs throughout the tropical regions of the world, distinctly centering, both to sections and species, in South America where 9 sections out of 19 are represented.

About 200 *spp.* have been distinguished in the genus, but the number of good species will possibly be less. Africa is poor in species, Madagascar relatively rich, Asia, Malaysia, and Queensland poor; in the Pacific obviously only represented in Melanesia (Solomons and New Caledonia) and not reported from Fiji, Samoa, or Micronesia.

All Malaysian *spp.* belong to the *sect. Coelocarpus*, which includes also Australian and African *spp.* Two South American *spp.* of *sect. Archerythroxylum* are cultivated in Java.

Ecol. The Malaysian *spp.* are confined to the substage of the primary rain-forest up to *c.* 1600 m, obviously avoiding areas subject to a dry season; of *E. cuneatum* only two specimens have been collected in the seasonal area of the Lesser Sunda Islands, *viz* on an islet of the Kangean group and on Sumbawa. In Africa and Australia some xerophytic species are known under arid climatic conditions.

E. cuneatum is often found in the coastal forest along the beach or behind the mangrove as a small tree.

Galls. Among New Guinean material of *E. ecarinatum* an undescribed flower gall was found in which the pedicels are swollen into globular galls with a lignified wall.

Morph. The *ramenta* occurring in certain species represent stipules of leaves with early arrested development; the rudimentary leaf blade is sometimes present as a minute thick awn concealed in the dorsal groove between the 2 nerves of the ramentum. In most species ramenta occur in great number and are closely set at the base of the lateral twigs, but they may also be found between the leaves higher up the twig; naturally they are alternate. In certain cases they may bear flowers. In Malaysia clearly developed ramenta are only found in *E. coca.*

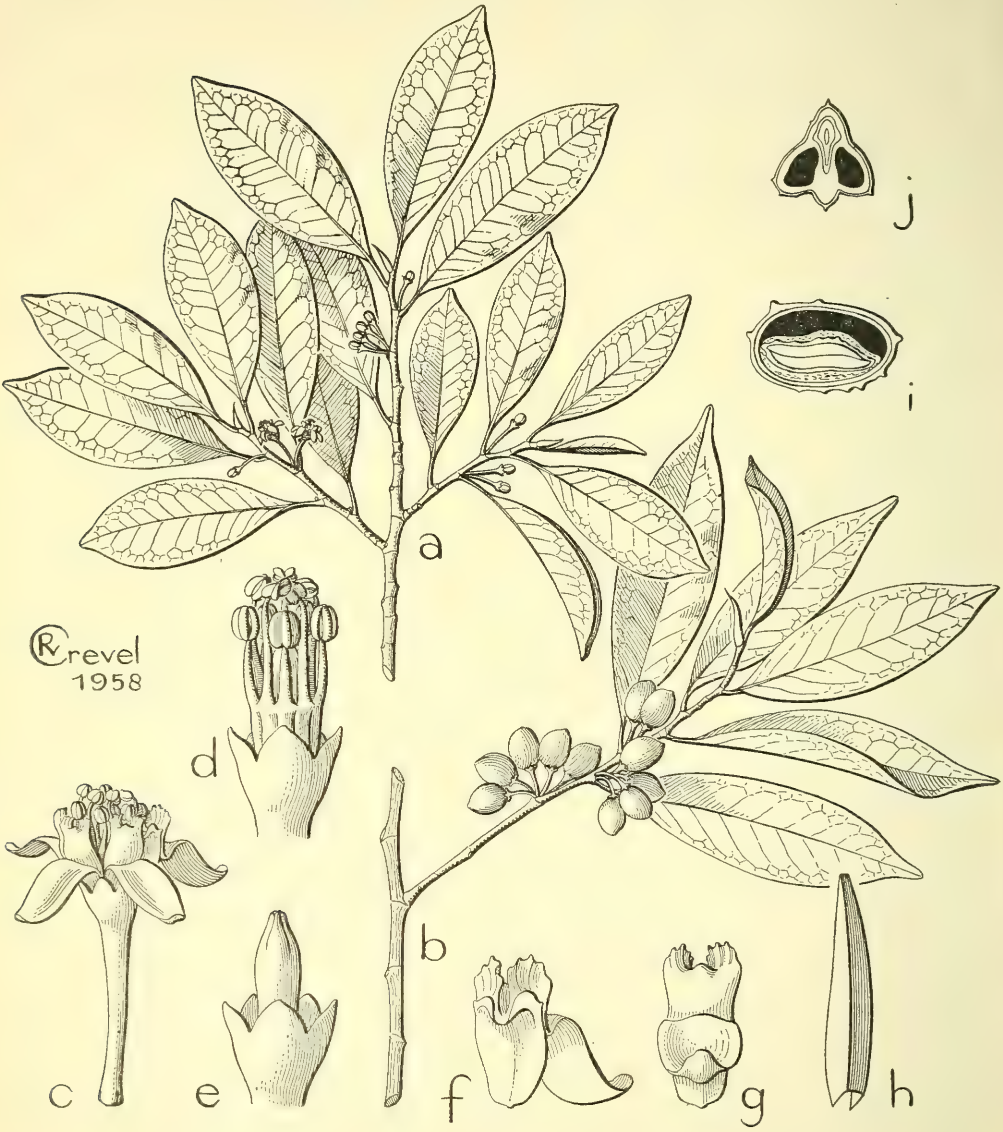


Fig. 1. *Erythroxylum ecarinatum* BURCK. *a.* Flowering twig, × $^2/_3$, *b. ditto* fruiting, × $^2/_3$, *c.* flower, × 4, *d. ditto*, petals removed, × 7, *e.* calyx and gynoecium, × 7, *f–g.* petal, lateral and dorsal, × 7, *h.* stipule with flattened dorsal, 2-nerved face, × 7, *i.* the 1-celled fruit in cross-section, the seed shrunk, × 3.—*Erythroxylum cuneatum* (MIQ.) KURZ. *j.* The 3-celled fruit in cross section, 2 lateral cells empty, × 3 (*a, c–h* BRASS 28561, *b, i* BRASS 7679, *j* HOCHREUTINER 78).

Several species possess dimorphous flowers: *brachystylous* (short-styled) and *dolichostylous* (long-styled). See fig. 4. *E. cuneatum* (MIQ.) KURZ possesses even four types of flowers.

In brachystylous flowers the stamens are either all equal in size and shape (*E. cuneatum*) or unequal ('*E. densinerve*'). In dolichostylous flowers the stamens are sometimes all equal, but in other specimens 5 stamens are short and 5 are long. In the case of unequal stamens the anthers of the shorter filaments are always larger than those on the longer filaments. The heteromorphism is specific but each specimen has one type of flowers and is either brachystylous or dolichostylous.

BURCK has described the details of the remarkable heterostylism in *Erythroxylum* (Ned. Kruidk. Arch. 6, 1895, 254–262, in Dutch). He observed abundant fruiting in *E. novogranatense* of which only dolichostylous flowers occurred in Java; the same phenomenon was found in *E. coca* (*l.c.* p. 261–262).

Also from the restricted geographical distribution pattern of brachystylous and dolichostylous flowers in Malaysia I conclude that the genetics of this character are not random.

Wood-anat. DESCH, Mal. For. Rec. 15^1 (1941) 155 (hand lens). HEIMSCH, Lilloa 8 (1942) 100; METCALFE & CHALK, 1 (1950) 273; NORMAND, Atlas des Bois de la Cote d'Ivoire 1 (1950) 145; RECORD & HESS, Timbers of the New World, Yale Univ., New Haven (1947) 149.—HEIMSCH considers, that the wood anatomy suggests close affinity with the *Linaceae*, but that the two families are distinct.—C.A.R.-G.

Dispersal. In all probability the drupes will be dispersed by animals, though the empty, air-filled cavities of the sterile cells might be advantageous for providing buoyancy capacity in waterborne dispersal. The habitat, however, does not indicate that this potentiality is effective in nature. From the experiments with the cultivated *spp.* it appears that the germination capacity is rapidly lost.

Uses. *E. coca* LAMK and *E. novogranatense* (MORRIS) HIERON. are very important because of the high content in valuable alkaloids found in their leaves. Cocaine is used nowadays medicinally throughout the world as a stimulant and as an anaesthetic, specially in eye-surgery.

In Malaysia only *E. novogranatense* is grown for coca. In trade it is generally known as 'Java coca' or 'Truxillo coca'.

E. cuneatum (MIQ.) KURZ furnishes a hard and durable, pink-coloured timber, which is through its often small dimension and quantity of minor importance.

Taxon. The *Erythroxylaceae* have in the past been incorporated in several families. At first A. L. DE JUSSIEU tentatively referred the genus *Erythroxylum* to the *Malpighiaceae* (Gen. Pl. 1789, 281).

In 1821 KUNTH described it as representing a separate family, including the genera *Erythroxylum* and *Sethia;* the latter genus contained one Indian species, *S. indica* DC. = *E. monogynum* ROXB. (in H.B.K. Nov. Gen. 5, 1821), now recognized as the single representative of *sect. Sethia.*

In 1862 BENTHAM incorporated the genera *Erythroxylum*, *Aneulophus* (and *Hebepetalum*, which is retained in *Linaceae*) in the *Linaceae* as a separate tribe (in B. & H. Gen. Pl. 1, 1862, 244); he was followed by BAILLON and later still by SOLEREDER (Syst. Anat. Dikot. 1899).

In 1878 EICHLER (Blütendiagr.) and PEYRITSCH (in Fl. Bras. 12, 1) re-established the *Erythroxylaceae* definitely as a distinct family, a point of view retained to the present day.

Several authors recognize the close affinity to the *Linaceae* and this is obviously sustained by the wood-anatomy according to HEIMISCH (Lilloa 8, 1942, 100), though he admitted that the differences should be given family rank: *Erythroxylaceae* lack scalariform vessel perforations and have more uniform ray types.

HUTCHINSON revived JUSSIEU's opinion and accepted a close affinity with the *Malpighiaceae*, arranging them with the *Humiriaceae* in the *Malpighiales* (Fam. Fl. Pl. 1926) instead of with the *Linaceae* in the *Geraniales.*

ERDTMAN stated that palynologically *Erythroxylaceae* are more or less closely related to the *Linaceae* (except the genus *Nectaropetalum*), the *Malpighiaceae*, and the *Trigoniaceae*, without giving further preference.

The genus *Erythroxylum* is very homogeneous and it has not been possible to distinguish subgenera within it. O. E. SCHULZ (1907, *l.c.*) has subdivided it into 19 different sections.

P. BROWNE (1756) attributed two unnamed species to the genus, one of which was named by LINNAEUS in 1759 *E. areolatum* L. (Syst. Nat. ed. 10, p. 1035). This is therefore the type species of the genus. Consequently *sect. Heterogyne* O. E. SCHULZ (1907, *l.c.*, p. 63) becomes the type section *Erythroxylum.*

SCHULZ distinguished the sections primarily on characters of the stipule which he considered, through its constancy, as the most important one from the taxonomical point of view. He found great difficulty in the distinction of the species caused by the variable morphology of the flowers and the plasticity of the foliage. It appears that his keys to both sections and species contain many 'feeble' places as for instance between his sections 7 to 11, where all characters mentioned are a matter of (mostly overlapping) quantity rather than of quality. Consequently, the sections represent rather natural but grading groups of allied species of certain geographical areas than sharply defined taxa. It seems rather strange that *E. ecarinatum* is inserted without comment in *sect. Coelocarpus* though it differs in a set of important characters from the other *spp.* of this section by its sessile stigmas, the structure of the exalbuminous embryo, and the remarkable fact that the ovary is 1-celled without vestiges of other cells.

My impression is that with the abundant material collected posterior to SCHULZ's monograph, it has appeared that many species have become connected by intergrades and consequently must be united.

KEY TO THE SPECIES

1. Stipules persistent. Styles free. Sterile cells of the drupe inconspicuous, very much smaller than the fertile cell (*sect. Archerythroxylum* O. E. SCHULZ).
  2. Leaves oblong-obovate, long persistent, bright green above. Ramenta none or few. Flowers white. Fruits on leafy branches. Young twigs not warty . . . . **1. E. novogranatense**
  2. Leaves broad-elliptic, soon falling, dark green above. Ramenta numerous. Flowers yellowish-green. Fruits almost always on bare branches. Young twigs warty . . . . **2. E. coca**
1. Stipules early caducous. Styles more or less connate or stigmas almost sessile. Sterile cells of the drupe either conspicuous (as large as or even larger than the fertile cell) or absent (*sect. Coelocarpus* O. E. SCHULZ).
  3. Styles almost absent, stigmas sessile. Ovary 1-celled. Drupe biconvex, compressed. Seed without endosperm. Midrib of the leaves prominent on both sides . . . . . . **3. E. ecarinatum**
  3. Styles well developed. Ovary 3-celled. Drupe trigonous, not compressed. Sterile cells as large as or larger than the fertile one. Seed with endosperm. Midrib of the leaves prominent beneath, not prominent (usually sunken) above . . . . **4. E. cuneatum**

1. Erythroxylum novogranatense (MORRIS) HIERON. Bot. Jahrb. 20, Beibl. 49 (1895) 35; O. E. SCHULZ, in Urban, Symb. Ant. 5 (1907) 199; Pfl. R. Heft 29 (1907) 85; BACK. Schoolfl. (1911) 164; KOORD. Exk. Fl. Java 2 (1912) 416; VAN GORKOM, Oost-Ind. Cult. 3 (1913) 163; HEYNE, Nutt. Pl. (1927) 855; BURK. Dict. 1 (1935) 950; BACK. Bekn. Fl. Java (em. ed.) 4c (1943) fam. 111, p. 1.—*E. coca var. novogranatense* MORRIS, Kew Bull. (1889) 5; J. Linn. Soc. Bot. 25 (1890) 384; BURCK, Teysmannia 1 (1890) 385, 449.—*E. coca var. spruceanum* BURCK, Teysmannia 1 (1890) 456.—*E. truxillense* RUSBY, Druggist's Circular Chemic. Gaz. (1900) 220; (1901) 48.

Bush or shrub *c.* 1–3 m. Lenticels on the branches minute. *Leaves* abundant along the twigs, not soon falling, obovate-oblong, bright green above, paler and glaucous beneath, *c.* (2–)3–6(–7) by 1–3 cm; rounded or sometimes emarginate, always with a mucronate tip or notch, attenuate at the base; midrib rather prominent beneath, specially at the base, nerves numerous, on both surfaces equally distinct, venation delicately anastomosing, central part included between the areolation lines slightly concave and of a paler colour on both surfaces; petiole thin, *c.* 3–7 mm. Stipules green, triangular, shorter or half as long as the petiole, *c.* 2½–4 by 2–3 mm, slightly bicarinate, persistent, on old branches brown, top emarginate, 2-toothed, margin more or less fimbriate. Ramenta none or occasionally a few. *Flowers* in clusters of 1–4(–8). Bracteoles green, deltoid, acuminate, scarious, up to *c.* 2½ by 1 mm, margin delicately fimbriate. Pedicels thickened, *c.* 5–10 mm. *Calyx* green, the tube 1–1½ mm, lobes triangular-ovate, acuminate, *c.* 1½–2 by 1 mm. *Petals* white or greenish-white, oblong, convex *c.* (3½–)4(–5) by 2 mm; ligule 3-lobed, with crisped lobes, half as long as the blade of the petal; claw *c.* ⅕–¼ the length of the petal.

Brachystylous flowers.—Staminal tube pale green *c.* 1 mm. Stamens equal, filaments *c.* 3½–5½ mm, anthers *c.* ½ by ⅓ mm. *Ovary* distinctly longer than the staminal tube, *c.* 2 by 1 mm; styles free, *c.* 1 mm.

Dolichostylous flowers.—Staminal tube 1 mm. Stamens unequal, episepalous filaments ½–¾–1 mm, epipetalous ones ½–1½–2 mm, anthers ¾–½ by ½–¼ and ½ by ¼ mm respectively. *Ovary* longer than the staminal tube, *c.* 1½ by 1 mm; styles free, *c.* 2–3 mm.

Drupe red, elliptic-oblong, in the fresh state 9–11 by 4–5 mm; stone narrower, pointed, obtusely trigonous, with 4–6 ribs and furrows, *c.* 8–10 by 3–4 mm; sterile cells hardly distinct, fertile cell almost triangular in section. *Seed* with 3 distinct ribs; endosperm abundant; embryo central, small, *c.* 6–7 by 1 mm, flattened; cotyledons lanceolate, *c.* 3–4 mm; radicle *c.* 2–3 by ½ mm.

Distr. Native in South America, cultivated elsewhere in the tropics; in *Malaysia*: in the Malay Peninsula (Perak, Selangor), W. and E. Java, Br. N. Borneo, Celebes (Minahasa), and the Philippines (Luzon).

Ecol. In *Malaysia* often grown as a hedge plant, up to 750 m. *Fl.-fr.* Jan.–Dec.

Uses. Cultivated in Java since 1875 in the Botanic Garden at Bogor, when the first seeds were received. In 1885 after many difficulties and contradictory reports and advices an experimental plantation was started in the Tjikeumeuh Agricultural Garden at Bogor from seeds imported by the firm of Herman Linden & Co, which proved successful. Since 1886 many seeds were distributed to new plantations. The culture never gained great importance in Java; the price of the leaves rapidly decreased in the early twenties. Several estates used the species as hedges and as accessory crop. According to CORNER (Ways. Trees 1, 1940, 220) cultivation was prohibited in the Malay Peninsula.

From the dried leaves medicinal tinctures were prepared and by refining these alkaloids are obtained of which the main one is cocaine, which is used as a stimulant and as an anaesthetic mainly for eye-surgery. In Java a factory was built to prepare the crude alkaloid for export in order to avoid the costs of transport of the leaves to Europe (BURKILL, *l.c.* p. 952).

Vern. *Coca, truxillo coca, Java coca,* D, E.

Notes. O. E. SCHULZ described 3 varieties based on the size of the leaves. This is, however, very much depending on the environment (soil, altitude, moisture, and temperature) and also on the amount of shade; they have no taxonomical value. *E. novogranatense* adapts itself better to moist and warm tropical conditions than *E. coca* LAMK. Both are grown in their native countries in South America up to high altitudes to over 2000 m.

Though according to PRESCOTT (History of the Conquest of Peru 1, 1847, 129) both *E. coca* and *E. novogranatense* have been cultivated on a large scale in S. America from time immemorial and have never been found in a truly wild state, Peru has been accepted as the native country. In the Inca culture the plants were originally held sacred and reserved only for kings and priests. This reservation was later abandoned and leaves were chewed freely by the people, specially by carriers and messengers for avoiding a heavy food and water supply during far, rapid journeys over the mountains.

2. **Erythroxylum coca** LAMK, Enc. Méth. Bot. 2 (1786) 393; Cav. Diss. 7 (1789) 402; DC. Prod. 1 (1824) 575; HOOK. Comp. Bot. Mag. 1 (1835) 161; 2 (1836) 25; MARTIUS, Abh. Ak. München 3 (1841) 367; GOSSE, Mém. Cour. Acad. Roy. Belg. 12 (1861); PEYRITSCH, Fl. Bras. 12, 1 (1878) 156; BERKHOUT, Tijd. Nijv. Landb. N.I. 31 (1885) 251; TRIM. Ceyl. Adm. Rep. (1887) 13; MORRIS, Kew Bull. 3 (1889) 3, 221; J. Linn. Soc. Bot. 25 (1890) 381; BURCK, Teysmannia 1 (1890) 385, 449; HOOK. *f.* Bot. Mag. 50 (1894) t. 7334; BACK. Fl. Bat. 1 (1907) 210; O. E. SCHULZ, Pfl. R. Heft 29 (1907) 83; BACK. Schoolfl. Java (1911) 164; MERR. Fl. Manila (1912) 267; KOORD. Exk. Fl. Java 2 (1912) 416; VAN GORKUM, Oost-Ind. Cult. 3 (1913) 171; BURK. Dict. 1 (1935) 950; KANEHIRA, J. Dept Agr. Kyushu Imp. Un. 4 (1935) 341; BROWN, Useful Pl. Philip. (1950) 190.—*E. peruvianum* PRESCOTT, Hist. Conquest of Peru 1 (1847) 129, *nom. nud.*—*E. bolivianum* BURCK, Teysmannia 1 (1890) 456.

Small tree or shrub up to $2^{1}/_{2}$ m. Lenticels on the branches sometimes warty, very prominent. *Leaves* chiefly at the ends of the twigs, soon falling, broad-elliptic, *c.* 3–8 by 2–4 cm, dark green above, paler and glaucous beneath, acuminate or rounded with a mucronate tip, cuneate at the base; midrib prominent beneath; nerves numerous, very faint on both sides, venation delicately anastomosing, two lines giving a clearly distinguishable, slightly concave areolation of a paler colour; petiole *c.* 2–6 mm. Stipules triangular, more or less bicarinate, shorter than or as long as the petiole, *c.* 3–5 by 3–5 mm, persistent, on old branches brown and stiff, top acute, 2-toothed. Ramenta numerous. *Flowers* in clusters of 6–12, rarely more, in the axil of leaves or ramenta. Bracteoles deltoid small and scarious. Pedicels thickened, *c.* 4–6 mm. *Calyx* green, the tube 2–1 mm, lobes triangular-ovate, acute, *c.* 1–2 mm. *Petals* yellow or yellowish green, oblong, convex, *c.* 4–$4^{1}/_{2}$ by 2 mm; ligule 3-lobed (2 lobes crisped), half as long as the blade, claw broad, *c.* $^{1}/_{5}$ of the petal.

Brachystylous flowers.—Staminal tube *c.* $1^{1}/_{2}$ mm. Stamens equal; filaments 4 mm, anthers $^{1}/_{2}$ by $^{1}/_{3}$ mm. *Ovary* ellipsoid, slightly longer than the staminal tube, *c.* 2 by $1^{1}/_{2}$ mm; styles free, *c.* 2 mm.

Dolichostylous flowers.—Stamens unequal; episepalous filaments 2 mm, epipetalous ones 3 mm; anthers $^{3}/_{4}$ by $^{1}/_{2}$ and $^{1}/_{2}$ by $^{1}/_{4}$ mm respectively. Styles free, 4 mm.

Drupe red, oblong-ovoid, pointed, when dry obtusely trigonous, furrowed, *c.* 7–10 by 3–$4^{1}/_{2}$ mm; sterile cells not very distinct, fertile cell large, almost triquetrous in section. *Seed* with 3 distinct ribs; endosperm abundant; embryo central, small, *c.* 6 by $1^{1}/_{2}$ mm, flattened, cotyledons lanceolate *c.* 4 mm; radicle *c.* 2 mm.

Distr. Native in South America, cultivated in various other tropical countries, in *Malaysia* obviously only cultivated in a few Botanic Gardens but not used as a crop in plantations.

Ecol. At Bogor it produces abundant fruit but not much foliage as it does at higher altitudes, for example in tropical South America, where it is grown on red clay soils up to 1600 m. *Fl.-fr.* Jan.-Dec.

Uses. In S. America chewed by the Indians as a stimulant, leaves being exported for distillation abroad.

Vern. *Peru coca*, *coca*, D, E.

3. **Erythroxylum ecarinatum** BURCK, Ann. Jard. Bot. Btzg 11 (1893) 191; HOCHR. Pl. Bog. Exs. (1904) 79; O. E. SCHULZ, Pfl. R. Heft 29 (1907) 141; MERR. Philip. J. Sc. 11 (1917) Bot. 277; O. E. SCHULZ, Bot. Jahrb. 58 (1923) 249; HEYNE, Nutt. Pl. (1927) 855; C. T. WHITE, Contr. Arn. Arb. 4 (1933) 47; FRANCIS, Austr. Rain-for. Trees (1951) 419.—*E. sp.* TEYSM. & BINN. Cat. Hort. Bog. (1866) 214.—*E. montanum* TEYSM. & BINN. *ex* EYKMAN, Ann. Jard. Bot. Btzg 7 (1888) 225, *nomen*; MORRIS, Kew Bull. 3 (1889) 11, *nomen.* —*E. moluccanum* TEYSM. & BINN. *ex* SCHULZ, Pfl. R. Heft 29 (1907) 141, *nomen in synon.*—*E. salomonense* WHITE, J. Arn. Arb. 31 (1950) 89. —**Fig. 1.**

Tree 7–37 m; crown small, not widely spreading. Bark brown or greyish brown, often soft-suberose and thin (2–6 mm), fissured lengthwise or scaly. Branches 2–3(–4) mm diam., with large lenticels in the light brown bark, sometimes giving a warty appearance; very young branchlets 1–2 mm diam. *Leaves* abundant at the ends of the twigs, narrowly elliptic, *c.* 6–12(–17) by 1–4(–5) cm; dark green often shining above, light green and less shining beneath, acuminate with an obtuse tip, base cuneate, midrib always more or less prominent above, very prominent and yellowish beneath; nerves on both sides slightly prominent, venation delicate; areolation often distinct; petiole *c.* 4–8 mm. Stipules oblong-lanceolate, longer than or as long as the petiole, rarely somewhat carinate, *c.* (4–)8–11(–20) by (1–)2–4(–5) mm; top more or less falcate. Ramenta none. *Flowers* in clusters of (2–)4–8(–20). Bracteoles triangular, scarious, rather large, sometimes up to 2 mm. Pedicels thickened towards the calyx, *c.* 5–10 mm. *Calyx* tube *c.* $2^{1}/_{2}$–$1^{1}/_{2}$ mm high, lobes triangular, *c.* $^{1}/_{2}$–$1^{1}/_{2}$ mm; acuminate with a bluntish tip. *Petals* white, yellow to greenish yellow and cream, outside light brown, oblong, convex, 1-nerved with 2 lateral nerves in the blade, *c.* 4–5 by $1^{1}/_{4}$–2 mm; ligule 3-lobed, half as long as the blade, claw *c.* $^{1}/_{3}$ as long as the petal.

Brachystylous flowers.—Staminal tube *c.* $1^{1}/_{4}$–2 mm; stamens unequal; episepalous filaments *c.* $^{1}/_{2}$–1 mm, epipetalous ones *c.* 1–2 mm; anthers light purple, *c.* $^{1}/_{2}$–1 by $^{1}/_{2}$ and $^{1}/_{4}$–$^{1}/_{2}$ by $^{1}/_{4}$–$^{1}/_{2}$ mm respectively. *Ovary* 1-celled, oblong, exceeding the staminal tube, *c.* 2–3 by $^{1}/_{4}$–$^{3}/_{4}$ mm, light yellow; style none or very short, stigmas (2–)3, brown, clavate, *c.* $^{1}/_{2}$ mm.

Drupe ovoid or broadly ovoid, often curved, when maturing turning from yellow via orange to red; more or less compressed, sometimes slightly oblique with a rounded top, *c.* 8–12(–17) by 5–7(–8) mm and *c.* 4–5 mm thick. *Seeds* without endosperm; embryo *c.* 6–9(–15) by 3–5(–6) mm with more or less ovate, thick cotyledons *c.* 5–$7^{1}/_{2}$ by 3–5 mm and a distinct radicle *c.* 1–2 by $^{1}/_{2}$ mm.

Distr. Queensland and Melanesia (Solomon Islands: New Georgia), in *E. Malaysia:* Celebes, Moluccas (Halmaheira, Sula Isl., Buru, Ceram, Ambon), and New Guinea.

Ecol. A very common subsidiary tree of scattered occurrence in the Moluccas and New Guinea, from the lowland up to 2000 m in primary rainforests on slopes and mountain ridges, on rocky and clayey soils, in Halmaheira on coral rock. *Fl.-fr.* Jan.–Dec.

Uses. In Celebes used as a medicine (*obat jaguar*). The timber is used in New Guinea for boat and house building. The latter use is also reported from the Solomon Islands.

Vern. *Liqeliqe*, Solomons; *lowa waino* (= woman), *lowa motea* (= hard), Tobelo lang., *samainding*, Madi lang., Celebes; *dodojo*, *gemi*, Tobelo lang., Halmaheira; *kasoeli*, Sula Isl.; *naniwar*, Ceram; *kahunar*, *naniwar*, Ambon; *aibon*, Numfoor lang., *biyu*, Anona lang., *dora*, West Papuan, *irèpo*, Tariè lang., *ruachwau*, Karas lang., New Guinea.

Galls. Some specimens from Ambon and many from New Guinea have flower galls, in which the calyx is swollen into a very hard, orange, globular gall.

Notes. Sapwood white or yellow to brown, abruptly set off against the brown or brownred heartwood.

O. E. SCHULZ (*l.c.* 1923, p. 249) distinguished a *var. ledermannii*, based on LEDERMANN 12028, 12135, and 12176 from New Guinea. I have not succeeded in obtaining duplicates for study; the holotypes were obviously lost during the war. According to the description it would differ mostly by the smaller petals (3 mm) and fewer flowers (1–2 per axil).

As far as I could observe the ovary is 1-celled without vestiges of other cells and the drupe is 1-seeded. In herbarium specimens there appears, through shrinkage of the seed, some space between the pale brown testa and the light yellow endocarp. This space gives the false appearance of representing reduced empty cells.

In a remarkably high percentage of specimens the fruits are fully developed but do not contain seed.

4. Erythroxylum cuneatum (MIQ.) KURZ, J. As. Soc. Beng. 43, ii (1847) 135; O. E. SCHULZ, Pfl. R. Heft 29 (1907) 146, *incl. var. bancanum* (BURCK)

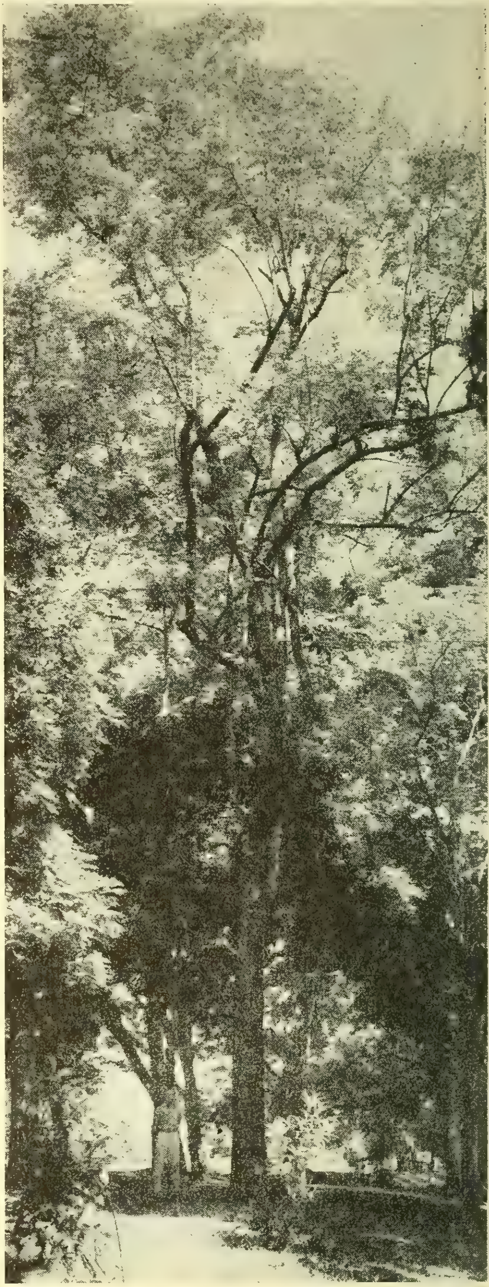


Fig. 2. *Erythroxylon cuneatum* (MIQ.) KURZ. Cultivated tree in Kebun Raya Indonesia (III. K. 5a), Nov. 1957.

O. E. Schulz, *l.c.* 148; Merr. Philip. J. Sc. 3 (1908) Bot. 232; Back. Schoolfl. (1911) 164; Guillaumin, Fl. Gén. I.–C. 1 (1911) 591; Merr. En. Philip. 2 (1923) 325; Craib, Fl. Siam. En. 1 (1926) 199; Heyne, Nutt. Pl. (1927) 855; Burk. Dict. (1935) 950; Corner, Ways. Trees (1940) 220; Back. Bekn. Fl. Java (em. ed.) IV C (1943) fam. 111, p. 1; Tardieu-Blot, Fl. Gén. I.–C. Suppl. 1 (1945) 516; Quis. Philip. J. Sc. 77 (1947) 153.—*Ficus cuneata* Wall. Cat. (1828) *no* 4534, *nom. nud.*—*Urostigma ? cuneatum* Miq. in Hook. Lond. J. Bot. 6 (1847) 585.—*E. burmanicum* Griff. Posth. Papers, Not. Pl. As. 4 (1854) 468, t. 581, fig. 3; Kurz, J. As. Soc. Beng. 39, ii (1870) 68; Scheff. Nat. Tijd. N.I. 32 (1873) 409; Hook. *f.* Fl. Br. Ind. 1 (1874) 414; Scheff. Nat. Tijd. N.I. 34 (1874) 95; Kurz, For. Fl. Burma 1 (1877) 171; Burck, Ann. Jard. Bot. Btzg 11 (1893) 190; King, J. As. Soc. Beng. 62, ii (1893) 190; Ridl. J. Str. Br. R. As. Soc. *no* 33 (1900) 55; Hochr. Pl. Bog. Exs. (1904) 78; Craib, Kew Bull. (1911) 24; Ridl. Fl. Mal. Pen. 1 (1922) 325.—*E. sumatranum* Miq. Sum. 1 (1861) 200, 512; Illustr. (1871) 71.—*E. retusum* Bauer *ex* Teysm. & Binn. Cat. Hort. Bog. (1866) 214, *nom.*; Nat. Tijd. N.I. 29 (1867) 254, *descr.*[1]; Morris, Kew Bull. (1889) 11.—*E. bancanum* Burck, Ann. Jard. Bot. Btzg 11 (1893) 192, t. 16.—*E. latifolium* Burck, Ann. Jard. Bot. Btzg 11 (1893) 192, *incl. var. longipetiolatum* Boerl. & Koord. Ic. Bog. 1 (1897) t. 6; O. E. Schulz, Pfl. R. Heft 29 (1907) 144, *incl. var. angustatum* O. E. Schulz; Merr. En. Born. (1921) 313; Masamune, En. Phan. Born. (1942) 357.—*E. longistipulatum* Burck, Ann. Jard. Bot. Btzg 11 (1893) 193.—*E. densinerve* O. E. Schulz, Pfl. R. Heft 29 (1907) 142; Merr. En. Born. (1921) 313; Masamune, En. Phan. Born. (1942) 357.—*E. platyphyllum* Merr. Philip. J. Sc. 3 (1908) Bot. 232; En. Philip. 2 (1923) 325.—*E. iwahigense* Elm. Leafl. Philip. Bot. 5 (1913) 1776; Merr. En. Philip. 2 (1923) 325.—*E. borneense* Merr. Pl. Elm. Born. (1929) 112; Masamune, En. Phan. Born. (1942) 357.—**Fig. 1j, 2–4.**

Small to large tree or a shrub, (1–)8–40(–45) m, up to 35–55 cm diam. Bark noted to be grey to brown often with vertical grooves, inner bark yellow to reddish brown. Branches 1½–4 mm diam., brown to black when dried, the tips 1–3 mm diam. *Leaves* very variable in size and shape, even on the same twig, mostly obovate, elliptic or oblong, *c.* (3–)5–11(–18) by 2–3(–7) cm; dark green to greenish brown often shining above, dull light green beneath, shortly acuminate or rounded with a more or less emarginate, mostly mucronate tip, base attenuate or cuneate; midrib nearly always sunken above, very prominent beneath; nerves on both sides equally distinct, often almost horizontal and close together giving a dense nervation, venation delicate; areolation often distinct; petiole 2–7(–9) mm. *Stipules* triangular to lanceolate, mostly as long as the petiole, not divided, entire, distinctly bicarinate *c.* 2–7(–9) mm, top mostly curved. Ramenta very rarely a few. *Flowers* in clusters of 1–8, mostly in pairs, faintly scented. Bracteoles deltoid, scarious, *c.* 1 mm long, 1-nerved. Pedicels thickened towards the calyx, *c.* (1–)4–10 or in fruit even to 35 mm (in the Philippines). *Calyx tube c.* 2–1½ mm high; lobes triangular, *c.* ½–1½ mm, acuminate with a bluntish tip. *Petals* white, whitish green to light green and yellow (also pink recorded from Central Celebes), oblong or oblong-elliptic, convex, *c.* 3–4 by 1½–2 mm; ligule 3-lobed, half as long as the blade; claw often distinctly narrowing towards the base, *c.* ⅓ as long as the petal. Flowers dimorphous, both types either with equal or unequal stamens.

Brachystylous flowers.—Staminal tube *c.* 1–2 mm. *Stamens equal*; filaments *c.* 2–3½ mm; anthers *c.* ½ by ½ mm. Ovary ellipsoid or ovoid, somewhat longer than staminal tube, *c.* 2 by 1 mm, top often truncate; styles (2–)3, *c.* 1–2 mm, shortly connate or only connate at the base, stigmas capitate, often flattened, broader than the style.

Brachystylous flowers.—Staminal tube 1–1½ mm. *Stamens unequal*; episepalous filaments *c.* 1½–4 mm, epipetalous ones *c.* 2–4½ mm; anthers ⅓ by ⅓ mm. Ovary ovoid to subglobular somewhat longer than staminal tube, *c.* 1¼–2 by 1–1½ mm; styles *c.* 1¼–2 mm, very shortly connate at the base; stigmas oblong-ovate, broader than the style.

Dolichostylous flowers.—Staminal tube *c.* 1–2 mm. *Stamens equal*; filaments *c.* 2–4 mm, sometimes thickened at the base. Ovary ellipsoid to subglobular, somewhat longer than staminal tube, *c.* 2–1½ by 1 mm, styles *c.* 2–5 mm, connate from ⅓ to ⅔ of their length, stigmas capitate, often flattened, broader than the style.

Dolichostylous flowers.—Staminal tube *c.* 1½–2 mm. *Stamens unequal;* episepalous filaments *c.* ½–¾ mm, epipetalous ones *c.* 1–1¼ mm; anthers *c.* ½ by ½ and ½ by ¼ mm respectively. Ovary ellipsoid to subglobular, somewhat longer than the staminal tube, *c.* 2–1½ by 1 mm, styles *c.* 2–4 mm, connate to various degree from ½ to ⅛ of their length, stigmas capitate, often flattened, broader than the style.

Drupe oblong-ovoid, often somewhat curved, red, when dry obtusely trigonous, distinctly furrowed, top pointed, *c.* 7–12 by 3–6 mm; fertile cell as large as or smaller than sterile cell, bilaterally compressed, sterile cells distinct and large, on both sides of the fertile cell. *Seed* flattened often somewhat curved, with distinct furrows, *c.* 5–10 by 1–2½ mm, endosperm little; embryo flattened, slightly curved or straight, green, *c.* 4–8 by ½–1½ mm; cotyledons linear, very thin, *c.* 2½–6 by ½–1½ mm; radicle distinct 1½–3½ mm.

Distr. Burma (Tenasserim, Moulmein, Mergui, and Andaman Isl.), Siam, and Cochinchina, in *Malaysia:* Sumatra (throughout), Malay Peninsula, Banka, Billiton, Riouw & Lingga Arch., West Java, Lesser Sunda Islands (Kangean,

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(1) *E. retusum* Baill. *ex* Schulz, Pfl. R. Heft 29 (1907) 137, *non* Bauer *ex* Teysm. & Binn. 1867 *l.c.*, from Madagascar = *Erythroxylum leandrianum* Payens, *nov. nom.*

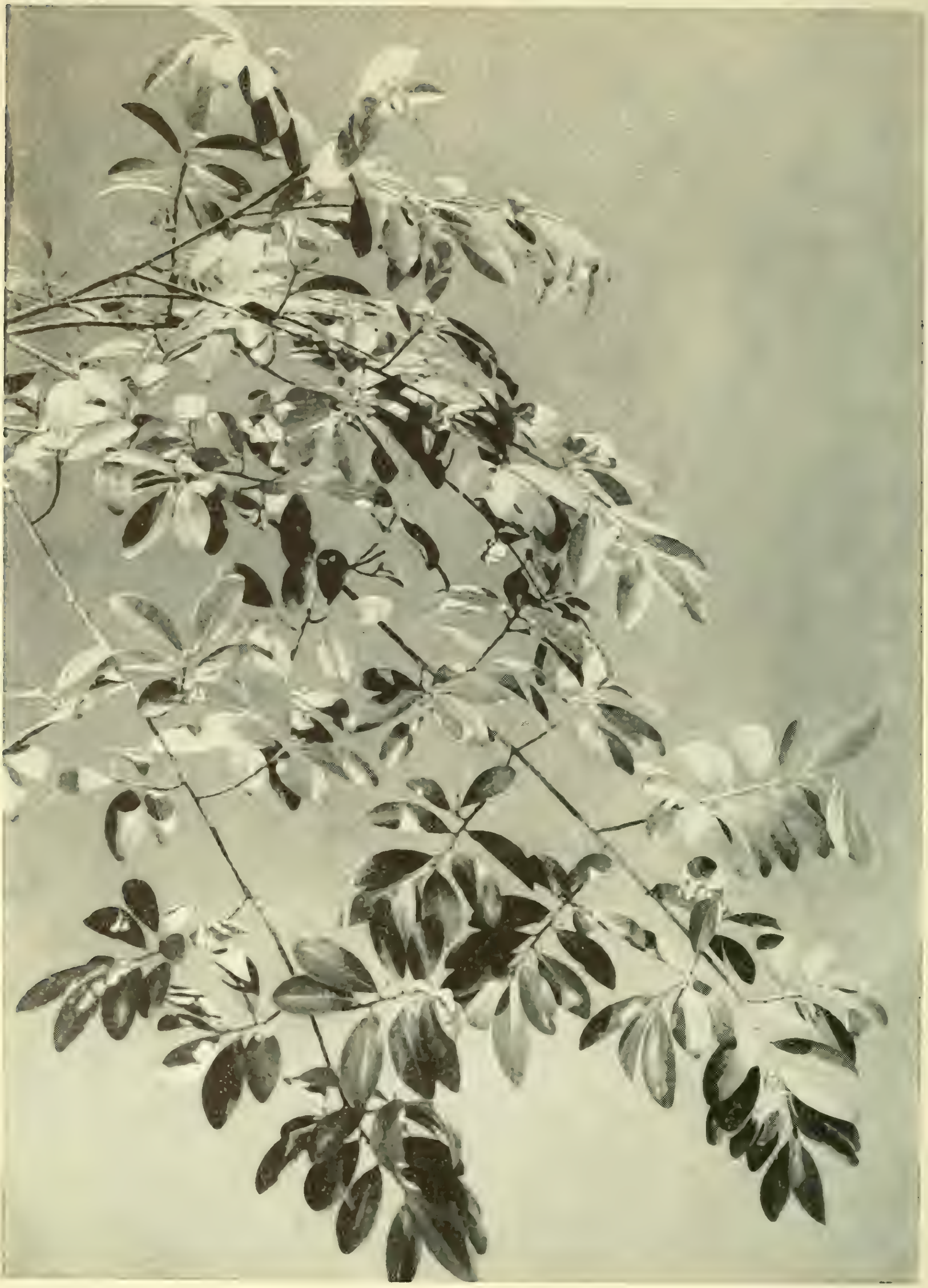

Fig. 3. *Erythroxylum cuneatum* (MIQ.) KURZ. Flowering and fruiting twig in Kebun Raya Indonesia (III. K. 5), Nov. 1957.

Sumbawa), Anambas and Natuna Isl., Philippines (Palawan, Luzon, Mindanao), Central Celebes (also Muna Isl.), Moluccas (Halmaheira, Ternate, Ceram), West New Guinea (the islands of Waigeo and Misool), but not yet found on the mainland of New Guinea.

Ecol. Very tolerant and found in a variety of habitats. It is often a tree or shrub behind sandy beaches or rocky shores; in Johore it is a characteristic constituent of the *Eugenia grandis* coastal forest. Also inland it is found under various conditions: sandy or rocky hills, average dryland forest, inundated peat-forest, sometimes on exposed limestone summits, both in primary and secondary vegetation. Sometimes in groups, more often scattered and nowhere dominant, from sea-level up to 900 m. *Fl.-fr.* Jan.–Nov.

Uses. The sapwood is white to yellow, abruptly set off against the brown heart-wood which is very durable and easy to work; it shrinks, tears, and warps very little and the timber is used for house-building in the Malay Peninsula, and in Sumatra also for bridges. Beams are said to be very durable but can seldom be obtained in quantity. The fresh wood sinks in water. In Trengganu, according to HOLTTUM, the leaves are pounded and applied on the forehead of women after miscarriage. In Bunguran leaves are reported to be used in sajur (vegetable soup).

Vern. *Ankara mula*, *garu lanang*, *g. abang*, *gĕlundi*, *kaju urang*, *k. katjang*, *kĕpitis*, *ngĕlĕgundi*, *pietis*, *pulas*, *tĕlung*, *tĕnara punai* (= *pepitis*), *tĕnaropunang*, M (Sum.); *kayu mutoh*, Banka, *mĕmbĕntaän* or *nĕmbĕntahan*, Billiton; *baka*, *chinta mola* (*mula*, *mulah*, or *mulek*), *inai-inai*, *mansira*, *mĕdang* or *bunga langundi*, *payoli* (also *mĕdang bunga langundi payoli*), *poko buluntas bukit*, *sri mula*, Mal. Pen.; *ki beureum*, S; Borneo: *asan*, *djĕnging*, Tidung lang., *gĕrongan*, Dusun Kinabatangan, *liduja*, *mahui*, Bekumpai lang., *paris*, *piling*, *tailan*, *tĕbakan*, Sarawak, *kaju sapat*, Bandjar.; Philippines: *baransiágau*, Ilk., *manambo*, *salñgen*, Bik., *sáleng*, Tag.; *bugunran*, *horu malako* or *malau*, Ternate.

Galls. On a specimen from Singapore and from Atjeh flower galls were found, giving a thickening of the pedicels.

Notes. The large variety of ecological conditions under which this species is found must be held partly responsible for the variability in habit and leaf shape and size of this vegetatively plastic species. Specimens collected on rich soils (heavy black soil, yellow clay, or old volcanic soils) are often small trees or shrubs already flowering and they possess large leaves which remain green when dried. Other large-leaved specimens showing this were collected as shrubs on coastal karst-limestone in Waigeo and along mangrove swamps in Mindanao and Bunguran Isl.. A few times it has been collected on exposed limestone summits (Philippines and a hill in Perak) scrambling as a very small-leaved, almost xerophytic shrub in the open. Trees over 15 m height always possess small or relatively small and thicker leaves, specially where the habitat is dry sandy soils, high forest, or inundated peat-swamp.

I got the rather remarkable impression that from Tenasserim to the Malay Peninsula it is always recorded as a medium-sized tree, but in Sumatra, Borneo, and Java either as a tree or a shrub. In the Philippines the data are insufficient to judge, but in East Malaysia it has never been recorded as a high tree.

The leaf apex may differ considerably in leaves from one branch, ranging from distinctly rounded to acuminate, the tip being always emarginate. In Borneo there were some specimens with exclusively either rounded or acuminate leaves.

The vegetative reaction to habitat and the fact that juvenile specimens freely flower and fruit in the open are held responsible for the variation of the leaf shape and size. Several authors have given specific or varietal names to certain leaf types or extremes but, after an intensive study of a large amount of specimens, I am perfectly satisfied that the leaf cannot be used for specific discrimination.

Characters for specific distinction can only be found in the fruit, the stipules, and to a certain extent in the structure of the flower.

The fruit proves to be very constant in structure, the fertile cell being accompanied on both sides by a large sterile cell. I found only one deviating specimen (Palembang: DUMAS 1564) which possessed very large drupes, measuring 15–17 by 7–8 mm, in which no embryo was developed; its absence may account for the abnormal size of the pericarp which in cross-section leaves no doubt that it belongs to *E. cuneatum*.

The flower has appeared to be more variable than formerly assumed. I have dissected flowers from all specimens and if material permitted of a number of flowers of one specimen. It has appeared that the flowers of one tree or twig are identical!

O. E. SCHULZ, in his key (Pfl. R. *l.c.* 139–140), has used the relation between the length of the staminal tube and that of the calyx as a character for distinguishing species but I believe this to be unreliable: in the majority of flowers the staminal tube exceeds the calyx, sometimes it was equal in length with the calyx, very rarely it was shorter.

Hitherto the flowers of *E. cuneatum* have been accepted to be 3-morphous, as found by BURCK. It has appeared, however, that they are 4-morphous. Fig. 4.

There are two major groups, *brachystylous* and *dolichostylous* flowers, but within either group

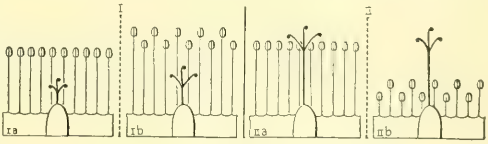

Fig. 4. Schematic drawing of the 4 flower types of *Erythroxylum cuneatum* (MIQ.) KURZ. I. *Brachystylous* flowers, *ia* stamens equal, *ib* stamens unequal. II. *Dolichostylous* flowers, *iia* stamens equal, *iib* stamens unequal. All × 3.

there are specimens with equal and specimens with unequal filaments, resulting into 4 subgroups.

Within both major groups the length of styles and degree of their coalescence is very variable, ranging from almost free or very shortly connate at the base in some brachystylous flowers to almost entirely connate in some dolichostylous ones.

Among brachystylous flowers the stamens are mostly equal and rarely unequal. Also among the dolichostylous flowers equal stamens predominate, but unequal stamens are less rare.

As far as adequate flowering material was available, the frequency of the flower forms turned out to be as follows: *form Ia, brachystylous flowers, stamens equal*, 46 specimens, *form Ib, ditto, stamens unequal*, 5 specimens, *form IIa, dolichostylous flowers, stamens equal*, 16 specimens, *form IIb, ditto, stamens unequal*, 11 specimens.

I have tried to correlate the four flower forms with geographical distribution: In Tenasserim, Burma, and Siam (3 specimens) I found only specimens of form Ia. In the Malay Peninsula (20 specimens) only forms Ia and IIa are found. In Sumatra (19 specimens) all forms occur except IIb. In Borneo (12 specimens) and the Philippines (11 specimens) all forms are represented, in Central Celebes (2 specimens) only the forms Ia and IIb, and in the Moluccas & West New Guinea (11 specimens) only form Ia.

Obviously the distribution of the flower types is not entirely random.

Affinities of E. cuneatum with SE. Asiatic species. —*E. cuneatum* can easily be distinguished from *E. monogynum* ROXB. by its caducous, entire stipules which are in the latter species persistent and finely serrate.

More difficult is its delimitation against the group *E. acuminatum* (ARN.) WALP., *E. obtusifolium* (WIGHT) HOOK. *f.* and *E. lanceolatum* (WIGHT) WALP. which belong with *E. cuneatum to* § *Coelocarpus.* All former authors have had trouble to distinguish these species from one another, and from *E. cuneatum.* I am inclined to look upon this triplet as representing one species, but I have not made a sufficiently thorough study of them for reaching a final conclusion. All three differ from *E. cuneatum* in the same difference in the fruit which in cross-section offers a large fertile cell flanked by 2 very small sterile cells.

E. kunthianum KURZ differs from *E. cuneatum* by very deeply bifid stipules with a serrate margin (entire and undivided in *E. cuneatum*).

Excluded

Ixonanthes JACK was inserted in the *Lineae trib. Ixonantheae* by BENTHAM & HOOKER *f.* in their 'Genera plantarum' and, though their delimitation of this family is no longer upheld in its original concept, the genus *Ixonanthes* is by some British authors still considered to make part of a segregate of these *Lineae* and referred to the *Erythroxylaceae*, for example by RIDLEY (1900), HUTCHINSON (1926), and BROWNE (1955). HALLIER *f.* (1923) inserted *Ixonanthes* in his *Linaceae sens. lat.* in the tribe *Ixonantheae* but placed *Erythroxylum* in a separate tribe with *Hugonieae.*

ADDENDA, CORRIGENDA ET EMENDANDA

As was done in the preceding volume p. 592–599 it seemed useful to correct some errors which have crept into the text of volumes 4 and 5 as well as to add some additional data, new records, and new species or other taxa which came to our knowledge and are worth recording.

Though we strive to make this a work of precision I have given up all hope that I will ever succeed in editing a volume in which no corrections in references and authority of taxa will appear to be necessary. This may be possible in a century from now when the entries in Index Kewensis are completed, when all books have nicely been extracted, and their dates of publication have been fixed once and for all by zealous librarians.

Valuable help in framing these addenda was received from Dr R. C. Bakhuizen van den Brink *f.*, additions of the *Convolvulaceae* I owe to Dr S. J. van Ooststroom, of the *Flacourtiaceae* and *Proteaceae* to Dr H. Sleumer, of the *Umbelliferae* and *Juncaceae* to Mr J. H. Kern, of the *Goodeniaceae*, *Dichapetalaceae*, and *Burseraceae* to Mr P. W. Leenhouts, of the *Burmanniaceae* to Dr F. P. Jonker.

Printing errors have only been corrected if they might give rise to confusion.

Volume and page number are separated by a colon.

Page numbers provided with either *a* or *b* denote respectively the left and right columns of a page.

Ancistrocladaceae

4: 8 Start the first sentence as follows: Wall. Cat. (1829) 1052; Arnott, *etc.* Further line 5, add behind '250': *nom. conserv.*

In the Rules of nomenclature it has been erroneously stated that *Ancistrocladus* Wall. Cat. (1829) 1052 is a *nomen nudum*. Wallich expressly introduced it as a *nomen novum* for *Wormia* Vahl, 1810, *non* Rottb. 1783.

Aponogetonaceae

4: 12 *Aponogeton loriae* Martelli.

Malayan specimens of *Aponogeton* have been found in the Van Kleef Aquarium, Singapore, said to have been brought in from Johore. If the identification is right, which I am not able to verify, the locality is very unusual as one would expect to find in West Malaysia a continental Asiatic species and not an East Malaysian-Queensland species. The discovery was made public by Purseglove in his commemorative pamphlet in honour of H. N. Ridley (1955) p. 8.

Mr Sinclair wrote me (Jan. 25, 1956) that he grew the plant in a tank. It flowered and he had a drawing made which shows the sheath still present when the extremely fragrant flowers had opened, but he did not observe how long the sheath persisted and whether it is circumsciss and caducous. The most distinctive feature about the plant was the vegetative budding. Young plantlets profusely form from buds and then roots appear. These plantlets finally drop off and fall to the bottom where they soon grow. The rootstock is vertical and oblong and densely clothed with thin fibrous roots. Dr H. C. D. de Wit has the same species from Siam and it is now cultivated in the Leyden Botanic Gardens for future observation of the flowering state.

Burmanniaceae (F. P. Jonker)

4: 15 **2a. Burmannia ledermannii** Jonker, Monogr. (1938) 107, 126, f. 9.

Dr P. van Royen collected at the base of Mt Cycloop, Netherlands New Guinea, between Skyline and Kujabu River, *n.* 4478, 240 m alt., a fairly large number of specimens belonging to this species which, hitherto, was only known from one collection in the Carolines (Palau Isl.: Babelthaop, Ledermann 14486).

From the new material it appeared that the type material collected by Ledermann consists of monstrous specimens. In the place of the anthers shortly stipitate stigmas occur. The perianth limb is very short and the inner perianth lobes are missing. The van Royen material also shows the same malformations in a number of specimens. In one case the stigmas replacing the anthers appeared to be long-stipitate. In some flowers the three anthers are absent and not replaced by stigmas; in other cases the normal anthers are missing but in the place of one or two a stigma occurs.

Normal flowers which also occur in the van Royen collection are narrowly winged, the wings slightly narrower than the perianth tube. Outer perianth lobes erect, ovate, apiculate, 2 by 1$^1/_2$ mm; inner ones linear-lanceolate, obtuse, *c.* $^4/_5$ mm long. Anthers sessile, at the base of the inner perianth lobes. Connective quadrangular, provided with two divergent, slightly papillose, apical crests and a basal, hanging, acute spur. Flower wings $^1/_2$ mm wide, running from the upper half of the limb to below the base of the ovary.

The species differs from *B. geelvinkiana* Becc. by its basal hanging connective spur which is absent in that species and by its flower wings running from the upper half of the limb to below the base of the ovary.

According to the collector the limb and wings are light purple, the tube and the ovary yellowish green.

The question arises whether the specific epithet is legitimate as Art. 67 of the International Code of Botanical Nomenclature (1950) says that a name must be rejected when it is based on a monstrosity. As it was not based on monstrous specimens of an already known species and no other name for the species exists, I prefer to maintain the specific epithet and to avoid the introduction of a new name.

4: 21 Line 8 from bottom replace '3' by: 6.

Moringaceae

4: 45 *Moringa oleifera* Lamk.

With a ruthless application of the Rules the oldest correct name for the species seems to be *Moringa pterygosperma* Gaertn. Lamarck included in his *M. oleifera* a reference to *Balanus myrepsica* Garsault (1764) which, though his description is entirely based on *M. oleifera* and *does not contain any characters of Moringa myrepsica* (Gars.) Thell. (*syn. M. aptera* Gaertn.), would in the eyes of some systematists illegitimize his combination.

The question is what is meant in the Code by 'circumscription'. If Lamarck had, in his lengthy description of *M. oleifera* taken in characters of *M. myrepsica* and mixed these with those of *M. oleifera*, or based his description entirely on the diagnosis of Garsault, his name were to be rejected. It appears that he made a mistake by his tentative reduction of *M. myrepsica* and *that it was his intention* to describe a species differing from *M. myrepsica*. Therefore, I cannot see valid reasons for not accepting the combination *M. oleifera*.

Juncaginaceae

4: 57 *Scheuchzeria palustris* L.

Additional research with the diatom tracer method has shown that the doubtful specimen from Java almost certainly was collected in Central Europe, *cf.* van Steenis, Taxon 5 (1956) 157.

Amaranthaceae

4: 73 *Celosia argentea* L. *var. cristata.*

Add to the synonyms: *Celosia castrensis* Dietr. Pflanzenreich 1 (1775) 246, based on Rumph. Herb. Amb. 5, t. 84.

In a cytological study by W. T. Grant (Bot. Gaz. 115, 1954, 323-336) it is said that *C. argentea* would have $2n = 72$ chromosomes and the *var. cristata* $2n = 36$ and the hybrid $2n = 56$ chromosomes.

Grant classified the tetraploid cockscomb as a variety under the diploid *C. argentea.* He assumes it not to be of recent origin and advances the hypothesis (*l.c.* 332b) "that it is an allopolyploid between cockscomb and a related species".

Simultaneously he inferred (*l.c.* 334a) that *C. argentea* must be "considered to be derived from the cockscomb".

This would represent, I feel, genetically a most unusual situation as it implies that the cockscomb would have been the ancestral species. It is known only in cultivation, however, and the argument of Grant (*l.c.* 334b) "that there is probably an insufficient number of flowers producing seed for the cockscomb to maintain itself in nature" seems far-fetched and ecologically unwarranted; it might have been rare on that argument, but not extinct.

I expect that further chromosome countings must reveal diploid *C. argentea;* my common sense tells me that this must be the ancestral plant from which a polyploid cockscomb arose as a sport and was saved by ancient man as a curiosity.

4: 81*b* *Digera muricata* (L.) Mart.

Add: now also found in the Botanic Gardens, Singapore, as a weed and collected in the Philippines, Cebu Isl., in fields, Elisabeth Co 38 (Up, L), Dec. 27, 1953.

4: 91*a*, 594*b* *Alternanthera repens* (L.) Gmel. Linn. Syst. Nat. ed. 13, 2 (1791) 106; Link, En. Pl. Berol. 1 (1821) 154; Steud. Nom. ed. 2, 1 (1840) 65; O.K. Rev. Gen. Pl. (1891) 536.—*Achyranthes repens* Linné, Sp. Pl. 1 (1753) 205.—*Illecebrum achyrantha* Linné, Sp. Pl. ed. 2 (1762) 299.—*Alternanthera achyrantha* Forsk. Fl. Aeg.-Ar. (1775) lix, 28; R. Br. Prod. (1810) 417.

Linné (1753) described this plant with a reference to Dillenius (Hort. Elth. 1, p. 8, t. 7, f. 7) who cultivated, described, and pictured a specimen which he got through Gerard and which came from Tucuman (The Argentine) as '*Achyracantha repens foliis bliti pallidi*'. Linné stated that the species occurred in 'Turcomannia'. Whether this means Turkey or is a mistake for Tucuman is uncertain.

In the 2nd edition of the Sp. Pl. (1762, p. 299) Linné deliberately changed the name into *Illecebrum achyrantha* L. with a reference to Sp. Pl. ed. 1 and without additional new data. Consequently the specific epithet *achyrantha* is superfluous and illegitimate in this combination.

Forskåll who installed the genus *Alternanthera* (1775) described the species as *Alternanthera achyrantha* Forsk. without reference to earlier works and basing himself on specimens which he had from Rosette *leg.* Hamel. Obviously this American weed had been introduced into the Mediterranean, possibly specially near harbours. Formally the type of his species is herbarium material and not the Linnean name of 1762, though there is little doubt in my mind that he derived the epithet from it.

Gmelin (1791, *l.c.* 106), in the briefest way possible, accepted Forskåll's genus, referred to Forskåll, but used the epithet *repens*. Obviously his intention was to recognize the genus *Alternanthera* but to point out that the correct epithet for the species should be *repens*. He did not properly refer to *Achyranthes repens* L. 1753, but the custom in this work was to make reference only to authors who used the same generic name as Gmelin himself accepted; in this case Forskåll was the only one. Through this procedure many basionyms have been suppressed in this work.

It should be admitted that in the same work Gmelin entered under *Illecebrum* (*l.c.* 427) *I. achyrantha* L. copying it from Sp. Pl. ed. 2 (1762) with proper reference to Dill. Hort. Elth. Obviously he did not realize that in this way he entered the same species twice.

In my opinion it is reasonable that the nomenclatural synonymy should run as cited above.

I do not believe that *A. pungens* H.B.K. is specifically different.

4: 93*a*, Read: *Alternanthera ficoidea* (L.) R. Br.
594*b* *ex* Link, En. Pl. Berol. 1 (1821) 164.
This appears the earliest legitimate transfer and correct authority.

4: 94*a*, *Alternanthera brasiliana* (Torner) O.K.
594*b* Add: Recently also found in the Philippines: Mindanao, Davao City, *pr.* Bago Oshiro, F. S. Gachalian *c.s.* Pnh 33542, Feb. 12, 1955.

4: 94*a*, *Alternanthera philoxeroides* (Mart.) Gri-
594*b* seb.; Sinclair, Gard. Bull. Sing. 14 (1953) 35.
Add to Distr.: Singapore, Sinclair, *l.c.*

Umbelliferae (J. H. Kern)

4: 114 Read at the end of fork 6b of the key: 3. *Trachymene*. Read at the end of fork 20b of the key: 12. *Petroselinum*.

4: 118 Replace line 2 of the key by the following:

8. Leaves at least 5 times as long as broad.
  8a. Leaves rosulate, narrow cuneate-spathulate, 2–9 cm by 4–7 mm, with (1–)3(–5) obtuse teeth. Calyx lobes obtuse . . . **4. T. rigida**
  8b. Leaves not rosulate, terete-filiform, $1^{1}/_{2}$–$2^{1}/_{2}$ cm by $^{1}/_{2}$ mm, apiculate. Calyx lobes apiculate. **17. T. filiformis**

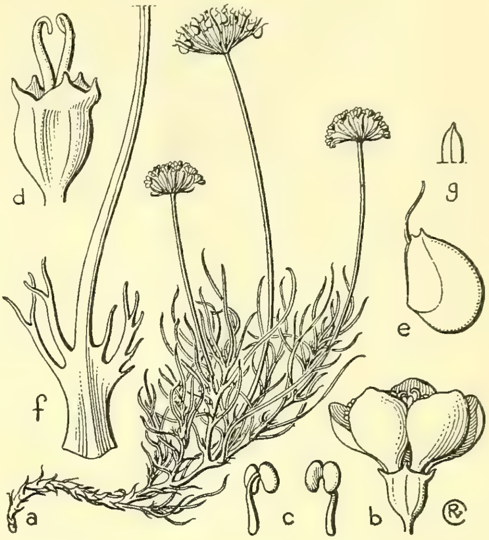

Fig. 1. *Trachymene filiformis* Steen. *a*. Flowering branch, × $^{2}/_{3}$, *b*. flower, × 10, *c*. stamens, × 12, *d*. flower beyond anthesis, × 16, *e*. mericarp, × 4, *f*. leaf-base with laciniate sheath, × 4, *g*. its apiculate tip, × 7 (Eyma 4320).

4: 125 **17. Trachymene filiformis** Steen. Nova Guinea n.s. 7 (1956) 8, f. 1.—**Fig. 1.**

Glabrous, branched dwarf shrub, apparently of tufted habit, *c.* 30 cm diam. *Leaves* on the stems, not rosulate, densely set, terete-filiform, entire, glabrous, with a ventral groove, acute, apiculate, $1^{1}/_{2}$–$2^{1}/_{2}$ cm by $^{1}/_{2}$ mm; sheath laciniate, *c.* $1^{1}/_{2}$ mm. *Umbels* solitary, terminal between a a whorl of sympodial side-branches on 3–7 cm long peduncles exceeding the foliage, in fruit up to 10 cm. Involucral bracts *c.* 10, linear, acute, 4–7 by $^{1}/_{5}$ mm. Pedicels *c.* 15–30, 3–4 mm long, spreading, rather erect in fruit. *Flowers* rosa-white. *Calyx* lobes persistent, broadly triangular, apiculate. *Petals* broad-elliptic, *c.* 1 mm long. Styles 1 mm. Mericarps 3 by 2 mm, on pedicels up to 7 mm.

Distr. *Malaysia:* Western New Guinea (Wissel Lake region: Eyma 4320, Rappard 3312).

Ecol. Heaths on limestone, 1600–1800 m.

Note. Unfortunately no material was available to Dr Buwalda when he made his revision. It keys out next to *T. rigida* Buw. but is very different from that species by the non-rosulate leaves, the laciniate sheath, the terete-filiform leaf, and the apiculate calyx lobes.

4: 125 *Sanicula europaea* L.

In a revision of the genus R. H. Shan & L. Constance (Un. Cal. Publ. Bot. 25, 1951, 1–78) have split the specific population as accepted by BUWALDA into two replacing microspecies which have in my opinion merely racial rank. The Malaysian microspecies is called *S. elata* HAM. *ex* DON. occurring from S. Africa to Japan and the Moluccas.

4: 128 *Oreomyrrhis andicola* HOOK. *f.*
Add to the generic and specific distribution: Formosa.

M. E. MATHIAS & L. CONSTANCE have split the species more finely than BUWALDA, but their microspecies are in my opinion of racial rank, *cf.* Univ. Cal. Publ. Bot. 27 (1955) 347–416, 25 fig.

4: 140 Add under *Daucus* the following key and description:

KEY TO THE SPECIES

1. Coarse plant. Compound umbels long-peduncled, with numerous, regular rays. Umbellules many-flowered. Pedicels incurved after anthesis.
Larger petals 1–4 mm, rayed. Central flowers not sessile, often sterile, and with red petals. Mericarps 3–4 mm long . . . . **1. D. carota**

1. Not coarse. Compound umbels sessile, the uppermost ones seemingly peduncled; rays 2–5, irregular in length. Umbellules 1–6-flowered. Pedicels not incurved after anthesis. Petals *c.* $^{1}/_{2}$ mm. Central flower often sessile, not sterile, not red. Mericarps 4–5 mm long. **2. D. glochidiatus**

2. Daucus glochidiatus (LABILL.) FISCHER, MEYER & LALLEMANT, Ind. IX Sem. Hort. Petrop. Suppl. (1843) 11; Linnaea 18 (1844) 209; THELL. in Hegi, Ill. Fl. Mitt. Eur. 5^2 (1926) 1503, f. 2574; in Fedde, Rep. 23 (1926) 156, f. 2; BLACK, Fl. S. Austr. 2, ed. 3 (1952) 659.—*Scandix glochidiata* LABILL. Nov. Holl. Pl. Sp. 1 (1805) 75, t. 102.—*Caucalis glochidiata* POIR. in Lamk. Enc. Suppl. 2 (1811) 137; DC. Prod. 4 (1830) 216.—*D. brachiatus* SIEB. *ex* DC. Prod. 4 (1830) 214; BENTH. Fl. Austr. 3 (1866) 376; BAILEY, Queensl. Fl. 2 (1900) 727.—*Scandix 'pectinata'* [*sphalm. pro glochidiata*] HOOK. *f.* Fl. Tasm. 1 (1860) 161, *in syn.*—*D. pusillus* (*non* MICHX.) F.v.M., *fide* BENTH. Fl. Austr. 3 (1866) 376, *in nota.*—**Fig. 2.**

Annual. *Stems* slender, erect, almost glabrous to more or less hispid, (2–)20–30 cm. *Leaves* with slender petioles, bipinnate, ultimate segments ovate, incised, minutely mucronulate. Compound *umbels* irregular, very loose, sessile, those at the apex of the stems seemingly peduncled; involucral bracts 2–3, pinnatisect; rays 2–5, very unequal, the longest ones in fruit longer than the involucre; bracts of the involucels unequal, short, usually entire; pedicels very unequal, longer than the fruit (but central flower often sessile or almost so). *Fruit* slightly compressed, ovoid or ellipsoid, 4–5 mm long; carpophore subulate, somewhat incrassate at the base; primary ribs with fine bristles, secondary ribs with strong bristles glochidiate at the top.

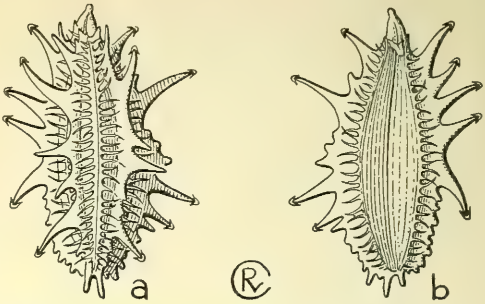

Fig. 2. *Daucus glochidiatus* (LAB.) FISCHER, MEYER & LALLEMANT. *a.* Mericarp from outside, *b.* from inside, both × 7 (VAN STEENIS 18458).

Distr. Australia, Tasmania, New Zealand; a few times introduced with Australian wool into Europe (Scotland, France, Switzerland); in *Malaysia:* Lesser Sunda Islands, Portug. Timor (Mt Tatamailau, Jan. 5, 1954, VAN STEENIS 18458, Bo, BM, L.).

Ecol. A common herb in grassy *Eucalyptus* forest, 2500-2950 m. The fruits must be easily dispersed by animals.

Notes. Closely related to *D. montanus* HUMB. & BONPL. *ex* SCHULT. from S. America, and united with this species by HOOKER *f.*, Fl. Tasm. 1 (1860) 161 and URBAN, Fl. Bras. 11^1 (1879) 350.

Very polymorphic, especially in the shape of the fruit bristles. The Timor specimens belong to *var. glochidiatus*, in which the bristles of the secondary ribs are laterally compressed and often confluent at the base into a narrow crest (in *var. pachyacanthus* THELL. in Fedde, Rep. 23, 1926, p. 159, they are conical-subulate, almost terete in cross-section, and not confluent at the base).

According to THELLUNG *var. glochidiatus* can be divided into 2 subvarieties: *subvar. glochidiatus* (*subvar. platyacanthus* THELL .in Fedde, Rep. 23, 1926, p. 158, f. 2b) with bristles strongly dilated at the base into a triangular basal part, and *subvar. leptacanthus* (THELL.) *stat. nov.* (*D. brachiatus* SIEB. *ex* DC., *s.s.; D. glochidiatus var. leptacanthus* THELL. *l.c.*, *s.s.*, f. 2a) with bristles slightly dilated into the lanceolate basal part. The Timor plants belong to *subvar. glochidiatus.*

The species can easily be distinguished from *D. carota* L. by its annual habit, the few-rayed, sessile umbels; pedicels very unequal, not incurved after anthesis; fruit 4–5 mm long.

Dilleniaceae

4: 141 Bottomline add: *Korosvel* ADANS. Fam. Pl. 2 (1763) 442, *descr.*, 544.—

4: 152 *Acrotrema costatum* JACK.
This species has definitely appeared to occur in North Sumatra. In 1957 excellent material became available, collected by the late Mr H. SURBECK, collected Oct. 24, 1941, near Badiri, along the road from Sibolga to Padang Sidempuan (Tapanuli Res.) on moist steep rocks above Sibolga. The collector's notes read: Pretty plant with dark-green leaf rosette and yellow flowers. Flowers mostly 5 in a raceme.

Juncaceae (J. H. KERN)

4: 213 *Juncus prismatocarpus* R. BR.; KERN, Gard. Bull. Sing. *in the press.*
Add to Distr.: Malay Peninsula, Cameron Highlands (summit of Batu Brinchang, 2000 m, BURKILL 783; Brak Pressure Tank, 1500 m, BURKILL 823).

Pedaliaceae

4: 217*b* *Sesamum indicum* L.; STEEN. Nova Guinea n.s. 6 (1955) 34.
Add: also found in South New Guinea, *pr.* Sg. Aendua (Uta), 3 m, AET (exp. LUNDQVIST 522, July 13, 1941 (Bo, L).

4: 218*a* Line 6 from top replace part of citation by: Beskr. Guin. Pl. 2 (1827) 56;
This paper is a pre-issued reprint from Vid. Sel. Phys. og Math. Skr. ser. iv, . . .

Phytolaccaceae

4: 232*b* Add under Excluded:
Phytolacca ? javanica OSBECK, Dagbok Ostind. Resa (1757) 276, is, according to MERRILL, Am. J. Bot. 3 (1916) 583, *Terminalia catappa* L. (*Combretaceae*).

Flagellariaceae

4: 248 The genus *Hanguana* is probably not a *Flagellariacea* but would belong in the affinity of the *Xanthorrhoeaceae*, according to SMITHON, Kew Bull. 1956, p. 491 (1957). According to ERDTMAN (Pollen Morph. 1, 1952, 180) the pollen structure is distinctly different from that of *Flagellaria* and *Joinvillea* and ERDTMAN suggested to remove it to an other family. The pollen shows a slight resemblance to that of *Lomandra*.

Pontederiaceae

4: 258*b* *Monochoria hastata* (L.) SOLMS *var. elata* (RIDL.) BACKER.
Nov. 1957 I found this variety also in clay ditches along the large road from Bangkok northward through the rice bowl of Siam. It is a very distinct variety.

Corynocarpaceae

4: 263 **1. Corynocarpus cribbianus** (F. M. BAILEY) L. S. SMITH, Proc. R. Soc. Queensl. 67 (1956) 31.—*Cyanocarpus cribbiana* F. M. BAILEY, Queensl. Agr. J. 1 (1897) 370.—*Helicia cribbiana* F. M. BAILEY, Queensl. Fl. 4 (1901) 1327; SLEUM. Blumea 8(1955) 15.—*Corynocarpus australasica* C. T. WHITE, Contr. Arn. Arb. 4 (1933) 57, t. 5; *cf.* STEEN. Fl. Mal. I, 4 (1951) 263.
The following field notes were given from fresh material in Queensland: Understorey tree up to 18 m by 30 cm. Fruit a subglobular, fleshy drupe; exocarp thin and smooth and a bright pinkish red colour; mesocarp a whitish coloured flesh; endocarp 1–1½ mm thick.

Sonneratiaceae

4: 282 As an additional distinguishing character between *Sonneratia alba* and *S. caseolaris* the colour of the filaments has been mentioned. In Port. Timor I found, however, near Dili, in Dec. 1953, specimens of undoubted *S. caseolaris* (VAN STEENIS 17999) of which the stamens were entirely bloodred. This character should be omitted from the key.

Dipsacaceae

4: 291 Line 1. *Triplostegia mairei* LÉV. has been reduced to *Chrysosplenium macrophyllum* OLIVER by HARA, J. Fac. Sc. Un. Tokyo sect. III, 7 (1957) 86.

Dioscoreaceae

4: 305*b* *Dioscorea palawana* PRAIN & BURKILL. Add: an isotype of MERRILL's collection is in SING.

Xyridaceae

4: 367 Line 6 from top add: *Kotsjiletti* ADANS. Fam. Pl. 2 (1763) 60, *descr.*, 544. This generic synonym is based on Rheede, Hort. Mal. 9, t. 71; it is synonym of *Xyris indica* L.

Droseraceae

4: 378 **3a. Drosera rotundifolia** LINNÉ, Sp. Pl. 1 (1753) 281; DIELS, Pfl. Reich Heft 26 (1906) 93.

ssp. **bracteata** KERN & STEEN. Nova Guinea n.s. 6 (1955) 279.

Leaves in rosettes, patent, $^3/_4$–7 cm petioled, blade roundish, 4–10 by 5–18 mm. *Stipules* 5–8 mm, halfway adnate, the upper half divided into narrow subsetaceous segments. *Peduncle* solitary, erect, $^1/_2$–2 cm, glabrous, 3–10-flowered. Pedicels not exceeding 2 mm. *Bracts* ligulate, concave, with a broad insertion, *c.* $4^1/_2$ by 1–$1^1/_4$ mm, minutely glandular- denticulate, broadly rounded at the apex. *Sepals* connate at the base, oblong, minutely glandular-denticulate, *c.* 5 by $1^1/_2$ mm. *Petals* white, spathulate, *c.* 5–6 by 3 mm. Stamens 4–5 mm. Ovary ellipsoid, 3 mm; *styles* 3, each arm 2-parted with a club-shaped top, $1\ ^1/_2$–2 mm. *Seeds* minute, narrow-fusiform, with a prolonged testa.

Distr. The species in all temperate and warm-temperate parts of the northern hemisphere, the nearest station to Papua being Japan, the subspecies endemic in *Malaysia:* West New Guinea (Wissel Lake area, *pr.* Arupa).

Ecol. Sphagnum swamps at *c.* 1750 m. *Fl.* March.

Vern. *Gagura*, Kapouka.

Notes. This is the only record of this species on the southern hemisphere and it came very unexpected; from its station in New Guinea we would conclude that it might occur in intermediate stations somewhere in the Moluccas, Central Celebes, or Luzon.

Comparable distributional areas: isolated (obviously relic) stations in the Papuan highland and mountain swamp flora of genera or species which have their main areas on the northern hemisphere are not unknown; we point to the records of *Androsace umbellata* (LOUR.) MERR., *Triplostegia glandulifera* WALL., and *Hydrocotyle vulgaris* L. which are more or less equiform to that of *D. rotundifolia.*

We have compared the Papuan specimens in great detail with very numerous specimens of the typical form, but can find only one very distinct difference in the floral bracts, which in the typical form, *ssp. rotundifolia*, are consistently filiform to very narrow-lanceolate (up to $^1/_4$ mm wide), very acute, and more or less caducous.

In both subspecies the place of insertion of the bracts can vary: at the base of the pedicels, higher up along the rachis, or even on the pedicels just below the calyx.

In the key on p. 378 it would come close to *D. spathulata* which is found in similar habitats and belongs in the same *sect. Rossolis*, but it can at once be distinguished from that species by its erect scape, the orbicular leaf-blade, the ± glabrous inflorescence, and the remarkable fusiform seeds.

4: 379*b* Add in the map of the localities of *Drosera spathulata* a dot on the north of the Malay Peninsula for Kedah Peak (HOLTTUM 14880), *cf.* STEEN. Blumea 7 (1954) 595.

Convolvulaceae (S. J. VAN OOSTSTROOM)

4: 390 Change in the key:

15. Stigmas filiform or elliptic.
  16. Stigmas filiform.
    16a. Stigmas 2 . . **10. Convolvulus**
    16a. Stigmas 4 . . **12a. Polymeria**
  16. Stigmas elliptic . **8. Jacquemontia**
15. Stigmas globular.

4: 393*a* 3. *Cuscuta timorensis.* The correct name for this species is *C. cassytoides* NEES *ex* ENGELM. Trans. Ac. Sc. St Louis 1 (1859) 513; YUNCKER, Mem. Torr. Bot. Cl. 18 (1932) 250; MEEUSE, Bothalia 6 (1957) 651.

Distr. East to South Africa and *South Malaysia:* East Java (Asem Bagus) & Lesser Sunda Islands (Timor, Wetar), an extraordinary type of distribution.

4: 395 Add to the synonyms of *Evolvulus* L., besides those mentioned in VAN OOSTSTROOM's monograph, *l.c.* p. 19–20: *Vistnu* ADANS. Fam. Pl. 2 (1763) 245, *descr.*, typified by *Vistnu-clandi* RHEEDE, Hort. Mal. 6, t. 64.

4: 395 After line 5 from bottom add:

KEY TO THE SPECIES

1. Peduncles well developed, a little shorter to much longer than the leaves. Sepals lanceolate, acute or acuminate. Corolla shallowly lobed, pale blue or rarely white . . . **1. E. alsinoides**
1. Peduncles absent or very short. Sepals ovate-oblong to oblong, obtuse or acutish. Corolla distinctly lobed, white **2. E. nummularius**

4: 398*b* After line 22 from top add:

2. Evolvulus nummularius (LINNÉ) LINNÉ, Sp. Pl. ed. 2 (1762) 391; OOSTSTR. Mon. Evolv. (1934) 114.—*Convolvulus nummularius* LINNÉ, Sp. Pl. ed. 1 (1753) 157.—**Fig. 3.**

A perennial herb. Stems few to several, prostrate and rooting at the nodes, slender, 10–40 cm long, with patent hairs, glabrescent. *Leaves* distichous, mostly broadly ovate, elliptic or orbicular, 4–15(–25) by 3–15(–18) mm, rounded, truncate or subcordate at the base, rounded or emarginate at the apex, glabrous on both sides or appressed-pilose beneath; petiole 1–5(–12) mm long.

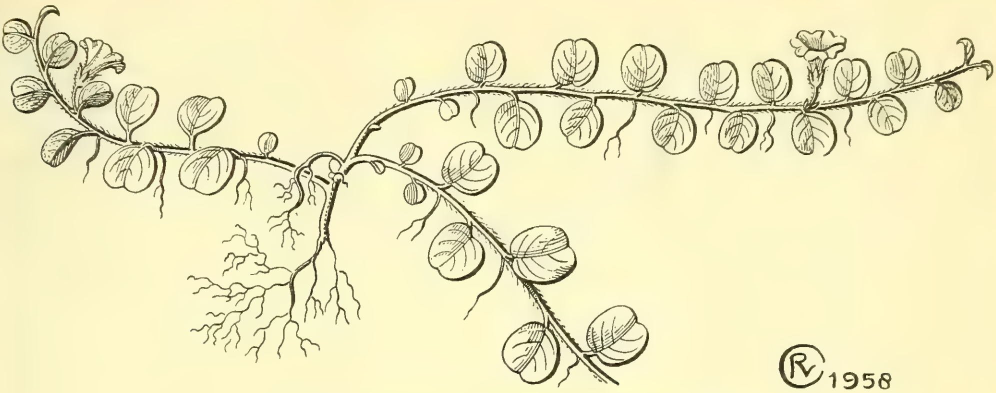

Fig. 3. *Evolvulus nummularius* (L.) L. Habit, × $\frac{3}{4}$.

Flowers 1 or 2 in the leaf-axils; peduncle none or very short; pedicels 2–6 mm long. Bracts linear or lanceolate, $\frac{1}{2}$–$1\frac{1}{2}$ mm long. *Sepals* ovate-oblong to oblong, obtuse or acutish, $2\frac{1}{2}$–4 mm long, sparsely pilose or glabrous, the margins ciliate. *Corolla* rotate to broadly funnel-shaped, white, the distinctly lobed limb *c.* 8 mm diam. Ovary glabrous. *Capsule* globular, glabrous, 4-valved. *Seeds* 4 or less, black or brown.

Distr. America, from Mexico to the northern Argentine, West Indies; tropical Africa, Madagascar; naturalized in India; in *Malaysia* found in one locality on the W. coast of the Malay Peninsula (Port Dickson: MONOD DE FROIDEVILLE 772, *a.* 1946), obviously a recent introduction.

Ecol. The only specimens known from the Malay Peninsula were collected in open, stony places along a cart-track in a cut down rubber-plantation.

4: 439 After line 5 from top add:

12a. POLYMERIA

R. BR. Prod. 1 (1810) 488; BENTH. Fl. Austr. 4 (1869) 431; BAILEY, Queensl. Fl. 4 (1901) 1071; GUILLAUMIN, Fl. Nouv.-Caléd. (1948) 303.

Mostly small annual or perennial herbs, glabrous or hairy; stems prostrate or erect, rarely twining. *Leaves* usually entire. *Peduncles* axillary, 1–3-flowered; bracts minute. *Sepals* 5, herbaceous, subequal or the outer ones much broader, mostly acute or acuminate. *Corolla* regular, small, funnel-shaped to campanulate, plicate, with subentire or angular limb, pink or white. *Stamens* 5; filaments adnate to the corolla, filiform; pollen ellipsoid, smooth. Ovary 2-celled, each cell with 1 ovule; style 1, simple, filiform; stigmas 4–8, rarely 2, linear. *Capsule* subglobose, 1–2-celled, 2–4-valved. *Seeds* 1 or 2, pilose or sometimes glabrous.

Distr. A genus of *c.* 8 species in Australia; one of these also in New Caledonia and Malaysia.

1. Polymeria pusilla R. BR. Prod. 1 (1810) 488; BENTH. Fl. Austr. 4 (1869) 434; BAILEY, Queensl. Fl. 4 (1901) 1072; GUILLAUMIN, Fl. Nouv.-Caléd. (1948) 303.

A small herb. Stems thin, almost filiform, 5–40 cm long, creeping, rooting at the nodes (or sometimes twining?), appressed-pilose to glabrous. *Leaves* with slender petioles, ovate to nearly kidney-shaped (or linear), widely cordate at the base with rounded or obscurely angular auricles, the blade shortly attenuate into the petiole, retuse and minutely mucronate at the apex, 4–15 by 3–12 mm, glabrous above, shortly pilose beneath; petiole 3–12 mm, shortly pilose. *Peduncles* axillary, 2–10 mm long, 1-flowered, shortly pilose; pedicels much longer than the calyx, 4–10 mm long, glabrous; bracts minute, linear, $\frac{3}{4}$–2 mm long. *Sepals* elliptic or ovate-oblong, all shortly pilose except for the glabrous margins of the inner ones; outer sepals 3–5 mm, inner ones $2\frac{1}{2}$–$4\frac{1}{2}$ mm long. *Corolla* white, about twice as long as the calyx, with pilose midpetaline bands. Style articulate near its base; stigmas 4, filiform.

Distr. Australia (Queensland), New Caledonia, in *Malaysia:* Timor (Portuguese Timor: VAN STEENIS 18124).

Ecol. Pyrogenous grassland on the Fuiloro plateau at 400 m, creeping together with *Goodenia koningsbergeri* (BACKER) BACKER *ex* BOLD. between tufts of *Schoenus falcatus* R. BR., *Themeda australis* (R. BR.) STAPF, *Fimbristylis marianna* GAUD., and specimens of *Pimelea sp.*, *Alysicarpus bupleurifolius* DC., *Eriosema chinense* VOGEL, *etc.*

4: 439 Change in the key of *Merremia:*

7. Pedicels with thick undulate ring or with warts immediately below the calyx.
    - 7a. Stems and leaves densely hairy. Outer sepals 15–18 mm long. Filaments inserted *c.* 12 mm above the corolla-base, 16–18 mm long. Style *c.* 28 mm long . **23. M. similis**
    - 7a. Plants glabrous or nearly so. Outer sepals 11–12 mm long. Filaments inserted *c.* 5–6 mm above the corolla-base, 5–7 mm long. Style *c.* 13 mm long. . . . **24. M. pacifica**
7. Pedicels without thick ring or warts below the calyx.

4: 444*b* 5. *Merremia emarginata* (Burm. *f.*) Hallier *f.*
Add to Distr.: Neth. New Guinea (Merauke).

4: 450*b* 14. *Merremia boisiana* (Gagnep.) Ooststr. *var. boisiana.*
Add to Distr.: Sumatra (Tapanuli).

4: 453*a* 21. *Merremia peltata* (L.) Merr.
Add to Distr.: Siam.

4: 454 After 23. *Merremia similis* Elmer add:

24. Merremia pacifica Ooststr. Blumea 3 (1939) 263, fig. 1, a–g.—**Fig. 4.**

A twiner. Stems terete, smooth, fistulose, up to 5 mm diam., glabrous or with a few scattered hairs in the apical portion. *Leaves* broadly ovate to orbicular, 10–14 by 10–11 cm, broadly cordate at the base, abruptly acuminate to cuspidate at the apex with a narrow acute mucronulate acumen, glabrous or sparsely hairy above near the base; lateral nerves 9–10 on either side of the midrib, curved at the margin; secondary nerves many, parallel; tertiary nervation distinctly reticulate beneath; petiole 3–5 cm long, glabrous or with short scattered hairs. *Inflorescences* axillary, 15–20 cm long; peduncle terete, glabrous or nearly so, branched close to the apex; branches 3–6 mm long. Pedicels with a thick undulate ring below the calyx, glabrous, $2\frac{1}{2}$–$3\frac{1}{2}$ cm long, in fruit erect, up to 5 cm. Bracts caducous. *Sepals* concave, membranaceous with pellucid margins and with glandular dots on the inner surface, the outer ones obovate to suborbicular, rounded or retuse and mucronulate at the apex, 11–12 mm long; the inner ones often broader, retuse and mucronulate at the apex, as long as the outer ones or a little shorter, *c.* 8–9 mm; the calyx enclosing the fruit as a cup, with sepals to 18 mm long. *Corolla* campanulate to funnel-shaped, *c.* 3–5 cm long, white with a yellow centre, very shallowly 5-lobed, glabrous or with some hairs at the apex of the midpetaline bands. Filaments inserted *c.* 5–6 mm above the corolla-base, 5–7 mm long, papillose on the much broadened base; corolla-tube inside with 2 hair-lines below the base of each filament. Anthers straight or slightly twisted, glabrous. Ovary glabrous. Style *c.* 13 mm long. *Capsule* ovoid or globular, *c.* 2 cm long, dark brown.

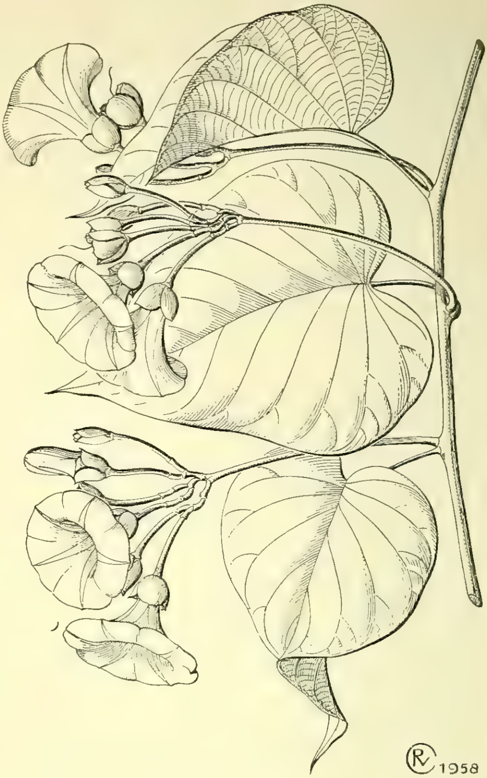

Fig. 4. *Merremia pacifica* Ooststr. Flowering branch, × $\frac{1}{3}$ (Brass 28540).

Distr. Polynesia (Fiji Islands) and *Malaysia* (Papua, Rossel Island: Brass 28540).

Ecol. In rain-forest regrowths; at *c.* 80 m.

4: 459 Change in the key:

8. Sepals entirely glabrous (sometimes muricated, or dentate on the nerves).
    - 8a. Outer sepals with 3 dentate keels. **22a. I. fimbriosepala**
    - 8a. Outer sepals not keeled and not dentate.
9. *etc.*

4: 460 Change in the key:

22. Leaves with 3–4 nerves on either side of the midrib. Plant more or less tomentose with stellate hairs, or glabrescent to glabrous, except at the nodes . . . **33. I. asterophora**

22. Leaves with 7 or more nerves on either side of the midrib. Plant glabrous, or with simple hairs.
  22a. Leaves with 7–9 nerves on either side of the midrib, deeply cordate at the base . . **36a. I. abrupta**
  22a. Leaves with 10–15 nerves on either side of the midrib, shallowly cordate to truncate at the base. **36. I. illustris**

4: 469*b* 12. *Ipomoea tiliacea* (Willd.) Choisy. Add to Distr.: Papua and Australia (Queensland).

4: 472*a* No 16 must be read as follows:

16. Ipomoea ochroleuca Spanoghe, Linnaea 15 (1841) 340 ('*ochroleucea*'); Miq. Fl. Ind. Bat. 2 (1857) 614 ('*ochrolacea*'); Ooststr. Blumea 3 (1940) 523 ('*ochroleucea*').—*I. kentrocarpa* Hochst. *ex* Rich. Tent. Fl. Abyss. 2 (1851) 70; Hallier *f.* Bot. Jahrb. 18 (1893) 139; *ibid. l.c.* 28 (1899) 41; Baker & Rendle, Fl. Trop. Afr. 4, 2 (1905) 163.—*I. ophthalmantha* Hallier *f.* Bot. Jahrb. 18 (1893) 141.

Stems twining, thin, slender, glabrous or sparsely, shortly and patently pilose; old stems with yellow, lacerate bark. *Leaves* ovate to broadly ovate, $3^1/_2$–8 by $2^1/_2$–7 cm, cordate at the base, with rounded lobes, shortly to long-acuminate at the apex, with acute or obtusish mucronulate acumen; mostly glabrous on both sides, the margins sometimes shortly fimbriate; petiole thin, 1–4 cm. *Inflorescences* axillary, peduncles thin, $^1/_2$–5(–$6^1/_2$) cm, glabrous or with very short patent hairs, cymosely one- to several-flowered. Pedicels much longer than the calyx, $1^1/_2$–3(–$4^1/_2$) cm, smooth, glabrous, or hairy like the peduncle, thickened towards the apex in fruit. Bracts minute, oblong to triangular. *Sepals* equal in length or the outer ones a little shorter, 5–$6^1/_2$ mm long, oblong to ovate-oblong, with acutish, obtusish, rounded or truncate and slightly emarginate, mucronulate apex, glabrous; outer sepals with thick centre and thin, pale margins, inner ones thinner. *Corolla* widely funnel-shaped, *c.* 4–$5^1/_2$ cm long, yellow (orange-yellow, sulphur-yellow or cream-coloured), with a purple centre (always?), glabrous, the pubescent apical parts of the midpetaline bands excepted. Stamens and style included; filaments unequal in length, hairy at the base. Ovary glabrous. *Capsules* on reflexed pedicels, broadly ovoid, crowned by the style-base, 10–11 mm high, straw-coloured, 2-celled, 4-valved, at the base with the reflexed sepals. *Seeds* 4, black, shortly pubescent or farinose, *c.* 4–6 mm long.

Distr. Tropical Africa; in *Malaysia:* Lesser Sunda Islands (Timor, Alor), North Borneo; New Caledonia.

Ecol. In Timor on rocks near the sea; according to Mrs Walsh restricted to that habitat; in Borneo the species was collected in a fairly open situation on the bank of a small stream, at 20 feet altitude.

4: 478*a* After 22. *Ipomoea stolonifera* (Cyrill.) J. F. Gmel. add:

22a. Ipomoea fimbriosepala Choisy in DC. Prod. 9 (1845) 359; Hallier *f.* Bot. Jahrb. 18 (1893) 143; Bull. Soc. R. Bot. Belg. 37 (1898) 97; Bull. Herb. Boiss. 7 (1899) App. 1, 48; Baker & Rendle, Fl. Trop. Afr. 4, 2 (1906) 199.—*I. choisyi* Montr. Mém. Ac. Sc. Lyon 10 (1860) 237.—*Aniseia hastata* Meissn. in Mart. Fl. Bras. 7 (1869) 319. —*I. phylloneura* Baker, J. Linn. Soc. Bot. 21 (1885) 426.—*I. smithii* Baker, Kew Bull. (1894) 73.—**Fig. 5.**

A herbaceous twiner. Stems terete or striate, glabrous or hirsute. *Leaves* ovate, ovate-deltoid, oblong, oblong-lanceolate or linear-oblong, 5–12 by 1–6 cm, cordate-sagittate or hastate at the base with rounded or acutish auricles, acuminate or attenuate to the obtuse, emarginate and minutely mucronate apex, glabrous; petiole 1–5 cm long, mostly glabrous, smooth, or sometimes minutely warty. *Inflorescences* axillary; peduncles nearly absent to 5(–9) cm long, cymosely one- to few-flowered at the top. Pedicels more or less angular, $1^1/_4$–3 cm, thickened in fruit. Bracts ovate or ovate-oblong, acuminate, mucronulate, 5–15 mm long. *Sepals* herbaceous, unequal, the outer ones longer, 15–20, in fruit up to 25 mm long, ovate, acute to acuminate, mucronulate (mucro filiform), with broad incurved margins, their back strongly 3-keeled; keels more or less irregularly dentate; inner sepals ovate, acuminate, mucronulate, about $^3/_4$ as long as the outer ones, not keeled. *Corolla* funnel-shaped, *c.* 4 cm long, glabrous, pale purple with a deep purple centre. Stamens and style included; filaments pilose in their basal portion. Ovary glabrous. *Capsule* ovoid or globose, *c.* $1^1/_2$ cm long, 4-valved, the valves pale brown outside, whitish inside. Seeds *c.* 5 mm long, black, minutely puberulent.

Distr. Tropical America, tropical Africa, Madagascar, in *Malaysia* (New Guinea: Territory of New Guinea, Eastern Highlands Distr., Goroka Subdistr., near Gitunu village: Hoogland & Pullen 5288), Pacific (New Hebrides, New Caledonia, Austral Isl.: Raivavae and Rapa).

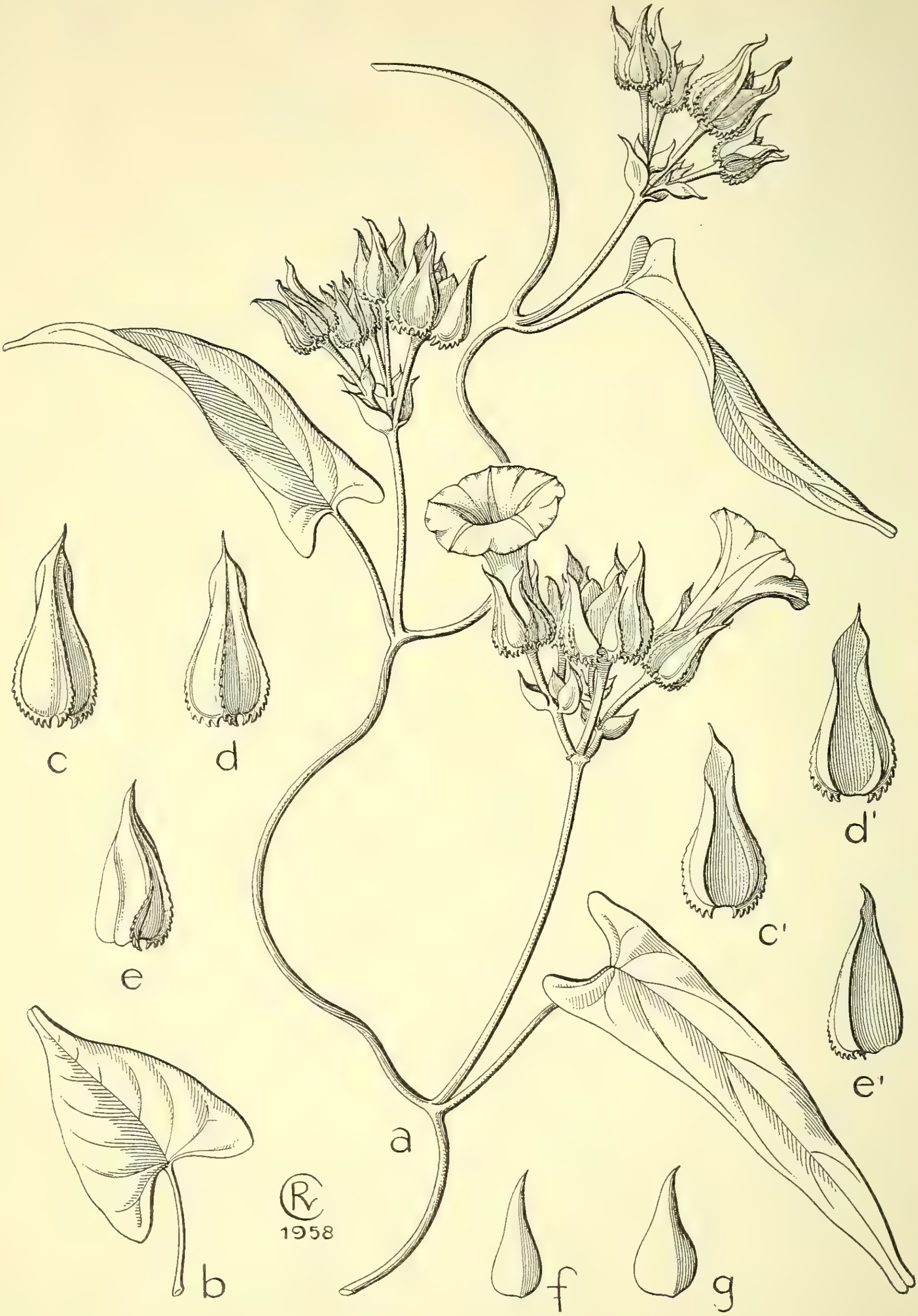

Fig. 5. *Ipomoea fimbriosepala* CHOISY. *a*. Flowering branch, ×1/2, *b*. leaf, ×1/2, *c–g*. sepals 1–5, from the outside, c′–*e*′. sepals 1–3, from the inside, all nat. size (all after HOOGLAND & PULLEN 5288, except *b* E. ULE 5196).

Ecol. In New Guinea only found in one locality at *c.* 1500 m in a depression in grassland, fairly common.

4: 481*a* Line 9 from bottom:
For species 30. *Ipomoea angulata* the correct name is **I. hederifolia** LINNÉ, Syst. Nat. ed. 10 (1759) 925; OOSTSTR. Nova Guinea n.s. 6 (1955) 28.

4: 485*b* After 36. *Ipomoea illustris* (CLARKE) PRAIN add:

36a. Ipomoea abrupta R. BR. Prod. 1 (1810) 485; BENTH. Fl. Austr. 4 (1869) 421; BAILEY, Queensl. Fl. 4 (1901) 1062. —*Convolvulus abruptus* SPRENG. Syst. 1 (1825) 596.

A woody twiner, glabrous or nearly so. Stems terete, fistulose, *Leaves* ovate, 5–9 (–15) by 5–7(–10) cm, deeply cordate at the base, shortly acuminate at the apex with an obtuse or retuse, mucronulate acumen; nerves 7–9 on either side of the midrib; petiole slender, 3–6(–10) cm long. *Inflorescences* axillary; peduncles shorter than the petioles, cymosely one- to several-flowered. Pedicels angular, slightly thickened towards the calyx, in fruit up to 2½–3 cm long. *Sepals* slightly unequal, glabrous, coriaceous, with wrinkled back (in fruit), ovate, obtuse; outer ones 7½–10 mm long (in fruit up to 15 mm); inner ones a little shorter (in fruit up to 10–12 mm long). *Corolla* funnel-shaped, 7½–9 cm long. Stamens and style included. Ovary glabrous. *Capsule* broadly ovoid or globose, *c.* 12 mm high (according to BAILEY up to 2½ cm diam.), apiculate by the long style-base. *Seeds* 3–4, *c.* 6 mm long, with long silky hairs near the margins and along these.

Distr. Australia (N. Australia, Queensland), in *Malaysia:* Thursday Island (JAHERI *a.* 1901).

4: 485*b* Line 13 from bottom. *Corolla* pink or pale lilac. Add:, rarely white.

4: 487*a* Line 6 from bottom. Add to Distr.: tropical Australia.

4: 489*b* Line 11 from bottom. Add to Distr.: Siam.

4: 495 Change in the key:

10. Stamens and styles about as long as or longer than corolla; corolla smaller, *c.* 3 cm long or less.
  10a. Lateral nerves 5–6 on either side of the midrib. Upper surface of leaves glabrous or nearly so. **1a. A. corneri**
  10a. Lateral nerves 9 or more on either side of the midrib. Upper surface of leaves more or less densely pilose, sometimes glabrescent.
    11. *etc.*

4: 496 Change in the key:

40. Filaments papillose or pubescent at the base.
  41. Sepals glabrous. Bracts narrowly triangular, 1–2 mm long, glabrous. **38. A. boholensis**
  41. Sepals pilose. Bracts larger, linear to filiform, 8–12 mm long, pilose. **40. A. apoensis**
40. Filaments glabrous at the base.
  42. Two outer sepals ovate-triangular, obtuse at the apex, shortly pilose outside or partly glabrous. Filaments with a large tooth at the base. **36. A. pseudorubicunda**
  42. Two outer sepals orbicular, broadly rounded at the apex, densely silvery strigillose outside. Filaments without a tooth at the base **36a. A. lamii**

4: 504*b* *Argyreia corneri* HOOGL. appears to belong to section 1. *Ptyxanthus* G. DON, and has to be inserted on p. 497*b* after *Argyreia mollis* (BURM. *f.*) CHOISY. The description reads as follows:

Stems twining, to 15 m or more, terete, strigose. *Leaves* ovate, 3½–9 by 2–5 cm, obtuse or rounded at the base, abruptly acuminate to cuspidate at the apex with a narrow, acute, mucronulate acumen; upper surface glabrous except the strigose midrib, lower surface densely light-yellowish sericeous or much less hairy to nearly glabrous; midrib and 5–6 nerves on either side prominent beneath, minor nervation reticulate, inconspicuous when covered by the indument; petiole 1–2½ cm, strigose. *Peduncles* axillary, terete, short, 10–18 mm, densely sericeous, cymosely 1–5-flowered, usually 1-flowered. Pedicels *c.* 4–6 mm, sericeous. Bracts linear, to *c.* 10 mm long, sericeous, caducous. *Sepals* broadly ovate, broadly acute to rounded at the apex, densely sericeo-tomentose outside, one margin of sepal 3 and both margins of sepals 4 and 5 less densely hairy or partly glabrous; three outer sepals *c.* 8½ mm, two inner ones *c.* 6½–7 mm long. *Corolla* funnel-shaped, *c.* 2½–3 cm long, pale pinkish white outside, rose-pink inside; limb shallowly lobed; midpetaline bands with appressed hairs, rest of corolla glabrous. Style and stamens nearly as long as the corolla. Filaments dilated and glandular hairy at the base. Ovary glabrous, 2-celled. Fruit unknown.

Distr. *Malaysia:* Malay Peninsula (Pahang, Trengganu).

4: 508*b* After 36. *Argyreia pseudorubicunda* OOSTSTR. add:

36a. Argyreia lamii OOSTSTR. Blumea Suppl. 4 (1958) 239, fig. 1.

Stems twining, sparsely to rather densely brownish strigillose. *Leaves* elliptic or elliptic-ovate, 10–17 by 4–8 cm, rounded at the base, shortly acuminate and mucronulate at the apex, subcoriaceous, dark green, glossy and glabrous above, paler green, glossy and sparsely strigillose beneath, mainly on the midrib; midrib and 7–8 nerves on either side prominent beneath; petiole 1½–3 cm, strigillose like the stems. *Peduncles* slender, 10–16 cm long, 1–1½ mm thick, strigillose like the stems, umbellately branched at the apex with 3–5 branches; primary branches 1¼–4 cm long, secondary ones shorter, ¾–1¼ cm long, tertiary if present still shorter. Pedicels 4–5 mm long, thickened towards the apex, densely silvery strigillose. Bracts linear or linear-lanceolate, *c.* 4 mm long, or the lower ones up to 8 mm long, soon caducous. Two outer *sepals* orbicular, *c.* 5 mm long, three inner ones orbicular or slightly broader than long, as long as the outer ones or a little shorter, all densely silvery strigillose outside; sepal 3 with one glabrous margin outside, sepals 4 and 5 with two glabrous ones. *Corolla* 5-parted, pinkish purple inside, white outside; tube cylindrical, *c.* 5 mm long, glabrous, lobes linear, recurved or rolled backwards, *c.* 18 mm long, appressed pilose outside, at the apex with a small glabrous lobule at one side (or sometimes at both sides). Filaments glabrous, inserted *c.* 4 mm above the corolla-base, without tooth at their ventral side. Ovary glabrous, 2-celled. Fruit unknown.

Distr. *Malaysia:* Malay Peninsula (Trengganu: SINCLAIR *c.s.* SF 40860).

Ecol. In lowland forest.

Stylidiaceae

4: 532 *Stylidium pedunculatum* R. BR.—*St. androsaceum* O. SCHWARZ, in Fedde, Rep. 24 (1927) 105, *nov. syn.*

Add in fig. 5 the following two Australian localities: Koolpinyah, 30 miles W of Darwin, BLEESER 411; near Grove Hill (13°28′S and 131°35′E), dull, ± olive-green tufts in a broad, flat, swampy drainage channel with sandy soil overlying clay, 90 m. July 6, 1942, S. T. BLAKE 16371.

Combretaceae

4: 544 **13. Combretum kostermansii** EXELL, Blumea 7 (1954) 557.

Scandent shrub; twigs initially fulvo-pilose and tomentellous, later sparsely pilose, dark-red. *Leaves* opposite, chartaceous, ovate to oblong-ovate, acuminate cordate at the base, 2–7 by 1¾–1½ cm, above shiny and almost glabrous except for the pilose midrib, beneath appressed-pilose on the nerves, not lepidote; nerves 3–6 pairs; petiole 1–3 mm, pilose. *Flower* in axillary and terminal panicles, bisexual, protogynous, 4-merous, sessile, white; rachis fulvo-pilose. Bracts filiform, fulvo-pilose, 3–4 mm long. Lower receptacle (ovary) 1–1½ mm long, densely pilose, upper receptacle cupular, 1½ by 2½ mm, pilosulous. *Calyx* lobes ovate-acuminate, 1 by 0.9 mm. *Petals* 4, broad-ovate, apiculate, 2 by 1½ mm, pilose. *Stamens* 8, in 2 whorls, filaments 2½ mm, glabrous, initially inflexed, anthers 1 mm long, glabrous. Disk inconspicuous. Style 4 mm long, glabrous. Ovules 2.

Distr. *Malaysia:* E. Borneo (Loa Haur, west of Samarinda).

Ecol. Lowland forest, at 60 m; *fl.* May 1952.

Note. Although the specimens lack any glandular hairs Mr EXELL is of opinion that it should be placed in the *sect. Glandulosae* in the affinity of *C. nigrescens*, from which it differs in the absence of glandular hairs, the shape and size of its leaves, and the much larger petals.

4: 548 Line 8 from bottom, add behind square bracket: *ex* DC. Mém. Soc. Phys. Hist. Nat. Genève 4, 1 (1828) 5;

4: 566*a* Line 3 from bottom, add behind t. 68: —*Phytolacca ? javanica* OSBECK, Dagbok Ostind. Resa (1757) 276, *cf.* MERR. Am. J. Bot. 3 (1916) 583, *non T. javanica* MIQ.

4: 571*b* *Terminalia macadamii* EXELL; Nova Guinea n.s. 7 (1956) 5.

Add the description of ♂ flowers from three supplementary collections:

Flowers sessile, cream, subglobose in bud, spikes axillary, 7–20 cm long, with mainly ♂ flowers towards the apex and ⚥ flowers towards the base; rachis rufous-tomentose, bracts 1 mm long, very early caducous. Lower receptacle (ovary) densely rufous-tomentose or tomentellous, 1½ mm long; upper receptacle little developed, *c.* ½ by 1½ mm. Calyx lobes somewhat recurved, deltoid, 1¾ mm long. Filaments glabrous, 3 mm, pale green with brownish anthers. Disk barbate. Style 2½ mm.

Vern. *Gahwah*, *ga'uw*, Onjob language, Koreaf, *gawiah*, Miniafi language, Utukap.

4: 585 *Lumnitzera* WILLD.

Add to the generic synonyms: *Funckia* DENNST. Schlüssel (1818), *nomen*, *non* WILLD. 1808.—*Petaloma* ROXB. Fl. Ind. ed. Carey 2 (1832) 372.—*Problastes* REINW. Syll. Pl. Ratisb. 2 (1825) 10.

4: 586*a* *Lumnitzera littorea* (JACK) VOIGT.

Add to the synonymy: *Petaloma alternifolia* ROXB. Hort. Beng. (1814) 90, t. 1428 in Kew, *cf.* Kew Bull. 1956, 367 (1957); Fl. Ind. ed. Carey 2 (1832) 372.—*Petaloma coccinea* BLANCO, Fl. Filip. ed. 1 (1837) 345.—*Problastes cuneifolia* REINW. Syll. Pl. Ratisb. 2 (1825) 10, type at Leyden.

4: 589*a* *Lumnitzera racemosa* WILLD. *var. racemosa.*
Add to the synonyms: *Kada-Kandel* RHEEDE, Hort. Mal. 6, t. 37.—*Funckia karakandel* DENNST. Schlüssel (1818) 32, *nomen.*

Flacourtiaceae (H. SLEUMER)

5: 3 In the key to the genera 9 after 3. *Scolopia* (partly) add: **5. Paropsia.**

5: 4 Replace lines 5 and 6 of the key (3, second part) by the following:

3. Sepals (or calyx lobes) and petals (3–)4–6, ± similar in size and shape.
  3a. Sepals and petals hardly or not exceeding 4 mm in length. Succulent berry . . . **3. Scolopia** (partly)
  3a. Calyx lobes and petals at least 6 mm long. Rather fragile capsule. **5. Paropsia**

5: 6 The exact reference of the genus *Erythrospermum* is: *Erythrospermum* LAMK, Ill. (1792) t. 274; Tabl. Encycl. 2, 6 (1819) 407, *nom. cons. prop.*, *cf.* SLEUM. Taxon 5 (1956) 197.—*Pectinea* GAERTN. Fruct. 2 (1791) 136, t. 111, *nom. rejic. prop.*

5: 7*a* Add to *Erythrospermum candidum* the synonym: *Pittosporum macrophyllum* LAUT. & K. SCH. in K. Sch. & Laut. Fl. Schutzgeb. (1901) 338; RECHING. Bot. Erg. Wiss. Reise Salom. Ins. (1913) 556.

5: 8 Add to the synonymy of *Scolopia: Richeopsis* ARÈNES, Not. Syst. 15 (1954) 2; Fl. Madag. fam. 150 (1954) 4, *cf.* CAPURON, Ess. Intr. Fl. For. Madag. (1957) 123.

5: 10*a* Line 15 from top, replace 'WALL.' by 'WIGHT'.

5: 12*a* Line 14 from top, omit the word '*bason.*'.

5: 13*a* Add to *Itoa stapfii* line 3 after '474': ; Suppl. 1 (1918) 16, t. 5a–5b.

New material of *Itoa stapfii* from New Guinea is polygamous; on the axillary, 4–5 cm long racemes the lower flowers are ♂♂, whilst the terminal flower is ♀; the latter has numerous staminodes (the anthers reduced in size) and an ovoid ovary with large, sessile, 5-fid stigma. Calyx lobes (3–)4–5(–6), in the ♀ flower *c.* 9 by 4 mm, but smaller in the ♂♂ ones.

The species is now known also from East New Guinea (Madang Distr., Ramu and Gogol R. valleys, 125–175 m).

5: 14*a* Line 24 from top, add to the description of the leaf of *Paropsia vareciformis:* ,with 2 (but sometimes hardly visible) ± distinct dark, rather flat glands at, or somewhat above, the base,.

5: 30*a* Line 10 from bottom, after (1873) insert: 236.

5: 35*b* *Scaphocalyx spathacea* RIDL.
This appears also to have been found in North Sumatra (Tapanuli, Padang Sidempoan, Padang Lawas: RAHMAT SI BOEEA 5050). Add to Vern.: *Kaju simburu.*

5: 39 Add to *Trichadenia* as a synonym: *Leucocorema* RIDL. Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 29; SLEUM. in E. & P. Pfl. Fam. ed. 2, 20b (1942) 392.

5: 39*a* Add to *Trichadenia philippinensis* MERR.: STEEN. Bull. Jard. Bot. Brux. 27 (1957) 114.—*Leucocorema latifolia* RIDL. Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 29.

The species has been found recently also in E. Borneo (Isl. of Nunukan, N of Tarakan: W. MEIJER 2185), W of Makassar Straits.

5: 45 Under fig. 18 read ♂ instead of ♀.

5: 46 Under fig. 19 read ♂ instead of ♀.

5: 48*a* *Ryparosa kunstleri* KING.
Add to Distr.: Borneo.

5: 56 Line 27 from top, *Cordylanthus* BL.: (1856) instead of (1852).

5: 63*a* After 21. *Homalium grandiflorum* BENTH. *var. javanicum* (K. & V.) SLEUM. add:

21a. Homalium dictyoneurum (HANCE) WARB. in E. & P. Pfl. Fam. III, 6a (1893) 36; GAGNEP. Fl. Gén. I.-C. 2 (1921) 1013, f. 110; CRAIB, Fl. Siam. En. 1 (1931) 740. —*Pierrea dictyoneura* HANCE, J. Bot. 15 (1877) 339.

Tree 20–30 m. Twigs robust, glabrous. *Leaves* ovate-oblong, gradually attenuate towards the apex, or obtusely acuminate, base broadly attenuate to nearly rounded, coriaceous, glabrous, shining on both faces, paler beneath, olivaceous when dry, entire, (10-)12–18 by (4–)5–7(–9) cm, midrib prominent on both sides, nerves in 8–10 pairs, arched, raised on both faces, veins ± transverse, forming a dense and prominent network with the veinlets on both sides; petiole stoutish, 12–15 mm. *Racemes* axillary, spiciform, rather robust, shortly fulvous-tomentose, 15–20 cm including the 1–2 cm long peduncle. *Flowers* scattered, with several ovate imbricate basal bracts 2–3 mm. Pedicels of the lower flowers 3–2 mm, shorter to very short below the upper flowers. Bracts fan-shaped or broadly obovate, glabrous inside, pubescent outside, ± 5 mm long, subpersistent. Bracteoles 2, at or near the apex of the pedicel, similar to but smaller than the bracts, subpersistent. *Calyx* tube obconical, densely yellowish-velutinous, 3 mm; sepals 9–10, linear, subobtuse, membranous and velutinous, *c.* 8 by 2 mm initially, much accrescent and becoming chartaceous in later stages, finally oblong-subspathulate, nerved, *c.* 18 by 3–4(–5) mm. *Petals* 9–10, oblong, subacute, velutinous, 5–6 by 2 mm at first, finally attaining *c.* 10 by 3 mm. *Stamens* 6, ± in pairs at and somewhat above the base of each petal, further 2 or 3 between each of the subglobose grey-tomentose glands; filaments slender, patent-pilose, 3–4 mm. *Ovary* white-tomentose, with 5–7 styles, these long-haired below, glabrous above.

Distr. Indochina, Siam, in *Malaysia:* Malay Peninsula (Pahang, Trengganu).

H. dictyoneurum is easily distinguished from the other *spp.* of the *sect. Pierrea* by the peculiar bracts.

5: 63 Line 6 from bottom, *Bennettia* MIQ.: (1858) instead of (1859).

5: 65*b* *Hemiscolopia trimera* (BOERL.) SLOOT.
Add to Distr.: W. Sumatra (G. Sago near Pajakumbuh, 900–1200 m), Malay Peninsula: Malacca, Johore, and P. Tulai (near P. Tioman, "common on rocks at sea-level in the Terminalia zone and behind"). These records practically unite the two partial areas given in fig. 27, *l.c.*

5: 70*a* *Flacourtia zippelii* SLOOT.
New material from New Guinea proved the species to be seemingly bisexual, but in fact unisexual and dioecious. Only in specimens with ♂♂ flowers the stamens are well developed; the ♀♀ flowers, besides the ovary, have rudimentary stamens. In the group of *F. tomentella*, *F. jangomas*, *F. rukam*, *F. kinabaluensis*, and *F. indica* the ♀♀ flowers have no staminodes at all.

5: 73*b* Add to the synonymy of *Flacourtia rukam* ZOLL. & MOR.:—*Lightfootia indica* THUNB. Nov. Gen. 7 (1792) 107.

5: 77*b* Replace at the end of the column '(*prob. Icacinaceae*)' by: = *Microdesmis magallanensis* (MERR.) STEEN. (*Euphorb.*), *cf.* STEEN. Act. Bot. Neerl. 4 (1955) 480.

5: 79*b* *Osmelia philippina* (TURCZ.) BENTH.
Add to Distr.: New Britain.

5: 81 Add to the synonymy of *Casearia* JACQ.: *Tardiella* GAGN. Not. Syst. 15 (1954) 32–33, *cf.* STEEN. Blumea 8 (1955) 170.

5: 86*a* *Casearia macrantha* GILG.
Add to Distr.: Goodenough Isl.

5: 89*b* *Casearia lobbiana* TURCZ.
In the Distr. omit Penang (based on CURTIS 2430, which is *Microdesmis caseariaefolia* PLANCH.).

5: 91*b* *Casearia velutina* BL.
Add to Distr.: Lower Siam, Malay Peninsula (Kedah).

5: 99*b* *Casearia tuberculata* BL.
Add to Distr.: Lingga Archipelago.

Butomaceae

5: 119*b* *Tenagocharis latifolia* (D. DON) BUCHENAU.
Add: COSTERUS & SMITH (Ann. Jard. Bot. Btzg 32, 1923, 18–19) recorded a flower with 5 ovaries and 2 stamens either free or paired.
Add: JOHRI (Proc. Ind. Ac. Sc. B4, 1936, 139–162) found pollen grains in the style canal and in the ovary, and in one case a pollen grain had germinated on the surface of an ovule. It is assumed that they were drawn in by some sort of suction mechanism; it is evaluated as a primitive character.
Add to Distr.: Yunnan, *cf.* WU & WANG, Act. Phytotax. Sin. 6 (1937) 191.

Pentaphylacaceae

5: 121 Under the generic description replace after Distr.: 'Two *spp.*' by 'Monotypic'.

5: 123*b* *Pentaphylax euryoides* GARDNER & CHAMPION.
Add to Distr.: West Central Sumatra: Mt Sago (near Pajakumbuh), 1700–1800 m, MEIJER 5144; Mt Singalang (near Bukit Tinggi), 2000–2200 m, MEIJER 5221.

Malpighiaceae

5: 126 The correct reference for *Aspidopterys* is: JUSS. in Endl. Gen. Pl. (April 1840) 1060; Ann. Sc. Nat. II, 13 (1840) 266, *post-Endl. edit.*, *cf.* JUSS. *l.c.* 347, in *adnot.* & ENDL. *l.c.* 1057.

5: 129*a* *Aspidopterys concava* (WALL.) JUSS.
Add to Distr.: Borneo (Sarawak: HAVILAND 2857).

5: 130 *Hiptage* GAERTN.
The generic name *Hiptage* was obviously intended by GAERTNER as a new name for *Gaertnera* SCHREB. Gen. 1 (1789) 290, *n.* 735, *non Gaertneria* MEDIC. Phil. Bot. 1 (1789) 45, *nom. rejic.* (*Compos.*). Consequently GAERTNER based *Hiptage* on the same type as *Gaertnera* SCHREB., *viz* RHEEDE, Hort. Mal. 6, t. 59. Both names were published in 1789 and it can be taken for granted that GAERTNER knew of both.

In 1791 two other genera of the name *Gaertnera* were published *viz Gaertnera* RETZ. Obs. 6 (1791) 24 which is a synonym of *Sphenoclea* GAERTN. 1788 (*Campan.*) and *Gaertnera* LAMK [Illustr. 2 (1791) 273, t. 167] Tabl. Enc. Méth. Bot. texte 1 (?1792) 379. The latter is the well-known genus for which the name *Gaertnera* is still in use and which is at variance attributed to the *Loganiaceae* and *Rubiaceae*.

This name which is generally accepted distinctly needs conservation in order to overcome the homonymy.

5: 132*b* Line 23 from top replace 437 by: 427.

5: 135*b* Lines 4 and 5 from bottom: 'light-coloured' should precede 'blade'.

5: 139 For some reason or other the original spelling *Ryssopterys* BL. *ex* JUSS. has been rejected in the Rules of Nomenclature to be replaced by the conserved spelling *Rhyssopterys* BL. *corr.* WITTST. Etym. Handwörterbuch ed. 2 (1856) 764.

Proteaceae (H. SLEUMER)

5: 150 Add to Wood Anatomy: CHATTAWAY, Austr. J. Sc. ser. B, 1 (1948) 279; DESCH, Mal. For. Rec. 15^{II} (1954) 441 (hand lens); WELCH, J. & Proc. R. Soc. N.S. Wales 58 (1925) 255.—C.A.R.-G.

5: 154*b* *Gevuina papuana* (DIELS) SLEUM.
Add to Distr. in New Guinea: recently found in primary mountain forest at Sioriep (Ransiki, Vogelkop Peninsula) and at the base of Mt Cyclops near Hollandia (between Ifar and Ormu, rather common in mossy forest at 950 m). The material now at hand demonstrates all transitions between a simple and a pinnate leaf in the same specimen.

5: 163*a* *Finschia ferruginiflora* WHITE.
Add to Distr.: also found in the Western Highlands of Papua (Upper Wahgi valley).

5: 197*a* Line 7 from top: *M. integrifolia* is considered to be a distinct species by L. S. SMITH, Proc. R. Soc. Queensl. 67 (1956) 39. It seems that the clones with edible nuts of *M.* '*ternifolia*' originated from this species.

Burseraceae (P. W. LEENHOUTS)

5: 224*b* Line 17 from top: replace 1200 by 2000.
Dacryodes kingii (ENGL.) KALKMAN.
In my opinion this species is probably conspecific with *D. laxa.*

5: 225*b* *Dacryodes elmeri* H. J. LAM differs in my opinion only very slightly from *D. incurvata* (ENGL.) H. J. LAM.

5: 232*a* Line 6 from bottom: replace 1–5-jugate by 1–6-jugate.

5: 234*a* Add to the synonymy of *Santiria apiculata* BENN.:—*Haplolobus borneensis* H. J. LAM, Fl. Mal. I, 5 (1956) 245, *cum cit.; cf.* H. J. LAM, Blumea 9 (1958) 270.

5: 238 Prof. H. J. LAM is publishing in Blumea 9 (1958) a revised revision of *Haplolobus.* The lamentable absence of sufficient material still offers great difficulty in correlating specimens and delimiting specific populations. As even in the new revision out of the 17 recognized species 7 have been provided with a question mark, and of 2 species only flowers are known, of 2 only ♂ flowers, of 4 only ♀ flowers, and of 3 only fruits, it appears that a subfinal revision has better to be postponed until the forest flora of New Guinea will have been more thoroughly explored.

5: 247*b* *Scutinanthe brevisepala* LEENH. *l.c.;* Nova Guinea n.s. 8 (1957) 176.—**Fig. 6c.**
Add to the description: ♀ Inflorescences as the ♂ ones 3–10 cm long. ♀ *Flowers* as the ♂ ones, differing only by the non-dehiscent anthers, and better developed, *c.* 3 mm high, glabrous, pistil. *Ovary* 2-celled, the columnar style distinctly demarcated against the ovary; stigma slightly 4-lobed. *Infructescences* with 1–2 fruits; calyx saucer-shaped, slightly undulate, *c.* $^1/_2$ cm diam. *Fruits* slightly oblique, acute-ovoid, acuminate, constricted or shortly stalked at the base, young ones up to $1^1/_2$ by 1 cm.
Add to Distr.: East New Guinea: Morobe Distr., near Lae. *Fr.* Feb.

5: 249 *Canarium* STICKM.
I have prepared a doctor's thesis containing a world revision of the genus which will appear in Blumea 9 (1958). As far as the Malaysian species are concerned only a few additions appear necessary in the revision in this Flora.

5: 261*b* *Canarium lamii* LEENH.
Tree up to 20–35 m. Add to Distr.: New Guinea.

5: 281*a* *Canarium kostermansii* LEENH.
Infructescences racemose, 10–20 cm long, with 3–6 fruits; calyx funnel-shaped, 3-lobed, *c.* 1 cm diam. Fruits spindle-shaped, 3 by $1^1/_4$ cm, glabrous; pyrene slightly 5-angular in cross-section, smooth, lids *c.* 2 mm thick. *Seed* 1, sterile cells moderately reduced.
Add to Distr.: Also collected in Br. N. Borneo, at *c.* 600 m alt. *Fr.* Oct.

5: 289*b* *Canarium chinare* GRUTTERINK & H. J. LAM.
Add to Distr.: Also collected in East New Guinea (Milne Bay Distr.).

5: 296*b* *Canarium angustifolium* (BL.) MIQ. under Excluded.
This has appeared finally to belong to a sapling of *Meliosma* (*Sabiaceae*), but the specific identity will obviously remain obscure forever.

Dichapetalaceae (P. W. LEENHOUTS)

5: 312*a* *Dichapetalum gelonioides* (ROXB.) ENGL. *ssp. sumatranum* (MIQ.) LEENH.
Add to Distr.: Malay Peninsula.

Goodeniaceae (P. W. LEENHOUTS)

5: 336*b* *Velleia spathulata* R. BROWN.
Add to Distr.: Louisiades Arch. (Sudest Isl.).

5: 339*a* *Lechenaultia filiformis* R. BROWN.
Add to Distr.: New Guinea (Hollandia) and Louisiades Arch. (Sudest Isl.).

5: 339 *Scaevola* LINNÉ.
Material of a new, endemic, Papuan species of *Scaevola* became unfortunately available too late for including it in the revision. In the key to the species it comes under 2, but differs from both species opposed there by *solitary,* axillary flowers.

5: 340 Bottom line (under fig. 3) replace '(MILL.) KRAUSE' by 'VAHL'.

5: 342*b* After 2. *Scaevola micrantha* PRESL add:

2a. Scaevola pauciflora LEENH. Nova Guinea n.s. 8 (1957) 175.—*Scaevola sp.* LAM, Sargentia 5 (1945) 103.—**Fig. 6a–b.**

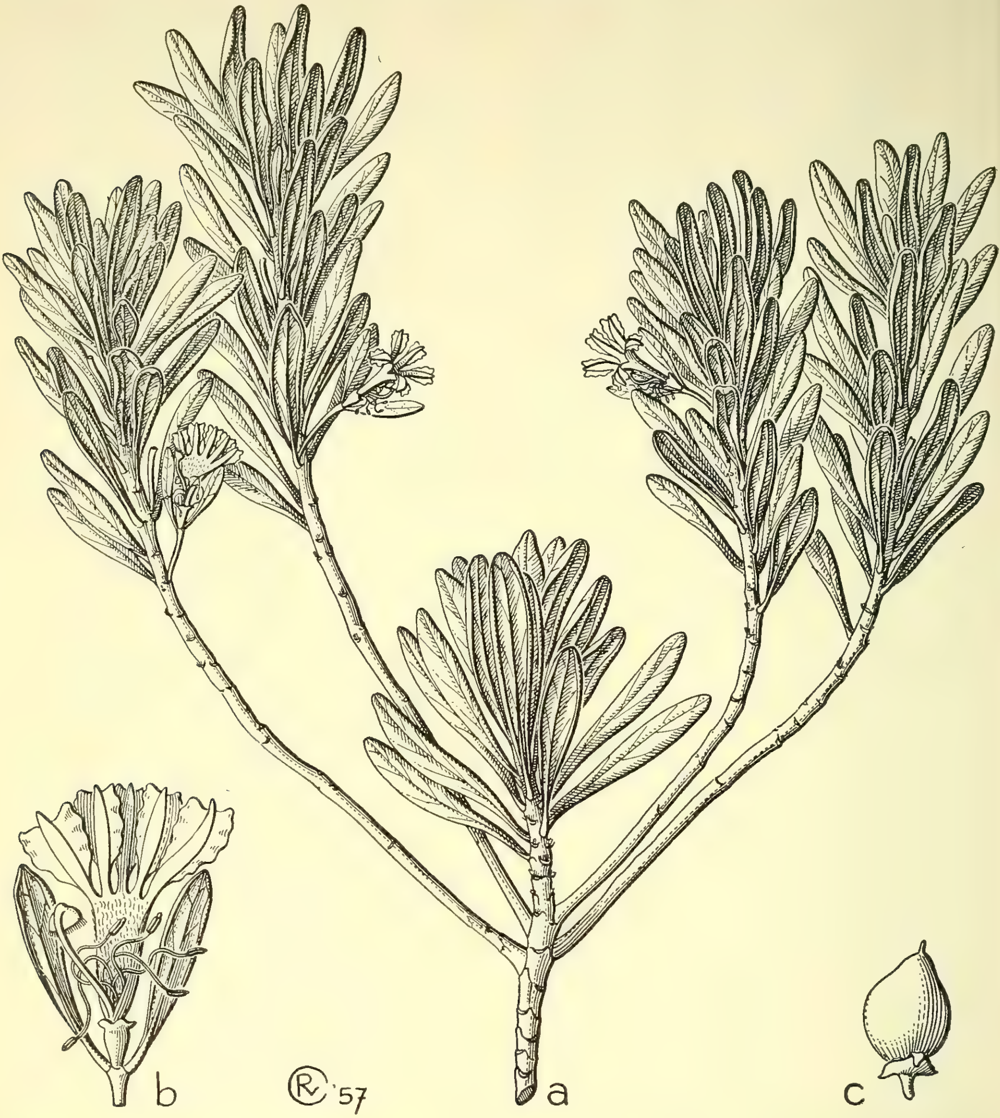

Fig. 6. *Scaevola pauciflora* LEENH. *a.* Habit, × 2/3, *b.* flower with bracteoles, × 2 1/2.—*Scutinanthe brevisepala* LEENH. *c.* Young fruit, × 4/3 (*a* & *b* from LAM 1837, *c* from NGF 8762).

Small shrub, *c.* 40 cm, candelabrum-like branched, glabrous except for hair tufts in the leaf axils. *Leaves* tufted at the twig ends, indistinctly petioled, spathulate, obtuse, 2 1/2–4 1/2 by 1/2–3/4 cm, stiff-coriaceous; margin revolute, entire; nerves and veins indistinct. *Flowers* solitary, sessile on top of a *c.* 1 1/2 cm long peduncle. Bracteoles spathulate, 13 by 2 mm. *Calyx* with a 1/2 mm high free margin, indistinctly lobed. *Corolla* 1 1/2 cm long, yellow-white, inside the tube densely long-hairy, margins of the lobes fimbriate at the base. Style glabrous, the margin of the cupular indusium excepted.

Distr. *Malaysia:* West New Guinea (Mt Doorman, once collected).

Ecol. Open mountain slope with low shrubs, *c.* 3000 m. *Fl.* Oct.

Note. Belongs to *sect. Scaevola* and allied to *S. micrantha* PRESL but distinctly different by smaller, much narrower, glabrous, not distinctly petioled leaves with revolute margin, by solitary, larger, distinctly sessile flowers, and a glabrous style.

Hydrocharitaceae

5: 407*a* *Thalassia hemprichii* (Ehrenb.) Aschers. Add to Distr.: This plant has also been recorded from Micronesia (Carolines & Marshall Islands).

Restionaceae

5: 420*a* *Leptocarpus disjunctus* Mast. Add to Distr., collections in Siam: Songkla (= Singgora) Kerr 15087, 15087A; Muang Samsip, *pr*. Ubon, Kerr 8353 (all in Herb. Dep. Agric. Bangkok).

C. G. G. J. van Steenis

INDEX TO SCIENTIFIC PLANT NAMES

compiled by

M. J. VAN STEENIS-KRUSEMAN

Families and higher taxa have been entered under their name.

Suprageneric epithets have been entered under the family name to which they belong preceded by the indication of their rank (tribes, *e.g.*).

Supraspecific epithets have been entered under the generic name to which they belong preceded by the indication of their rank (sections, series).

Infrageneric epithets have been entered under the generic name to which they belong preceded by the indication of their rank.

Names of families which have been revised in volumes 4 and 5 have been printed in **bold type.**

New names and *new combinations* have been printed in **bold type,** *synonyms* in *italics.*

'*Map*' printed behind a page number denotes that a map of the concerned taxon is present on that page.

An *asterisk* behind a page number denotes the presence of a figure of the concerned taxon.

Page numbers in **bold type** denote main treatment.

Some minor printing errors in plant names have been corrected.

N.B. An index to persons, plant names, and topics mentioned in the chapter on 'Specific Delimitation' is found on p. ccxxx. A select index has further been added to the 'Supplement Cyclopaedia of Collectors', see p. cccxxxvii. Plant names mentioned in the general chapters have not been inserted in the general index.

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